## 1NC

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#### Interpretation: Appropriation is permanent and exclusive

Babcock 19 Professor of Law, Georgetown University Law Cente. Babcock, Hope M. "The Public Trust Doctrine, Outer Space, and the Global Commons: Time to Call Home ET." Syracuse L. Rev. 69 (2019): 191.

Article II is one of those succeeding provisions that curtails “the freedom of use outlined in Article [I] by declaring that outer space, including the [m]oon and other celestial bodies, is not subject to national appropriation.”147 It flatly prohibits national appropriation of any celestial body in outer space “by means of use or occupation, or by any other means.”148 However, “many types of ‘use’ or ‘exploitation’. . . are inconceivable without appropriation of some degree at least of any materials taken,” like ore or water.149 If this view of Article II’s prohibitory language is correct, then “it is not at all farfetched to say that the OST actually installs a blanket prohibition on many beneficial forms of development.”150 However, the OST only prohibits an appropriation that constitutes a “long-term use and permanent occupation, to the exclusion of all others.”151

#### Megaconstellations do not appropriate

Johnson 20 [Chris Johnson is the Space Law Advisor for Secure World Foundation and has nine years of professional experience in international space law and policy. He has authored and co-authored publications on international space law, national space legislation, international cooperation in space, human-robotic cooperative space exploration, and on the societal benefits of space technology for Africa. "The Legal Status of MegaLEO Constellations and Concerns About Appropriation of Large Swaths of Earth Orbit." https://swfound.org/media/206951/johnson2020\_referenceworkentry\_thelegalstatusofmegaleoconstel.pdf]

No, This Is Not Impermissible Appropriation

An opposite conclusion can also be reasonably arrived at when approached along the following lines. The counter argument would assert that the deployment and operation of these global constellations, such as SpaceX’s Starlink, OneWeb, Kepler, etc., are aligned with and in full conformity with the laws applicable to outer space. These constellations are merely the exercise and enjoyment of the freedom of exploration and use of outer space and do not constitute any impermissible appropriation of the orbits that they transit.

Freedom of Access and Use Permits Constellations

Rather than being a violation of other’s rights to access and explore outer space, the deployment of these constellations is more correctly viewed as the exercise and enjoyment of the right to access and use outer space. Article I of the Outer Space Treaty establishes a right to access and use space without discrimination.

Not allowing an actor to deploy spacecraft, regardless of their number or destination, would be infringing with the exercise of their freedom. It would be discriminatory. Additionally, actors do not need permission from any other State, or group of States, to access and explore outer space.

Aligned with the Intentions of the Outer Space Treaty

This use of outer space by constellations in LEO, while not explicitly mentioned by the drafters of the Outer Space Treaty or other space law, actually is the fulfillment of their visions for the use of outer space. The preamble to the Outer Space Treaty (which contains the subject matter and purpose of the treaty and can be used for interpreting the operative articles of the treaty) speaks of the aspirations of humanity in exploring and using outer space. It is easy to see constellations that will provide Internet access to the world as fulfilling the visions of the drafters:

The States Parties to this Treaty, Inspired by the great prospects opening up before mankind as a result of man’s entry into outer space, Recognizing the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes, Believing that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development, Desiring to contribute to broad international cooperation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful purposes, Believing that such cooperation will contribute to the development of mutual understanding and to the strengthening of friendly relations between States and peoples, As such, subsequent article of the Outer Space Treaty should be read in a permissive light, as permitting constellations, rather than a restrictive light which only sees potential negative aspects of constellations. Due Regard and Harmful Contamination Will be Addressed

Operators in LEO are well aware of the challenges to space sustainability that their constellations will pose and will be taking efforts to mitigate the creation of debris. OneWeb is keenly focused on space sustainability and has even argued that the current norm, whereby spacecraft are not in space for longer than 25 years and are deorbited from lower orbits at the end of their lifetime (aka post mission disposal), is not sufficient to keep outer space clean and that shorter lifespan limits should be imposed on operators, especially operators in LEO, and operators of small satellites.

Additionally, these systems will be able to cooperate with emerging space safety and space traffic management plans and can operate in ways that do not restrict or impinge on other users of the space domain. Because due regard is therefore displayed for the space domain, and to the interests of others, these constellations do not prejudice or infringe upon the freedoms of use and exploration of the space domain and are therefore not occupation, or possession, much less appropriation.

This Does Not Constitute Possession, or Ownership, or Occupation

The use of LEO by satellite constellations is substantially similar to the use of GSO, and therefore permissible. In each region, individual actors are given permission - either from a national administrator or from an international governing body (the ITU) via a national administer–to use precoordinated subsections of space. In a way that is overwhelmingly similar to the use of orbital slots in GSO, the placement of spacecraft into orbits in LEO or higher orbits does not constitute possession, ownership, or occupation of those orbits. This is because States (and their companies) have been occupying orbital slots in GSO for decades, and these uses of GSO have never been accused of “appropriating” GSO. The users have never claimed to be appropriating GSO, and their exercising of rights to use GSO is respected by other actors in the space domain. This is the same situation for other orbits, including LEO and other non-Geostationary orbits.

And while GSO locations are relatively stable (subject to space weather and other perturbations, and require stationkeeping), spacecraft in LEO are actually moving through space and are not stationary, so it is even more difficult to see this use by constellations as occupation, much less appropriation. Moreover, Space Situational Awareness (SSA) and Space Traffic Management (STM) will allow other uses to use these orbits, and nothing about the use of any one user necessarily precludes others. Lastly, there is no intention by operators of constellations to exclusively occupy, must less possess or appropriate, these orbits. Would not the appropriation of outer space be an intentional, volutional act? No such intention can be found in the operators of global constellations.

#### Satellite positioning is de facto appropriation, not appropriation proper.

Matignon 19 [Louis de Gouyon Matignon, PhD in space law from Georgetown University, “ORBITAL SLOTS AND SPACE CONGESTION,” 06/03/19, *Space Legal Issues*, https://www.spacelegalissues.com/orbital-slots-and-space-congestion/, EA]

Near-Earth space is formed of different orbital layers. Terrestrial orbits are limited common resources and inherently repugnant to any appropriation: they are not property in the sense of law. Orbits and frequencies are res communis (a Latin term derived from Roman law that preceded today’s concepts of the commons and common heritage of mankind; it has relevance in international law and common law). It’s the first-come, first-served principle that applies to orbital positioning, which without any formal acquisition of sovereignty, records a promptness behaviour to which it grants an exclusive grabbing effect of the space concerned. Geostationary orbit is a limited but permanent resource: this de facto appropriation by the first-comers – the developed countries – of the orbit and the frequencies is protected by Space Law and the International Telecommunications Law. The challenge by developing countries of grabbing these resources is therefore unjustified on the basis of existing law. Denying new entrants geostationary-access or making access more difficult does not constitute appropriation; it simply results from the traditional system of distribution of access rights. The practice of developed States is based on free access and priority given to the first satellites placed in geostationary orbit.

#### Vote neg for predictable limits—including temporary occupation is a limits disaster—any aff about a single spaceship, satellite, or weapon would be T because they temporarily occupy space. Unlimited topics explode neg prep and draw unreciprocal lines of debate.

#### Fairness is a voter—it’s a gateway issue to the ballot.

#### Drop the debater to deter future abuse.

#### CI- Reasonability is arbitrary and we don’t know the brightline while prepping. Collapses since it uses an offense/defense paradigm to win it.

#### No RVIs- A] Illogical- you don’t win for being fair B] Encourages baiting theory which proliferates abuse C] Chills checking abuse for fear of the RVI D] Norming – we cant concede the ci which forces us to argue for bad norms

### 1NC---OFF

#### Mega constellations are key to save cloud computing---expands infra and every facet of the network.

Wainscott-Sargent 21 (, A., 2021. Enabling the Edge: Cloud Capabilities Push Satellite Forward. [online] http://interactive.satellitetoday.com/. Available at: <http://interactive.satellitetoday.com/via/november-2021/enabling-the-edge-cloud-capabilities-push-satellite-forward/\_fragment.html> [Accessed 17 February 2022] Anne Wainscott-Sargent is an award-winning science and technology writer whose work spans over two decades across the space, academia, computing, and government sectors.)-rahulpenu

Enabling the Edge: Cloud Capabilities Push Satellite Forward

Cloud computing â€“ pushing an organizationâ€™s data away from on-premise servers to the virtual environment â€“ is commonplace today for enterprises, with nearly seven in 10 businesses already using cloud technology in one capacity or another, and many reporting dramatic jumps in efficiency and revenue growth

Now, cloud is targeting the high-stakes satellite market as cloud innovators seek early-market advantage by offering cloud solutions to a sector poised to redefine broadband connectivity. Led by the big three cloud solutions providers, Google, Microsoft, and Amazon Web Services (AWS), cloud firms are forging significant alliances with leading satellite companies.

In the past year, SpaceX signed a deal with Google Cloud to provide cloud serves over its Starlink Low-Earth Orbit (LEO) mega-constellation; SES expanded its partnership with Microsoft Azure to deliver cloud at scale over the companyâ€™s new O3b mPOWER Medium-Earth Orbit (MEO) constellation; and Telesat selected Canadian-based CloudOps to develop a hybrid cloud platform for its LEO satellite network Lightspeed.

These developments underscore how the satellite cloud race is taking companies closer and closer to the edge â€“ the place where connectivity and data insights can reach end users quicker, leading to a better experience and competitive advantage.

â€œThere's a lot of movement by satellite players and cloud players alike to improve the access to ground stations and bring newer business models into the picture,â€ says Shivaprakash Muruganandham, consultant for NSR who authored the Cloud Computing via Satellite 2nd Edition report.

NSR expects the cloud-satellite market will reach $21 billion and generate 233 exabytes of traffic by 2030. Muruganandham says about half of that revenue will come from data downlink Earth Observation (EO), with the next biggest chunk from satcom.

NSR forecasts that cloud-based services in the EO market over the next decade represents a $10 billion opportunity. The other two markets, big data analytics and orbital infrastructure, whether providing storage or edge computing solutions in space, are still emerging.

Amazon Web Services (AWS) is working to make data from space more accessible by leveraging its cloud capabilities. Clint Crosier, director of AWS Aerospace and Satellite Solutions division, said during SATELLITE 2021â€™s Future Space Digital Forum in July that the industryâ€™s move toward a combined â€˜space-cloud nexusâ€™ is akin to â€œa new industry within the industry.â€

â€œWe are entering an age where the biggest challenge for satellite customers will be effectively collecting, formatting, analyzing, processing and distributing these massive volumes of data,â€ Crosier tells Via Satellite in an interview. â€œWe believe advances in space will continue to be driven largely by innovation and best practices from the commercial space industry, which will largely be driven by cloud technologies.â€

As a further sign of the cloudâ€™s growing role in space, Microsoft became the first cloud customer for SESâ€™s next-generation MEO system â€“ O3b mPOWER â€“ set to launch later this year. Microsoft will buy managed services from SES for Azure and will also support Microsoftâ€™s Azure Orbital ground station solutions business. SES is co-locating four O3b mPOWER ground stations at or near Azure data centers.

SES CEO Steve Collar said in a press briefing on Aug. 17 that SESâ€™s placement of gateways near Microsoftâ€™s largest data centers will ensure its customers â€œare only ever one short hop away from the cloud.â€ Microsoft, in turn, will access the MEO network to improve the resiliency and redundancy of the system.

â€œAs more critical workloads move to the cloud, Microsoft will leverage our MEO constellations â€” both current and upcoming â€” to deliver additional network diversity, service resiliency and gigabit connectivity at its core network,â€ the company stated.

Itâ€™s All About the End User Experience

The days of satellite providers relying solely on a wholesale connectivity model are becoming obsolete in a cloud-driven market, says Maddison Long, vice president of Products for CloudOps. Such a model keeps satellite players too far removed from the end user. Creating better customer experiences will drive this future â€“ an area that cloud companies excel at.

â€œWhatâ€™s made the cloud providers successful will also make the satellite providers successful and that is their relentless focus on the end user experience,â€ says Long. â€œBoth as an individual consumer and as a business, youâ€™re really dependent on both the connectivity and the cloud experience working in tandem.â€

And that means engaging customers directly and building massive developer ecosystems that know how to build applications on their clouds.

â€œAt AWS, 90 percent of what we do is driven by our customers telling us what matters most to them,â€ says Crosier. â€œThe other 10 percent is us helping them imagine the art of the possible and innovating on their behalf.â€

For AWS customers, that means accessing their data anywhere, whether at ground stations, operations centers, on satellites, or in space, and converting that data into analysis-ready and actionable information. With Artificial Intelligence and Machine Learning (AI/ML), users can transform and analyze vast amounts of data very quickly, says Crosier, who is seeing increasing demand for virtual mission operations, edge computing, image processing, intelligence analytics, and secure satellite connectivity.

Edge Computing is Key

Many innovators see edge computing â€“ defined as bringing computing and data storage closer to the sources of data to improve response times and save bandwidth â€“ as key to creating richer user experiences while handling the growing data processing demands coming from new constellations in LEO and MEO. Gartner predicts by 2022 that about 75 percent of all will need analysis and action at the edge, and by 2028, edge computing is expected to be an $800 billion market opportunity.

Naeem Altaf, IBM distinguished engineer and CTO of Space Tech for IBM Cloud, asserts, â€œAt the end of the day itâ€™s all about data. Data has gravity â€“ wherever it sits, itâ€™s hard to move.â€

For Altaf, the ultimate edge is in the orbit of the satellite itself. â€œIf you are doing a lot of imaging and know how to minimize the movement of raw data, you can only send the data that is actionable.â€

And that will require the next generation of computing power on satellites, Altaf emphasizes. â€œIf we can get more computing power on the satellite, the more work you can do right there,â€ he says.

The explosion of Internet of Things (IoT) and cloud requirements in LEO has also highlighted the need for more agile and intelligent smallsat constellations capable of serving different sensing, imaging, and other data-gathering applications simultaneously.

Dennis Gatens, co-founder and CEO of LEOcloud, a cloud infrastructure and service provider, agreed. â€œData in motion results in latency and is expensive. Edge computing will drive competitive and operational advantages by moving from a centralized architecture where data is being backhauled at high volumes at significant cost and latency.â€

Ecosystem of Partners Poised to Deliver Edge Services

LEOcloudâ€™s planned Space Edge LEO services embrace a hybrid cloud option to deliver edge computing as close as possible to the sources and users of the data.

â€œWe're about bringing public cloud services to space,â€ says Gatens, referring to services provided by public cloud providers whether it be IBM, AWS, Google, or Microsoft. His company has partnered with Leaf Space of Europe and Red Hat, IBMâ€™s open-source software subsidiary, to build out its service. Early users include customers in the oil and gas and government sectors.

â€œThe real path forward is enabling public cloud services as they exist today on Earth in space, so that they simply are another hybrid cloud option to a customer and end user,â€ Gatens says.

IBM is working with LEOcloud as it seeks to bring lowest-latency cloud services to the space edge and ultimately to LEO.

â€œAn ecosystem of partners is finding it mutually beneficial to collaborate and deliver cloud capabilities,â€ says Gatens. â€œGround station providers want to work with us because weâ€™re bringing them customers. Weâ€™re bringing demand for their services. Satellite providers are the same. With cloud service providers we enable them to have an edge compute presence at all their ground station endpoints.â€

Gatens says a key unknown facing the industry is the scope of integration that providers will embrace. One of LEOcloudâ€™s partners, Leaf Space, is a European ground station network provider currently leveraging Google Cloud as its main cloud provider.

Giovanni Pandolfi Bortoletto, Leaf Space's co-founder and chief strategy officer, says satellite operators are starting to use cloud services for commercial purposes. He notes that half of Leaf Spaceâ€™s capacity is going to IoT application services, including Earth Observation, while the other half supports general access.

Founded in 2014, Leaf Spaceâ€™s mission is to simplify space access with global infrastructure that satellite operators can use as a service. Currently the company operates a network of 10 Ground Station as a Service stations across Europe and New Zealand.

â€œWe are cloud-provider agnostic,â€ says Pandolfi, who attributes the shift to cloud to the increasing number of small satellite providers who see the value of cloud since they lack a built-out infrastructure. In contrast, â€œspace agencies or more institutional operators which have made significant infrastructure investments in data centers,â€ he says. â€œWe see cloud services as an enabling technology â€” itâ€™s less capital investment.â€

Building Cloud Infrastructure in Space

Several cloud executives expressed excitement for the future orbital applications enabled by cloud and edge computing, which they called â€œa mobile data center in space.â€ For these cloud advocates, the satellite industryâ€™s future looks bright when it comes to leveraging cloud technology, both to democratize connectivity and to enable human exploration further into space.

â€œThere will be a permanent presence on the Moon within five years â€“ maybe soonerâ€” and beyond that thereâ€™s Mars. The need for edge computing is clear for driving the value of AI and analytics,â€ says Gatens of LEOCloud. â€œGoing forward to cislunar and beyond, you cannot be backhauling all this data to Earth. You need real-time access to AI and analytics workloads for decision making.â€

Altaf agreed, adding, â€œI think weâ€™re going to take the edge to the next level into orbit.â€

Advances in space will continue to be driven largely by â€œinnovation and best practices of the commercial space sector, which will largely be driven by cloud technologies,â€ says AWS's Crosier, who stressed that cloud and space providers need to continue to collaborate and invest in innovation and workforce development for this future to be fully realized. VS

#### Cloud computing solves warming and sustainable development.

Fintelics 21 (, 2021. How Cloud Computing Can Help The Environment. [online] Medium. Available at: <https://fintelics.medium.com/how-cloud-computing-can-help-the-environment-37df9ec750c7#:~:text=Cloud%20computing%20makes%20an%20outstanding,in%20reducing%20the%20carbon%20footprint.> [Accessed 17 February 2022].)-rahulpenu

The Green Cloud

Green Cloud computing was a concept started in 2010 where it stated that switching your IT services to the cloud would bring a considerable positive change in the environment.

Now the latest research suggests that switching to cloud computing can lessen the carbon footprint. If large organizations switch one department to cloud, they could be saving an average of 30k metric tons of CO2 within five years — it equals 6000 fewer automobiles off the road.

In today’s article we look at 6 ways cloud computing can help the environment. So, let’s start, shall we?

1. It Reduces Energy Consumption

If you have ever seen an on-site data center, then you already know how much energy it requires to operate — it’s a lot!

An interrupted power supply to run the data center and a heavy-cooling system for avoiding excessive heating is needed. Apart from that, the equipment soon gets old and goes straight to e-waste. This e-waste is causing a lot of pollution.

According to the National Renewable Energy Laboratory, these data centers consume about 2% of the total energy consumption in the US. You’d be stunned to know that it almost equals 73 to 75 billion kilowatt-hours — hmm, massive.

So, what cloud computing will do is it will reduce this consumption at a significant rate. Google-funded research has already laid its claim that cloud computing would cut energy use by a whopping 87% — imagine the amount of energy we will be saving.

The amount of energy cloud computing would save sufficient to power the whole of Los Angeles for a year. An impact is yet to be made globally when big firms worldwide would join in using cloud storage.

2. It Helps In Sustainable Dematerialization

Cloud computing makes an outstanding contribution to sustainability via dematerialization. This process lets high-carbon physical products get replaced by their virtual equivalents.

When you introduce energy-efficient items instead of carbon, it makes a good impact in reducing the carbon footprint. A prominent example of it is to use cloud-based video streaming services instead of going to the cinema.

Migrating to cloud computing will automatically lessen the machine and hardware use that consumes more energy. It will also help in lesser bills. You can save energy both at home and in the organization. Companies can benefit from this saving by investing in other valuable projects.

It also saves you from operating lots of machines and helps you maintain focus on your main task.

As soon as you reduce the use of this machinery and other physical equipment, you save the colossal disposal of e-waste. You save paper by going paperless, your storage devices are replaced with cloud storage, and you can do electronic signatures and avoid printing a document.

So apart from machinery, you’re going to save a lot of paper. We all know where papers come from, right? So, by preserving paper, cloud computing would contribute to the environment by cutting lesser trees.

3. It Helps In Shifting To Renewable Energy Sources

A considerable amount of cloud data centers are moving to renewable energy sources to operate. Some have already moved there.

These renewable energy sources like geothermal, solar, wind, hydropower, and other ones will generate more eco-friendly electricity. Many IT companies like Agile IT have already taken the initiative by powering their headquarters with wind power.

Cloud computing offers businesses a safe way to store their data and increase their working efficiency at the same time. Amazon Web Services is also a cloud provider platform working to create more renewable energy options.

Amazon has already planted wind farms all around the United States that provide uninterrupted energy and works as the backbone for the current and future data centers.

4. It Helps In Remote Working

Organizations must acknowledge that cloud computing will only help them grow even bigger and better.

It wasn’t possible before, but cloud computing now lets organizations hire remote workers. These remote workers would work from anywhere, anytime, or any place. They don’t need to be physically present at the office.

Your productivity will increase; lesser resources will be used at the office, ultimately putting an overall positive effect on our environment.

Imagine the amount of fuel saved by a worker. There will be less traffic on the roads at the office time. Your office wouldn’t overcrowd with a big pool of employees.

So, recruiting remote workers and letting them work through cloud computing will save you lots of energy and help save the ecosystem.

5. It Helps Increase Hardware Refresh Speed

Typically a data center can be used for a reasonable amount of time before it needs an up-gradation. And in some cases, replacement becomes necessary, which itself could cost a fortune and time.

The hardware used in the public cloud has a much higher usage than the traditional servers, which means that they wear out pretty soon. It means that it would have a faster refresh time.

It’s also cost-effective for public cloud servers and hardware to be updated at regular intervals so that new technology can be incorporated inside, saving more energy.

6. It Provides Better Infrastructure

Traditional public servers are located in limited areas. They don’t have a choice to be located near the power supply.

Facebook and Yahoo have kept their public servers limited in a few selected areas.

However, public cloud data centers would be mostly seen around facilities that would help power them efficiently. It reduces the cost of electric transmission over a long distance and helps these centers use less wattage.

These data centers don’t heat up quickly, thanks to their high-quality hardware setup. They optimize energy transmission, temperature, and other factors that non-cloud servers could not.

Conclusion

Cloud computing can prove to be a great contributor to reducing many environmental risks through:

Reduces Energy Consumption

Sustainable Dematerialization

Shifting To Renewable Energy Sources

Remote Working

Increased Hardware Refresh Speed

Better Infrastructure

### 1NC---OFF

#### Text – Private Entities should

* implement cooperative active debris removal measures aimed at mitigating debris from mega-constellations.
* Implement collision avoidance procedures
* cooperate on the development of a cloud-based infrastructure system between private and public entities with the purpose of advancing overall cyber security and create a protected mandatory reporting system for government contractors and critical infrastructure employees
* dismantle their antisatellite weapon systems and stop all development of space weapons
* adopt a system of market share liability in regard to the creation of debris in outer space by private entities in accordance with Munoz-Patchen 18
* indefinitely cease engagement with any offensive cyber operations regarding large satellite constellations
* agree not to escalate militarily in reaction to damage to space-based assets or offensive military operations in outer space
* ban rocket propellants that produce alumina particles in the stratosphere or deposit black soot in the stratosphere.

#### 1st plank solves Cyber-Attacks.

**Robertl and Vocl 21** [Christopher Robertl and Vince Vocl. Christopher is the Senior Vice President of Cyber Intelligence and Supply Chain Security Policy at the U.S. Chamber of Commerce. Vince VocI is the Executive Director Cyber Policy and Operations at the U.S. Chamber of Commerce. 5-14-2021, accessed on 8-8-2021, U.S. Chamber of Commerce, "4 Ways U.S. Government Leaders Can Protect IP and Personal Data", <https://www.uschamber.com/on-demand/cybersecurity/how-can-the-government-help-protect-intellectual-property-and-personal-data>] Adam

During the past several months, U.S. adversaries have carried out significant cyber-enabled espionage campaigns, impacting a wide range of public and private sector targets. With our nation’s cybersecurity at risk, government leaders have quickly turned to legislative solutions to protect our intellectual property and personal data.

Protected Mandatory Reporting Can Help Thwart Increasingly Sophisticated Cyberattacks

Since the [Cybersecurity Information Sharing Act of 2015](https://www.cisa.gov/publication/cybersecurity-information-sharing-act-2015-procedures-and-guidance#:~:text=of%20Mass%20Destruction-,Cybersecurity%20Information%20Sharing%20Act%20of%202015%20Procedures%20and%20Guidance,indicators%20with%20the%20Federal%20Government.) was passed, companies facing data breaches have been encouraged to share this information with the U.S. government. Yet cyberattacks have only become more sophisticated since then, according to [Sen. Mark Warner](https://www.warner.senate.gov/public/), chairman of the Senate Select Committee on Intelligence.

“There is an evolving belief that the 2015 structure, on a voluntary basis, is not giving us the level of comprehensive security that we need,” said Warner. “The bad guys, when they’re focused, they’re going to have a fairly high probability of getting in.”

In response, the Committee on Intelligence is working on a bipartisan level to create a structure that would mandate reporting for government contractors and critical infrastructure employees.

“Some of the privacy and other kinds of counter-incentives don’t take place,” Sen. Warner noted, adding that affected companies would have limited immunity and anonymized information. “We can pulse the overall system in a way that will allow [the] public sector and private sector to respond in a more comprehensive way.”

The U.S. Seeks to Work With Its Allies to Establish Cyber Incident Notification Systems

After creating a limited mandatory reporting system in the country, Warner hopes that the U.S. can work with its allies to establish similar notification systems as well as multilateral cyber norms.

“If our adversaries violate these norms and we can find appropriate attribution, there will be consequences to their actions,” Warner explained. “Our failure to have norms [and] a more robust notification system in existence … has allowed, in many ways, Russia and China to launch cyberattacks with virtual impunity.”

“This is a problem of protecting intellectual property … [and] personal information,” he continued. “As long as we can provide that level of limited immunity with anonymity so that those reports are then not made public, I think we can earn industry support.”

The U.S. Cyberspace Solarium Commission Outlines Priorities for 2021

In 2019, the U.S. Cyberspace Solarium Commission was chartered to manage cyber risk and significant cyber events at home and abroad. With several of the Commission’s recommendations being codified into law in 2020, this year has seen a renewed focus in engaging the private sector.

“We’re looking at ways that [we] can get to a common cloud-based environment between federal government agencies, state, local, tribal, territorial and the private sector, basically to get common visibility,” said Solarium commissioner [Frank J. Cilluffo](https://www.solarium.gov/commissioners/frank-cilluffo).

“We’re also going to be zeroing in on what we’re calling SICI (systemically important critical infrastructure) ... which will basically hone in on the most critical of our critical infrastructures, our lifeline sectors, and establish a set of … benefits and burdens to truly get to that partnership between the public and private sector,” Cilluffo added.

Public and Private Sector Collaboration Is Crucial to Cybersecurity Advancement

“We want to make sure that at the end of the day, our companies, our national security agencies and our citizens as a whole are enhancing their overall cybersecurity efforts,” stated Cilluffo. “The bottom line is, we need to follow up our ideas with the resources.”

“This is not going to be accomplished through Washington alone,” he stressed. “The private sector needs a front-row seat at his table and ultimately will be most critical to any success going forward.”

[Mark Montgomery](https://www.solarium.gov/about/staff/mark-montgomery), executive director of the Cyberspace Solarium Commission, agreed that partnership between the public and private sectors would be crucial for success in 2021.

“We actually have to build, pay for and establish infrastructure for collaboration,” Montgomery noted. “Once you do that, the companies will see that their equities are protected … and their opinions matter, and then we’ll get things done.”

#### 2nd solves for Mega-constellation Impacts.

Hardy 20, Brian Patrick. Long-term effects of satellite megaconstellations on the debris environment in low earth orbit. Diss. 2020. (Master of Science in Aerospace Engineering in the Graduate College of the University of Illinois at Urbana-Champaign)//Elmer

The results of this thesis demonstrate that satellite megaconstellations have the potential to leave a significant mark on the LEO debris environment, even centuries after they cease operations. Various test cases for the Starlink megaconstellation were analyzed in a new, medium-fidelity simulation for orbital debris evolution, and a variety of PMD and ADR rates for Starlink were considered. It was shown that if Starlink adheres only to the minimum regulatory requirement of 90% PMD for large constellations, then LEO debris levels will grow almost twice as fast as the baseline scenario with no megaconstellations. Improving Starlink’s PMD rate to 95% would lead to only 19% more debris, while 99% PMD is the preferred option that prevents any significant debris contributions at all. Importantly, Starlink’s choice of PMD strategy will affect its own collision risk very little over the short term, but the impact will be noticeable on multi-century timescales by the overall LEO environment. Finally, in scenarios with 90% and 95% PMD, active debris removal of non-operating Starlink satellites yields significant, if limited, benefits. The 90% PMD scenario combined with an ADR rate of 5 Starlink satellites per year, for example, is able to reduce debris levels to those seen for the 95% PMD scenario. This result suggests that active debris removal could be a viable mitigation strategy for megaconstellations with sub-optimal PMD rates.

#### 3rd plank solves space war – states won’t possess asat capability to escalate

#### 4th plank incentivizes sustainable use of space

**Munoz-Patchen 18** [Chelsea Munoz-Patchen, Chelsea Muñoz-Patchen is an associate in the Houston office of Latham & Watkins. While attending University of Chicago Law School, Ms. Muñoz-Patchen was an articles editor for The Chicago Journal of International Law. Her research on regulating space debris was published in 2018. Ms. Muñoz-Patchen served as a research assistant for Professors Daniel Abebe and Jonathan Masur, focusing on intellectual property and constitutional law in the US and Ethiopia. Prior to law school, Ms. Muñoz-Patchen earned her BA and BS in Geography from Arizona State University. As a graduate student, she studied political ecology and people’s relationship to urban nature, and taught Introduction to Physical Geography labs. 7-1-2018, Semanticscholar, "Regulating the Space Commons: Treating Space Debris as Abandoned Property in Violation of the Outer Space Treaty | Semantic Scholar", <https://www.semanticscholar.org/paper/Regulating-the-Space-Commons%3A-Treating-Space-Debris-Munoz-Patchen/607eff0141f48332a69ae8c5a3301d871057a4fa> accessed 12/21/21] Adam

* solves global commons

Market-share liability has been suggested as a way to deal with the difficulty of identifying the individual ownership of objects and it could be put to use in the obligation to clean up debris.154 Market-share liability would allow for the apportionment of responsibility based on the respective contribution to the risk, and would not require the identification of individual pieces of space debris.155 Market-share liability has already been successfully applied where multiple parties contribute to a dangerous situation, but where it is virtually impossible to tie a particular party to the harm caused.156 Market-share liability was created in 1980 in the case Sindell v. Abbott Labororatories. 157 In Sindell, the Supreme Court of California devised the concept in response to a case in which pharmaceuticals that were marketed to pregnant women caused cancer in their children at least a decade later.158 Since the latent period was so long, the women naturally could not remember the specific pill manufacturer out of two hundred such manufacturers.159 The court found that each defendant’s market share could be determined fairly accurately, and therefore used market share as a basis for the apportionment of liability.160 While market-share liability has not been broadly adopted, this is likely because cases with fungible products and a serious causation problem are rare.161 Academics have taken this idea and sought to apply it to space debris, which has similar fungibility and causation issues, but their applications have been limited to a tort-like context.162 One author suggested that whenever a collision occurs due to an unidentifiable piece of debris and a functional space object, liability and compensation should be apportioned “among spacefaring nations equal to the percentages of the total debris population for which the particular nation is responsible.” 163 This mechanism frees the victim from having to prove causation by a specific nation, when that would be virtually impossible.164 There will be difficulties calculating the percentage with precision in such a system, but there is fairly accurate information from the U.N. including registry, sampling, mathematical models, and other records of known collisions and the resultant debris.165 Without strong buy-in, it may be challenging to get this rarely used domestic tort theory to apply in international space law, especially with the potential for disputes over the proper apportionment of market share.166 The states primarily responsible for existing debris are the U.S., Russia, and China – powerful countries unlikely to be pleased with this newfound expense. That said, though these nations would be paying the highest cost, this would be proportional to their respective contributions to the problem. Indeed, these nations may welcome this remedy, because their space activity is threatened by the proliferation of space debris and they likely value continuing their extensive and advanced use of space. This solution solves the free rider problem and would compensate any nation or company that cleans up space such that any nation (like the U.S., Russia, or China) fearing the collapse of its space program and unwilling to bear all the cleanup costs itself would see this as an attractive solution. It is even possible that liable states like the U.S. and Russia will be eager to aid in debris identification, so as to add to other states’ liability.167 This regulatory remedy would resolve the current tragedy of the commons. By assigning responsibility for the cost of cleanup, nations or companies would be incentivized to begin cleanup operations, because they would know that others will not freeride on their costly efforts. Instead, they will have guaranteed compensation from those responsible. Obtaining the funds is crucial, particularly since the high cost of deploying existing technology to destroy space debris has been a hindrance thus far.168 Using market-share liability is also a useful way to compensate victims of debris collisions and to incentivize spacefaring nations to avoid creating new debris in the future.169 However, this does not do enough to remedy the persistent existence of space debris, which is threatening the very continuation of space activity. The Outer Space Treaty creates an obligation on states to carry out space activities “for the ‘benefit and interests of all countries,’ and that outer space shall never be subject to national appropriation.” 170 To uphold their obligations under this treaty, nations should not be creating debris, because it interferes with the ability of others to conduct their space activities, or perhaps keeps them from space altogether. Due to this legal violation, and the negative externality created by property abandonment, states should be required to pay for the disposal of debris in proportion to the amount they create. While the creation of debris may be unavoidable, there are existing practices that can greatly minimize the proliferation of debris, and any debris that is nonetheless created can be dealt with through market-share liability payments. This collection of market-share disposal payments would not simply be a tax on operations or tort compensation for harmful acts. Instead, once liability is apportioned, (and this could be done on an ongoing or periodic basis to reflect new developments), nations or companies undertaking actions to clean up space would be compensated for their costs by the nations responsible according to their percentage of responsibility. The U.N. Office for Outer Space Affairs (UNOOSA) could allocate the percentage of liability, drawing on its role in promoting international cooperation and the peaceful use of outer space, as well as preparing reports and studies.171 If any disputes were to arise from nonpayment, familiar procedures could be employed—perhaps by drawing from other notable space treaties that provide “established procedures for the peaceful settlement of disputes, in accordance with the Charter of the United Nations.” 172 In many of the space treaties and conventions, including the Liability Convention, disputes and claims can be brought to the SecretaryGeneral of the U.N.173 These bodies could be utilized here to assure fairness in allocating liability and handling routine compensation disputes. This new regulatory regime can thus be grounded in the existing space treaty regime and administered by existing authorities. It would resolve the incentive problems that exist in the international commons of space through regulation that allocates the cost of debris cleanup to those who have created and continue to create it. The regime can also adapt as the outer space marketplace and the actors who comprise it shift over time, and as the registry of space objects, incidents, and tracking capabilities improves. This regulatory regime also ultimately would allocate cleanup funds to parties who would like to continue to operate in space, removing the disincentive to carry the cost in the face of potential freeriding.

#### Collision avoidance solves

Arif 17 — (Aayesha Arif, Journalist, “This Is How Satellites Avoid Colliding Into Each Other“, Wonderful Engineering, Available Online at https://wonderfulengineering.com/satellite-collision/, accessed 3-22-2022, HKR-AR)

A standard collision avoidance procedure has been established by space agencies to avoid any such accident. Every time a satellite is launched, a Collision On Launch Assessment (COLA) is performed. To make sure that the space vehicle trajectory does not take it too close to any other object in space, the launch window is set such that it has COLA blackout period, the intervals during which the spacecraft does not lift.

The purpose of COLA is to avoid the collision after launch. To avoid any debris or spacecraft collision while in orbit, the satellite performs collision avoidance maneuver also called Debris Avoidance Maneuver (DAM). The collision avoidance maneuver is usually performed to raise or lower the orbit of the craft by a few kilometers. Read more about how the Hubble Space Telescope conducts it to avoid space debris hits.

#### solves ozone depletion

Mortillaro 21 (Nicole Mortillaro, Senior Reporter, Science, She is the editor of the Journal of the Royal Astronomical Society of Canada and the author of several books., 4/22/21, Canadian Broadcasting Corporation, “Rocket launches could be affecting our ozone layer, say experts”, <https://www.cbc.ca/news/science/rocket-launches-environment-1.5995252>, Accessed 1/27/22, HKR-RKT)

Black soot in the atmosphere The stratosphere is an important weather driver for Earth's systems, and that's where some particles from rocket launches are ending up. The ozone layer, which helps protect us from the sun's harmful ultraviolet rays, is also located in the stratosphere. In 1990, the Montreal Protocol was signed into law, banning harmful ozone-depleting substances, such as chlorofluorocarbons (CFCs), used in things like refrigerators and air conditioners, after it was revealed that the ozone layer was being stripped away by these chemicals. While the protocol touched on airlines, there was no mention of the aerospace industry. But now some industry experts are concerned that with no oversight, we could be in for a problem. There are different types of rocket propellants. Some, like liquid oxygen and liquid hydrogen, produce mainly water vapour and have little environmental impact. These were used in past shuttle launches and even in the Apollo-era Saturn V vehicles. Then there are those that produce alumina particles in the stratosphere, such as those in solid rocket boosters, which were also used in past shuttle launches, and are still being used today by some launch companies. Finally, there are those that deposit black soot in the stratosphere, such as kerosene used in SpaceX's Falcon 9 and Russia's Soyuz rockets. It's the alumina and black soot that is most concerning to experts.

#### Private Entities include people

**Cornell Legal Information Institute No Date** [Cornell Legal Information Institute, , "6 U.S. Code § 1501," <https://www.law.cornell.edu/uscode/text/6/1501#15_A> accessed 3/23/22] Adam

(15)Private entity

(A)In general

Except as otherwise provided in this paragraph, the term “[private entity](https://www.law.cornell.edu/definitions/uscode.php?width=840&height=800&iframe=true&def_id=6-USC-625312480-168358316&term_occur=999&term_src=title:6:chapter:6:subchapter:I:section:1501)” means any person or private group, organization, proprietorship, partnership, trust, cooperative, corporation, or other commercial or nonprofit entity, including an officer, employee, or agent thereof.

#### any theoretical reason to reject the cp is a reason to reject the aff – cx and the text of the 1ac plan text is binding and we shouldn’t be punished for private actor fiat anything else is irreciprocal and hurts clash

#### Reject 1AR theory- A] 7-6 time skew means it’s endlessly aff biased B] I don’t have a 3nr which allows for endless extrapolation C] 1AR theory is skewed to the aff because they have a 2ar judge psychology warrant.

#### Infinite abuse claims are wrong- A] Spikes solve-you can just preempt paradigms in the 1AC B] Functional limits- 1nc is only 7 minutes long

#### Condo is good proving a CP is bad doesn’t prove the plan is good, a logical policy maker can always choose not to act. Logic outweighs – it’s the basis of all rational arguments.

### 1NC---OFF

#### India’s digital divide is increasing and has uniquely undermined economic growth.

**Beniwal 20** [Vrishti Beniwal, Vrishti is a journalist for Bloomberg and ThePrint. 12-17-20, "As digital divide widens, India risks losing a generation to pandemic disruption," ThePrint, <https://theprint.in/india/education/as-digital-divide-widens-india-risks-losing-a-generation-to-pandemic-disruption/568394/> accessed 2/9/22] Adam

Plenty of Indians are facing a similar predicament: As many as 80% of Indian students couldn’t access online schooling during the lockdown, and many might not return to classrooms when they reopen, according to a recent study by Oxfam.

That’s just one example of how the pandemic has exacerbated the country’s digital divide — the gap between those with the means and knowledge to benefit from the internet, and those without — worsening already stark levels of inequality and weighing on economic growth. While the divide isn’t unique to India, it’s especially acute in a nation where more than half the population of 1.3 billion people is under 25 years old.

When Prime Minister Narendra Modi announced lockdowns earlier this year, services from banking and schooling to medical consultations and job searches moved online, and in some cases remain there nine months later. Many companies see “work from home” as the new normal.

Before the pandemic, government researchers estimated India’s digital shift could unlock as much as $1 trillion of economic value over five years. But the crisis is spreading those benefits unevenly and widening socio-economic inequalities, with girls suffering more than boys and rural areas more affected than cities.

“The digital divide in India is an ongoing problem and the pandemic has definitely made it worse,” said Sumeysh Srivastava, a New Delhi-based internet-access researcher at Nyaaya, an open-access platform that provides simple and actionable legal information. “The government needs to ensure that all Indians are in position to benefit from digitization, otherwise we’re at risk of creating a new class of digitally poor citizens.”

Internet access

India has the world’s second-largest pool of internet users, about 600 million, comprising more than 12% of all users globally. Yet half its population lacks internet access, and even if they can get online, only 20% of Indians know how to use digital services, according to government data.

Every 10% increase in India’s internet traffic delivers a 3.1% increase in per-capita gross domestic product, according to a 2018 report by the Indian Council for Research on International Economic Relations. But the benefits of those gains aren’t reaching everyone: Srivastava said government-run digital literacy programs cover 5% or less of the population, are focused only on rural areas and suffer from various design and implementation issues.

“The digital revolution has made services more tradable and enabled India to grow rapidly with a different growth model compared to China,” said Ejaz Ghani, a former economist at the World Bank. “But this is now being restrained by the digital divide.”

The launch of online job portals for laborers and e-passes to move around during the lockdown meant Indians who aren’t digitally literate could have lost out on livelihood opportunities.

#### Mega constellations are expanding access in India now.

**Vanamali 21** [Krishna Veera Vanamali, 11-9-2021, "Starlink and OneWeb: Can satellite broadband bridge India's digital divide?," Business Standard, [https://www.business-standard.com/podcast/current-affairs/starlink-and-oneweb-can-satellite-broadband-bridge-india-s-digital-divide-121110900035\_1.html accessed 2/9/22](https://www.business-standard.com/podcast/current-affairs/starlink-and-oneweb-can-satellite-broadband-bridge-india-s-digital-divide-121110900035_1.html%20accessed%202/9/22)] Adam

70% of India’s rural population does not have Internet access Union government had launched Digital India scheme to connect rural areas with Internet 1.78 lakh gram panchayats connected with optical fibre so far The target is to provide broadband connectivity to 2.5 lakh gram panchayats Internet penetration in the country stood at around 50% in 2020 India had launched [BharatNet](https://www.business-standard.com/topic/bharatnet" \t "_blank)project in 2011 to ensure that every village panchayat in the country has broadband Internet connectivity. But, according to a report in 2020, half of India’s population still does not have Internet access. And 70% of the country’s rural population is yet to log in to the Internet. Till date, [BharatNet](https://www.business-standard.com/topic/bharatnet" \t "_blank)connections have been provided to 1.78 lakh gram panchayats. In June this year, the Union Cabinet approved the implementation of the project in 16 states through the Public Private Partnership Model (PPP). When it comes to wired broadband, India had only 24.3 million customers at the end of August, most of whom are urban subscribers. How satellite-based internet service works Starlink and OneWeb are among a number of companies which use Low-Earth Orbit satellites to provide high-speed broadband Internet services around the world, with a special focus on remote areas where deploying mobile towers or fiber optic cables are difficult. These satellites can beam the Internet to virtually anywhere on the earth. Starlink and OneWeb Starlink is a subsidiary of Elon Musk’s rocket company SpaceX OneWeb is owned by Sunil Mittal’s Bharti Group along with the British government Leading the race, Starlink has already deployed more than 1,700 satellites in low-earth orbit Sensing the opportunity, Starlink and OneWeb are looking to provide the unserved areas with the Internet. Starlink is a subsidiary of Elon Musk’s rocket company [SpaceX](https://www.business-standard.com/topic/spacex)and OneWeb is owned by Sunil Mittal’s Bharti Group along with the British government. Starlink is one of a growing number of companies launching small satellites as part of a low-Earth orbiting network to provide low-latency broadband Internet services around the world, with a particular focus on remote areas that terrestrial Internet infrastructure struggles to reach. [Satellite](https://www.business-standard.com/topic/satellite)broadband wars Starlink has already deployed more than 1,700 satellites in low-earth orbit, against a target of having 12,000 satellites in its constellation. Meanwhile, OneWeb has put 322 satellites into orbit and plans to have 648 of them by the middle of next year. Starlink currently serves about 100,000 users in 14 countries. Recently, Starlink established a subsidiary in India headed by former PayPal executive Sanjay Bhargava as it gears up to launch its services in the country. It has already received over 5,000 pre-orders for its devices in India. But there are some factors which could hit its Indian venture, it’s the high cost is one of them

#### Constellations will bridge digital divide – costs fall over time.

**Croshier 22** [Rose Croshier, Rose Croshier is a policy fellow at the Center for Global Development, where her work focuses on enabling low and middle-income countries’ adoption of space-based technology. Before joining CGD, Croshier was an accomplished program and operations manager with the U.S. Air Force, specializing in areas such as Space Operations, Security Cooperation, Peacekeeping, Disaster Management and Military Intelligence. 1-19-2022, "Space and Development: Preparing for Affordable Space-Based Telecommunications," Center For Global Development, [https://www.cgdev.org/publication/space-and-development-preparing-affordable-space-based-telecommunications accessed 2/9/22](https://www.cgdev.org/publication/space-and-development-preparing-affordable-space-based-telecommunications%20accessed%202/9/22)] Adam

The starting block for emerging NGSO constellations providing 4G-5G broadband in the commercial space sector has been set thus far by Starlink, costing approximately $500 for a company-subsidized all-inclusive receiver, wifi router and hardware set and about $100 per month, uncapped, broadband subscription.

A combined “first month” cost of $600 is still not realistic for the majority of the undercovered or underconnected population, as illustrated in Figure 6.[[24]](https://www.cgdev.org/publication/space-and-development-preparing-affordable-space-based-telecommunications#edn24) Using India as an example, even though a Starlink antenna and broadband subscription is steeply cheaper than traditional VSAT options on the market today, it is still seven to eight times more expensive than what is typically available in India’s urban, in-network areas.[[25]](https://www.cgdev.org/publication/space-and-development-preparing-affordable-space-based-telecommunications#edn25)[[26]](https://www.cgdev.org/publication/space-and-development-preparing-affordable-space-based-telecommunications#edn26) A MIT study examining 37 countries determined that even though Starlink’s data is unlimited, the flat fee of $100 per month is affordable for only about 15 percent of the undercovered population. Starlink’s greatest potential for early uptake is in rural areas of high-income countries, or undercovered areas of middle-income countries in South America and Southeast Asia.

Over the following decade, however, the same study suggested NGSO satellite prices may drop closer to $30 per Mbps per month, opening up affordability to about 60 percent of the population considered. While these costs are more than what many individual households can afford, civil society organizations, government, and non-governmental organizations can take action to increase sustainability and uptake. Many rural communities, frustrated by the high for-profit cost of rural internet, have successfully established small, cooperative-owned, internet service provider community networks, like the Zenzeleni network in South Africa. These networks have made impressive progress in localizing use and boosting affordability of high-speed broadband.[[27]](https://www.cgdev.org/publication/space-and-development-preparing-affordable-space-based-telecommunications#edn27)[[28]](https://www.cgdev.org/publication/space-and-development-preparing-affordable-space-based-telecommunications#edn28)

Most promising, satellite-to-cellphone constellations like Lynk provide a shorter-term jump in both accessibility and affordability. Since they are designed to be incorporated into local mobile network operator’s ecosystem, then the access problem would be addressed, and the cost at level with the local market for cellphones and mobile credit.

Several other innovative approaches, like utilizing television “white space” (TVWS), or “buffer” space between television channels in the radio frequency spectrum to provide cheap broadband internet access, or using drones and balloons to extend middle and last mile coverage, provide additional alternatives for consideration. TVWS may fade as a viable option as countries become more efficient at reducing unused spectrum. Balloons and drones require significant in situ management and maintenance, thus making them less practical for expanding telecommunications infrastructure in developing countries.[[29]](https://www.cgdev.org/publication/space-and-development-preparing-affordable-space-based-telecommunications#edn29)

#### Indian economic strength deters China along the India-China border---military buildup and signal of resolve diffuses conflict.

**Haqqani and Pande 21** [Husain Haqqani and Aparna Pande 7-10-21. Haqqani is the director for South and Central Asia at the Hudson Institute in Washington D.C. and was Pakistan’s ambassador to the United States. Pande (Ph.D) is director of the Initiative on the Future of India and South Asia at the Hudson Institute. "India has a long way to go in confronting China". The Hill. https://thehill.com/opinion/international/562397-india-has-a-long-way-to-go-in-confronting-china]

India’s decision to move [50,000](https://www.bloomberg.com/news/articles/2021-06-27/india-shifts-50-000-troops-to-china-border-in-historic-defense-shift) additional troops to its border with China bolsters its ability to protect itself against Chinese aggression. It is a belated response to China’s actions [last year](https://www.bbc.com/news/world-asia-57234024), when the Chinese army [surprised](https://www.reuters.com/article/us-india-china-military-families-insight-idUSKBN2460YB) ill-prepared Indian soldiers and occupied several square miles of Indian territory in the Ladakh region to build roads and fortify military encampments. The hope of some Indian policymakers to resolve the matter diplomatically has not so far been fulfilled. Several rounds of military and diplomatic negotiations since April 2020, when the Chinese incursions started, have yielded little result. Any willingness on India’s part to deal forcefully with China would be welcomed in the U.S., where successive administrations have sought to integrate India into America’s Indo-Pacific strategy. Several years of an India-U.S. entente cordiale has been premised on India standing up to China. After all, with a population of more than one billion, India is the only country with enough manpower to match that of China. China sees India as a potential rival and covets parts of Indian territory. China [occupied](https://www.reuters.com/article/idINIndia-43780820091108) 15,000 miles of Indian territory in the Aksai Chin section of Ladakh after war in 1962. China’s desire for influence in South Asia and the Indian Ocean Region challenges India in its backyard, setting off [competition](https://www.tandfonline.com/doi/abs/10.1080/09700160801886314) for the same sphere of influence. But China’s phenomenal economic growth, coupled with India’s inability to keep pace, has hampered India’s ability to respond to China strategically. Even now the moving of troops to Ladakh is a tactical maneuver not backed by a clear strategic plan. On [four](https://www.washingtonpost.com/business/why-chinese-and-indian-troops-are-clashing-again/2020/09/11/c5939466-f402-11ea-8025-5d3489768ac8_story.html) occasions since 2012, China has indulged in salami-slicing along the largely un-demarcated India-China border. India’s response each time has been limited to diplomatic negotiations with limited military pushback. There is a co-relation between relative economic strength and China’s willingness to flex its muscle. Between 1988, when India and China signed a series of agreements to restore relations, and 2012, the border between India and China remained by and large quiet. During that period, the size of the two countries’ economies was not huge. In 1990, India’s GDP stood at $320 billion and China’s GDP at $413 billion. By 2012, China’s GDP had grown to $8.5 trillion, seven times larger than India’s $1.2 trillion economy. The [change](https://timesofindia.indiatimes.com/home/sunday-times/all-that-matters/chinas-rising-support-for-pakistan-and-their-collusion-may-affect-our-interests-says-former-nsa-shiv-shankar-menon/articleshow/82234601.cms) in China’s policy after 2012, encouraging its troops to use force against India along the border, coincided with the rise in China’s military and economic power and its impact on the relative balance of power with India. Like many in the West, India during the 1990s had bought into the view that deeper economic and diplomatic engagement with communist China would help maintain peace between the two Asian giants. But the India-China border dispute could not remain on the back burner as China became more aggressive in the wake of growing economic and military power. India can no longer rely solely on diplomacy to deal with China. It will soon have to build and deploy hard power to deter the Chinese. The recent deployment along the Ladakh border could mark the beginning of that process. With the latest addition, 200,000 of India’s more than a million strong army now face China along the 2,167-mile border. By way of comparison, 600,000 Indian troops are positioned along the 2,065-mile, fully fenced and fully demarcated border with Pakistan. It is inconceivable that any attempt by Pakistan to take territory would go unretaliated by India. While India’s attempts over the last year have been to convince China, primarily through diplomatic engagements, to return the border to status quo ante, most [military](https://www.orfonline.org/research/eastern-ladakh-the-longer-perspective/) and [strategic](https://www.lowyinstitute.org/publications/crisis-after-crisis-how-ladakh-will-shape-india-s-competition-china) experts argue that China has no interest in resolving the border dispute with India. India has for far too long acquiesced to Chinese aggression without sufficient retaliatory military action. India may not seek to provoke China into an all-out war, but it needs to find a sweet spot between ignoring and provoking. The United States and its allies, too, would like India to act like a major power in not taking Chinese provocations lightly. Western democracies and Japan have viewed India as an ideal partner and future ally in Asia and the Indo-Pacific. India has consistently been a democracy, shares pluralist values with the United States, and its embrace of free market reforms since 1992 have created an opening for expanded economic ties. India also shares America’s concerns about China’s rising power. In developing a pivot to Asia or an Indo-Pacific policy, successive U.S. administrations have assumed that a shared concern about China makes India a natural American ally. India-U.S. relations were referred to as the “[defining](https://www.google.com/search?q=obama+india+defining+partnership+of+21st+century&rlz=1C1GGRV_enUS751US751&oq=obama+india+defining+partnership+of+21st+century&aqs=chrome..69i57j33i160j33i299.7702j0j7&sourceid=chrome&ie=UTF-8) partnership of the 21st century” under President Obama. The Trump administration’s [2017](https://trumpwhitehouse.archives.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf) National Security Strategy spoke of India as a “leading global power” and a strong “strategic and defense partner.” The Biden administration’s [March](https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/03/interim-national-security-strategic-guidance/) 2021 “Interim National Security guidance” has described the “deepening partnership” with India as being critical to America’s “vital national interests.” But the Indo-Pacific policies of both the Trump and Biden administrations have focused on maritime security, ignoring India’s challenge from China on the continental landmass. China views India as an inward-looking democracy that has yet to focus on economic growth or military prowess. Only an expansion in India’s economy and military capability would convince China’s leaders to view it differently. Moreover, the two decades of celebrating convergence of democratic values and voicing of strategic concerns by Washington and Delhi now needs to be followed up with specific steps to counter Chinese hard power with Indian muscle.

#### That goes nuclear.

Rachman 20 “Erosion of nuclear deterrence makes India-China relations critical” GIDEON RACHMAN [Gideon Rachman became chief foreign affairs columnist for the Financial Times in July 2006. He joined the FT after a 15-year career at The Economist, which included spells as a foreign correspondent in Brussels, Washington and Bangkok.] September 7, 2020 <https://www.ft.com/content/311694ac-d1a4-4d92-a850-97e161ad887c> SM

Erosion of nuclear deterrence makes India-China relations critical

Countries with nuclear weapons are moving closer to military confrontation

My generation grew up in the shadow of a possible nuclear war. I was born a few months after the Cuba missile crisis — the closest humanity has come to nuclear Armageddon. The Campaign for Nuclear Disarmament was a big political force as I was growing up.

My children’s generation are much more likely to demonstrate against climate change than nuclear weapons. Leading politicians also no longer worry so much about nukes. Nuclear arms-control negotiations, a staple of the cold war, have fallen into abeyance. But this relatively relaxed attitude is having a paradoxical effect. It seems to be making countries armed with nuclear weapons more willing to risk military confrontation with each other.

There are three international rivalries where tensions between nuclear-weapons states are reaching dangerous levels. The biggest current risk is on the China-India border — where recent clashes have led to 21 Indian fatalities and an unknown number of Chinese casualties. Military tensions are also rising between China and the US in the Pacific. Meanwhile, the crisis in Belarus has led to fears of Russian military intervention, which would put Nato on alert.

The erosion of nuclear deterrence gives rise to two distinct, but related, risks. The first is of a conventional war, which could happen if two nuclear-weapons states believe they can fight each other without the risk of nuclear escalation. The second is of a nuclear war, which could happen if a conventional war escalated unexpectedly.

During the cold war, the US and the USSR were too conscious of the dangers of nuclear warfare ever to risk striking each other directly with conventional weapons. But the Chinese leadership has taken the risk of killing Indian troops, despite India's possession of nuclear weapons — and New Delhi is pushing back.

The deadly clash in the Himalayas over the summer was only the second time that two nuclear-weapons states have fought. The first was the Kargil war between India and Pakistan in 1999. That confrontation did not go nuclear. But it left world leaders profoundly shaken. Bill Clinton, the US president at the time, called the frontline where the two sides had clashed “the most dangerous place in the world”.

There are fewer nuclear-alarm sirens sounding this time around. Most experts take comfort from the fact that India and China both have a policy of “no first use” of nuclear weapons. But if Beijing and New Delhi’s confidence that the other side will not use nuclear weapons persuades China to press home its military advantage, then India may be tempted to alter its policy in an attempt to restore deterrence. Some experts point to the possibility of India deploying tactical nuclear weapons in the Himalayas, or formally renouncing its no-first-use policy.

Threatening to use nuclear weapons is always tempting for a country that fears it might lose a conventional war. Pakistani military doctrine envisages an early resort to nuclear weapons, in the event of an invasion by India that would otherwise lead to defeat.

### 1NC---OFF

## Case

### 1NC---AT: Advantage

private entities will just reclassify constellations as something else to circumvent the plan – mega constellations arent a term of art

#### Squo debris thumps

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Earth orbit is getting more and more crowded as the years go by. Humanity has launched about 12,170 satellites since the dawn of the space age in 1957, [according to the European Space Agency](https://www.esa.int/Safety_Security/Space_Debris/Space_debris_by_the_numbers) (ESA), and 7,630 of them remain in orbit today — but only about 4,700 are still operational. That means there are nearly 3,000 defunct spacecraft zooming around Earth at tremendous speeds, along with other big, dangerous pieces of debris like upper-stage rocket bodies. For example, orbital velocity at 250 miles (400 kilometers) up, the altitude at which the ISS flies, is about 17,100 mph (27,500 kph). At such speeds, even a tiny shard of debris can do serious damage to a spacecraft — and there are huge numbers of such fragmentary bullets zipping around our planet. ESA estimates that Earth orbit harbors at least 36,500 debris objects that are more than 4 inches (10 centimeters) wide, 1 million between 0.4 inches and 4 inches (1 to 10 cm) across, and a staggering 330 million that are smaller than 0.4 inches (1 cm) but bigger than 0.04 inches (1 millimeter). These objects pose more than just a hypothetical threat. From 1999 to May 2021, for example, the ISS conducted 29 debris-avoiding maneuvers, including three in 2020 alone, [according to NASA officials](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html). And that number continues to grow; the station performed [another such move in November 2021](https://www.space.com/space-station-dodging-chinese-space-junk-spacex-crew-3), for example. Many of the smaller pieces of space junk were spawned by the explosion of spent rocket bodies in orbit, but others were more actively emplaced. In January 2007, for instance, China intentionally destroyed one of its defunct weather satellites in a much-criticized test of anti-satellite technology that generated [more than 3,000 tracked debris objects](https://swfound.org/media/9550/chinese_asat_fact_sheet_updated_2012.pdf) and perhaps 32,000 others too small to be detected. The vast majority of that junk remains in orbit today, experts say. Spacecraft have also collided with each other on orbit. The most famous such incident occurred in February 2009, when Russia's defunct Kosmos 2251 satellite slammed into the operational communications craft Iridium 33, producing [nearly 2,000 pieces of debris](https://swfound.org/media/6575/swf_iridium_cosmos_collision_fact_sheet_updated_2012.pdf) bigger than a softball. That 2009 smashup might be evidence that the Kessler Syndrome is already upon us, though a cataclysm of "Gravity" proportions is still a long way off. "The cascade process can be more accurately thought of as continuous and as already started, where each collision or explosion in orbit slowly results in an increase in the frequency of future collisions," [Kessler told Space Safety Magazine in 2012](http://www.spacesafetymagazine.com/space-debris/kessler-syndrome/don-kessler-envisat-kessler-syndrome/).

#### Russian ASAT Tests thump

Panda 2021 (Ankit, STANTON SENIOR FELLOW NUCLEAR POLICY PROGRAM Ankit Panda is the Stanton Senior Fellow in the Nuclear Policy Program at the Carnegie Endowment for International Peace., The Dangerous Fallout of Russia’s Anti-Satellite Missile Test, November 21, 2021, https://carnegieendowment.org/2021/11/17/dangerous-fallout-of-russia-s-anti-satellite-missile-test-pub-85804)-TL

Russia has tested a direct-ascent anti-satellite (ASAT) missile against a live satellite target, the third test of its kind by a country since 2007. The test, and the resulting orbital debris, have focused international attention on the rapidly declining sustainability of near-Earth space and the need to constrain this kind of weapons testing. On November 15, a Russian PL19 Nudol interceptor missile launched in northern Russia struck the now-defunct Soviet-era COSMOS 1408 satellite at an approximate altitude of 480 kilometers (about 300 miles). The intercept has generated a massive debris field in low-Earth orbit (LEO); according to U.S. Space Command, “more than 1,500 pieces of trackable orbital debris” have already been detected, and “hundreds of thousands of smaller [fragments]” are likely to surface. The test represents a serious challenge to space sustainability and immediately increases the collision risk that other human-made objects in LEO face, including human-inhabited objects like the International Space Station and China’s Tiangong space station. This test underscores the pressing need to develop new international norms and rules of behavior in space. It should further galvanize international efforts to ban this sort of weapons testing, which has significant negative consequences for the space environment near Earth.

#### Collision risk is infinitesimally small

Fange 17 Daniel Von Fange 17, Web Application Engineer, Founder and Owner of LeanCoder, Full Stack, Polyglot Web Developer, “Kessler Syndrome is Over Hyped”, 5/21/2017, http://braino.org/essays/kessler\_syndrome\_is\_over\_hyped/

The orbital area around earth can be broken down into four regions. Low LEO - Up to about 400km. Things that orbit here burn up in the earth’s atmosphere quickly - between a few months to two years. The space station operates at the high end of this range. It loses about a kilometer of altitude a month and if not pushed higher every few months, would soon burn up. For all practical purposes, Low LEO doesn’t matter for Kessler Syndrome. If Low LEO was ever full of space junk, we’d just wait a year and a half, and the problem would be over. High LEO - 400km to 2000km. This where most heavy satellites and most space junk orbits. The air is thin enough here that satellites only go down slowly, and they have a much farther distance to fall. It can take 50 years for stuff here to get down. This is where Kessler Syndrome could be an issue. Mid Orbit - GPS satellites and other navigation satellites travel here in lonely, long lives. The volume of space is so huge, and the number of satellites so few, that we don’t need to worry about Kessler here. GEO - If you put a satellite far enough out from earth, the speed that the satellite travels around the earth will match the speed of the surface of the earth rotating under it. From the ground, the satellite will appear to hang motionless. Usually the geostationary orbit is used by big weather satellites and big TV broadcasting satellites. (This apparent motionlessness is why satellite TV dishes can be mounted pointing in a fixed direction. You can find approximate south just by looking around at the dishes in your northern hemisphere neighborhood.) For Kessler purposes, GEO orbit is roughly a ring 384,400 km around. However, all the satellites here are moving the same direction at the same speed - debris doesn’t get free velocity from the speed of the satellites. Also, it’s quite expensive to get a satellite here, and so there aren’t many, only about one satellite per 1000km of the ring. Kessler is not a problem here. How bad could Kessler Syndrome in High LEO be? Let’s imagine a worst case scenario. An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space? I’m guessing the world has launched about 10,000 tons of satellites total. For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, its odds of hitting that cube are tiny - less than 1 in 10,000.

#### Squo tracking, shielding, and removal plans solve

Dr. Brian Koberlein 16, Professor of Physics at the Rochester Institute of Technology and PhD in Astrophysics from the University of Connecticut, “Cascade Effect”, 5-4, https://archive.briankoberlein.com/2016/05/04/cascade-effect/index.html

In the movie Gravity the driving force of the plot is a catastrophic cascade of space debris. An exploding satellite sends high speed debris into the path of other satellites, and the resulting collisions create more space debris until everything from a space shuttle to the International Space Station faces an eminent threat of destruction. Not unexpectedly, the movie portrayal of such a situation is not particularly accurate, but the risk of a debris cascade is very real.

It’s known as the Kessler syndrome, after Donald Kessler, who first imagined the scenario in the 1970s. The problem comes down to the fact that small objects in Earth orbit can stay in orbit for a very long time. If an astronaut drops a bolt, it can stay in orbit for decades or centuries. Because the relative speed of two objects in orbit can be quite large, it doesn’t take a big object to pose a real threat to your spacecraft. On the highway a small pebble can chip your car windshield. In space it can be done by a chip of paint traveling at thousands of kilometers per hour. In the history of the space shuttle missions, there were more than 1,600 debris strikes. Because of such strikes, more than 90 space shuttle windows had to be replaced over the lifetime of shuttle missions.

While that might sound alarming, it’s actually quite manageable. Upgrades and maintenance were quite common on the shuttle missions, and we tend to err on the side of caution when it comes to replacing parts. Modern spacecraft also have ways to mitigate the risk of small impacts, such as Whipple shields made of thin layers of material spaced apart so that objects disintegrate when hitting the shield rather than the spacecraft itself. We also have a tracking system that currently tracks more than 300,000 objects bigger than 1 cm, so we can make sure that most spacecraft avoid these objects.

But the risk of big collisions isn’t negligible. In 2009 the Iridium 33 and Kosmos-2251 satellites collided at high speed, destroying both spacecraft and creating more dangerous debris. It wouldn’t take many collisions like this for the debris numbers to rise dramatically, and more debris means a greater risk of collisions. In Gravity the cascade happens very quickly, triggered by a single event. The reality is not quite so grave. Instead of happening overnight, Kessler syndrome would occur gradually, raising collision risks to the point where certain orbits become logistically impractical. It could occur so gradually that we might not notice it early on, and there are some that argue it’s already underway.

The good news is that we’re aware of the threat. And, as the old saying goes, knowing is half the battle. Already we take steps to limit the amount of debris created. New spacecraft include end of life plans to remove them from orbit, either by sending them into Earths atmosphere to burn up, or sending them to a “graveyard orbit” that poses little risk to other spacecraft. There are also plans on the drawing board to clear orbits of debris, particularly in low-Earth orbit where the risk is greatest. The cascade effect is a real risk, but it’s also one we can likely manage with a bit of ingenuity.

#### China also thumps

Chaturvedi 1/29 (Amit Chaturvedi, [Hindustan Times, New Delhi, ], 1-29-2022, “China plans 'megaconstellation' of 13,000 satellites, claims report“, Hindustan Times, accessed: 1-30-2022, https://www.hindustantimes.com/world-news/china-plans-megaconstellation-of-13-000-satellites-claims-report-101643421318766.html) ajs

China is embarking on a mission that has renewed concerns about spying. It plans to send upto 13,000 satellites in space - a ‘megaconstellation’ - that will encircle the Earth in the lower orbit, a report in the Daily Mail said.

The company that has got the responsibility of this work has said that the main goal of the mission is to establish supremacy in lower Earth orbit, the report further said.

Strengthening of 5G network is the aim: China

China's State Administration of Science, Technology and Industry for National Defense (SASTIND) has called for orderly development of small satellites, according to the Daily Mail report.

It said that the group of satellites will be able to provide surveillance over much of the Earth and strengthen internet facilities.

#### Zero risk of escalation

**Pavur and Martinovic 19** [James Pavur and Ivan Martinovic, May 2019, "The Cyber-ASAT: On the Impact of Cyber Weapons in Outer Space," ResearchGate, 11th International Conference on Cyber Conflict: Silent Battle [https://www.researchgate.net/publication/334422193\_The\_Cyber-ASAT\_On\_the\_Impact\_of\_Cyber\_Weapons\_in\_Outer\_Space accessed 12/10/21](https://www.researchgate.net/publication/334422193_The_Cyber-ASAT_On_the_Impact_of_Cyber_Weapons_in_Outer_Space%20accessed%2012/10/21)]Adam

A. Limited Accessibility

Space is difficult. Over 60 years have passed since the first Sputnik launch and only nine countries (ten including the EU) have orbital launch capabilities. Moreover, a launch programme alone does not guarantee the resources and precision required to operate a meaningful ASAT capability. Given this, one possible reason why space wars have not broken out is simply because only the US has ever had the ability to fight one [21, p. 402], [22, pp. 419–420].

Although launch technology may become cheaper and easier, it is unclear to what extent these advances will be distributed among presently non-spacefaring nations. Limited access to orbit necessarily reduces the scenarios which could plausibly escalate to ASAT usage. Only major conflicts between the handful of states with ‘space club’ membership could be considered possible flashpoints. Even then, the fragility of an attacker’s own space assets creates de-escalatory pressures due to the deterrent effect of retaliation. Since the earliest days of the space race, dominant powers have recognized this dynamic and demonstrated an inclination towards de-escalatory space strategies [23].

B. Attributable Norms

There also exists a long-standing normative framework favouring the peaceful use of space. The effectiveness of this regime, centred around the Outer Space Treaty (OST), is highly contentious and many have pointed out its serious legal and political shortcomings [24]–[26]. Nevertheless, this status quo framework has somehow supported over six decades of relative peace in orbit.

Over these six decades, norms have become deeply ingrained into the way states describe and perceive space weaponization. This de facto codification was dramatically demonstrated in 2005 when the US found itself on the short end of a 160-1 UN vote after opposing a non-binding resolution on space weaponization. Although states have occasionally pushed the boundaries of these norms, this has typically occurred through incremental legal re-interpretation rather than outright opposition [27]. Even the most notable incidents, such as the 2007-2008 US and Chinese ASAT demonstrations, were couched in rhetoric from both the norm violators and defenders, depicting space as a peaceful global commons [27, p. 56]. Altogether, this suggests that states perceive real costs to breaking this normative tradition and may even moderate their behaviours accordingly.

One further factor supporting this norms regime is the high degree of attributability surrounding ASAT weapons. For kinetic ASAT technology, plausible deniability and stealth are essentially impossible. The literally explosive act of launching a rocket cannot evade detection and, if used offensively, retaliation. This imposes high diplomatic costs on ASAT usage and testing, particularly during peacetime.

C. Environmental Interdependence

A third stabilizing force relates to the orbital debris consequences of ASATs. China’s 2007 ASAT demonstration was the largest debris-generating event in history, as the targeted satellite dissipated into thousands of dangerous debris particles [28, p. 4]. Since debris particles are indiscriminate and unpredictable, they often threaten the attacker’s own space assets [22, p. 420]. This is compounded by Kessler syndrome, a phenomenon whereby orbital debris ‘breeds’ as large pieces of debris collide and disintegrate. As space debris remains in orbit for hundreds of years, the cascade effect of an ASAT attack can constrain the attacker’s long-term use of space [29, pp. 295– 296]. Any state with kinetic ASAT capabilities will likely also operate satellites of its own, and they are necessarily exposed to this collateral damage threat. Space debris thus acts as a strong strategic deterrent to ASAT usage.

#### No IL to nuclear war from hacking none of your evidence says it

#### Hacking of SATs by the government nonuniques this advantage– we read in blue

Akoto 20 “Hackers could shut down satellites -- or turn them into weapons” February 13, 2020 William Akoto [a postdoctoral research fellow at the University of Denver.] <https://www.upi.com/Top_News/Voices/2020/02/13/Hackers-could-shut-down-satellites-or-turn-them-into-weapons/4091581597502/> SM

This scenario played out in 1998 when hackers took control of the U.S.-German ROSAT X-Ray satellite. They did it by hacking into computers at the Goddard Space Flight Center in Maryland. The hackers then instructed the satellite to aim its solar panels directly at the sun. This effectively fried its batteries and rendered the satellite useless. The defunct satellite eventually crashed back to Earth in 2011. Hackers could also hold satellites for ransom, as happened in 1999 when hackers took control of the U.K.'s SkyNet satellites.

Over the years, the threat of cyberattacks on satellites has gotten more dire. In 2008, hackers, possibly from China, reportedly took full control of two NASA satellites, one for about two minutes and the other for about nine minutes. In 2018, another group of Chinese state-backed hackers reportedly launched a sophisticated hacking campaign aimed at satellite operators and defense contractors. Iranian hacking groups have also attempted similar attacks.

#### The radiation scenario has nothing to do with mega constellations its just about space craft

#### Montreal Protocol failed AND non-covered materials thump ozone.

Pearce 17 Fred Pearce 8-14-2017 "Thirty Years After Montreal Pact, Solving the Ozone Problem Remains Elusive" <https://e360.yale.edu/features/thirty-years-after-the-montreal-protocol-solving-the-ozone-problem-remains-elusive> (Fred Pearce is a freelance author and journalist based in the U.K. He is a contributing writer for Yale Environment 360)//Elmer

Did the Montreal Protocol fix the ozone hole? It seemed so. With chlorofluorocarbons (CFCs) and other ozone-eating chemicals banned, many scientists said it was only a matter of time before the ozone layer recharged, and the annual hole over Antarctica healed for good. But 30 years on, some atmospheric chemists are not so sure. The healing is proving painfully slow. And new discoveries about chemicals not covered by the protocol are raising fears that full recovery could be postponed into the 22nd century – or possibly even prevented altogether. In mid-September, the United Nations is celebrating the protocol’s 30th anniversary. It will declare that “we are all ozone heroes.” But are we patting ourselves on the back a bit too soon? The ozone layer is a long-standing natural feature of the stratosphere, the part of the atmosphere that begins about six miles above the earth. The ozone layer filters out dangerous ultraviolet radiation from the sun that can cause skin cancer and damage many life forms. It may have been essential for the development of life on Earth. So there was alarm in the 1970s when researchers first warned that extremely stable man-made compounds like CFCs, used in refrigerants and aerosols, were floating up into the stratosphere, where they released chlorine and bromine atoms that break down ozone molecules. In the 1980s, Antarctic researchers discovered that these chemical reactions went into overdrive in the super-cold polar stratospheric clouds that formed over the frozen continent. They had begun creating a dramatic “hole” in the ozone layer at the end of each austral winter. The ensuing panic resulted in the signing of the Montreal Protocol on September 16, 1987. It and its successors have phased out production of a range of man-made chlorine and bromine compounds thought to persist for the several years needed for them to reach the stratosphere. Besides CFCs, they include carbon tetrachloride, hydrochlorofluorocarbons (HCFCs), and methyl bromide, a fumigant once widely used to kill pests. So far so good. The amount of ozone-depleters in the atmosphere has dropped by more than 10 percent since peaking in the late 1990s. In response, the total ozone in the atmosphere has been largely unchanged since 2000. But in the past five years, evidence has emerged that potential ozone-eating compounds can reach the ozone layer much faster than previously thought. Under some weather conditions, just a few days may be enough. And that means a wide range of much more short-lived compounds threaten the ozone layer – chemicals not covered by the Montreal Protocol. These compounds are all around us. They are widely used as industrial solvents for tasks like degreasing and dry cleaning. And their releases into the atmosphere are increasing fast. These new ozone-busters include dichloromethane (DCM), a common and cheap paint stripper, also used in foam-blowing agents and, ironically, in the manufacture of “ozone-friendly” alternatives to CFCs. With emissions now exceeding one million tons a year, the concentration of DCM in the lower atmosphere has more than doubled s

ince 2004. Even so, it has not been regarded as a threat to the ozone layer, because its typical lifetime in the atmosphere before it is broken down in photochemical reactions is only about five months. It should, atmospheric chemists concluded, remain safely in the lower atmosphere. But that view collapsed in 2015, when Emma Leedham Elvidge at the University of East Anglia in England examined air samples taken on board commercial aircraft cruising at the lower edge of the stratosphere. She found high levels of DCM, especially over the Indian subcontinent and Southeast Asia, and particularly during the Asian monsoon season, when strong updrafts fast-track air from the ground to the stratosphere. It seems they were taking DCM along for the ride. How much should we worry? Ryan Hossaini, an atmospheric chemist at Lancaster University, recently did the math. He calculated that DCM currently contributes less than 10 percent of the chlorine in the ozone layer. But on current emission trends, it could be That could delay the ozone hole’s recovery by 30 years, until at least 2095, he suggested. Others share that concern. “Growing quantities of DCM are leaking into the stratosphere, where it is exceptionally effective in destroying the ozone,” says David Rowley, an atmospheric chemist at the University College London, who was not involved in the research. “The potential for DCM to affect the global ozone budget is profound.” Alarm bells are ringing about dozens of other short-lived, potentially ozone-destroying chlorine compounds accumulating in the atmosphere as a result of fast-rising global manufacturing. They include 1,2-dichloroethane, a chemical widely used in the manufacture of PVC pipes. There are few atmospheric measurements of this compound yet, “but sporadic data suggest it is a significant source of chlorine in the atmosphere,” says Hossaini. The risks of such chemicals reaching the ozone layer are greatest in the tropics, where manufacturing is booming in fast-industrialising countries such as China and India, and where, as luck would have it, atmospheric circulation patterns are favorable. The Asian monsoon can propel the gases to the stratosphere in as little as ten days, according to unpublished research seen by Yale Environment 360. Thirty years on, the Montreal Protocol has not begun to come to grips with these chemicals, warns Rowley. “The naïve view until recently,” he says, “was that short-lived [chemicals] didn’t present a threat to stratospheric ozone. Wrong.” Other loopholes in the protocol are concerning researchers as well. In 2014, colleagues of Leedham Elvidge’s at the University of East Anglia warned that three CFCs supposedly banned under the protocol were turning up in increasing amounts in the clean air blowing round the Southern Ocean and captured at Cape Grim in Tasmania. Johannes Laube, an atmospheric chemist at the University of East Anglia, calculated that global emissions of CFC-113a, once an important feedstock in manufacturing both refrigerants and pyrethroid pesticides, doubled in two years.