# Stanford Octos Neg vs Ayala AM

# 1NC

### 1

#### Interp: if the aff defends that appropriation of lunar heritage site by private entities is unjust, they must define what a lunar heritage site is in a delineated text in the 1AC

#### Vote neg for stable ground — there is no global definition of lunar heritage site since UNESCO is yet to recognize any heritage sites on the moon, the US’s definition is not predictable on a global topic and nebulous - for example, the NASA website excludes chinese landing sites but their aff ev refers to heritage sites as past landing sites - that decks predictable neg ground because they can delink from DA by redefining the aff - for example, they could adopt a narrow definition of heritage sites to delink from DAs like mining or innovation, or pivot to a broad definition if they’re behind on solvency

#### Independently, vote neg on presumption - private entities will just interpret heritage sites narrowly as possible eg UNESCO heritage sites which don’t exist on the moon

### 2

#### CP:

#### Private entities ought to place 250 Earth Observation satellites in Geostationary Orbit and replace those satellites upon removal or destruction

#### States ought to place antineutrino detectors, streaming live data to and monitored by the International Atomic Energy Agency, within 10 meters of all nuclear reactors.

#### Solves stationary EO – continued observation

NESDIS n.d. “Geostationary Satellites” <https://www.nesdis.noaa.gov/current-satellite-missions/currently-flying/geostationary-satellites> TG

NOAA’s most sophisticated Geostationary Operational Environmental Satellites (GOES), known as the GOES-R Series, provide advanced imagery and atmospheric measurements of Earth’s Western Hemisphere, real-time mapping of lightning activity, and improved monitoring of solar activity and space weather.

GOES satellites orbit 22,236 miles above Earth’s equator, at speeds equal to the Earth's rotation. This allows them to maintain their positions over specific geographic regions so they can provide continuous coverage of that area over time.

#### That’s the internal link in Hamill – we inserted the key lines

Lunar Basing solves Earth Observatory – specifically Super-Volcanoes and Arctic Aviation.

Hamill 16, Patrick. "Atmospheric observations from the moon: A lunar earth-observatory." 2016 Ieee International Geoscience and Remote Sensing Symposium (Igarss). IEEE, 2016. (Department of Physics and Astronomy at San Jose State University)//Elmer

There are many reasons for placing an Earth atmospheric observatory on the Moon. Perhaps the most obvious reason is that from the Moon one can observe a single location on Earth for a relatively long period of time (hours, rather than seconds for a satellite in LEO).

#### EO sats observe and solve

Alonso 18 [(Elisa Jiménez, communications consultant with Acclimatise, climate resilience organization) “Earth Observation of Increasing Importance for Climate Change Adaptation,” Acclimatise, May 2, 2018, <https://www.acclimatise.uk.com/2018/05/02/earth-observation-of-increasing-importance-for-climate-change-adaptation/>] TDI

Earth observation (EO) satellites are playing an increasingly important role in assessing climate change. By providing a constant and consistent stream of data about the state of the climate, EO is not just improving scientific outcomes but can also inform climate policy.

Managing climate-related risks effectively requires accurate, robust, sustained, and wide-ranging climate information. Reliable observational climate data can help scientists test the accuracy of their models and improve the science of attributing certain events to climate change. Information based on projections from models and historic data can help decision makers plan and implement adaptation actions.

Providing information in data-sparse regions

Ground-based weather and climate monitoring systems only cover about 30% of the Earth’s surface. In many parts of the world such data is incomplete and patchy due to poorly maintained weather stations and a general lack of such facilities.

EO satellites and rapidly improving satellite technology, especially data from open access programmes, offer a valuable source information for such data-sparse regions. This is especially important since countries and regions with a lack of climate data are often particularly vulnerable to climate change impacts.

#### Their preempts form the Ding ev:

#### 1] Replacement solves longevity

#### 2] Stationary observation solves long term trands

#### 3] Large quantity of sats allow universal coverage in all conditions

#### The second plank solves Neutrinos – the technology already exists, it just needs to be implemented

Scoles 20, Sarah. “Neutrino Detectors Could Be Used to Spot Nuclear Rogues” Wired, Oct 6, 2020, <https://www.wired.com/story/neutrino-detectors-could-be-used-to-spot-nuclear-rogues/> TG

These days, Svoboda and a growing number of colleagues are interested in using signals from neutrinos that burst from reactors for nuclear security: to perhaps detect undeclared devices and to ensure that known reactors are not being used to amass material for weapons. The neutrino signature that slams straight through a reactor’s walls changes with what’s going on inside, providing a window into how much plutonium is in there, and whether it matches what’s expected. If not, it’s a clue that some of it may have been diverted toward weapons programs. It’s a real-time measurement that could augment the inspections and measurements that officials from the International Atomic Energy Agency currently do.

Those “safeguards” measures take many forms: first, declarations from facilities about what they’re up to. And second, monitoring. That involves inspections both routine and ad hoc, satellite imagery, open-source analysis, camera surveillance, collection and analysis of sample nuclear material, and environmental analysis. But neutrinos never lie, can’t hide, and tell the truth as it unfolds.

The tech isn’t quite ready for prime time, but some scientists think neutrino monitoring might be practical, and they’re taking (small) steps toward making that happen: The Department of Energy recently commissioned a study on nuclear security applications for neutrino detectors, and this summer it spooled up a group that aims to determine where the technology might be useful to policy types. A project with the creepy name Watchman, which Svoboda works on, is also developing detectors and methods that officials could use to pick up neutrino signals from a reactor dozens of miles away, revealing its activities without being right next door.

#### That solves prolif detection and is a sufficient distance – we’ve inserted lines they highlighted in 1AC Lee – it also concedes squo solves cuz the existence of the tech is a deterrent which is a reason to negate on presumption

* The neutrino detection technology could offer a solution.
* Optimizing reactor power levels to produce plutonium, a telltale sign that a country is trying to build a bomb, will change the rate and energy spectrum of antineutrinos that a device parked outside of the reactor can detect. And since these particles can pass through matter, the operator can’t shield the reactor’s release of antineutrinos the same way lead blocks X-rays.
* For now, a detector must stay within tens of meters of the reactor to be effective.
* And in any case, the mere knowledge that such technology has become a reality could prove to be a powerful deterrent to nuclear proliferation in itself.

#### 1AR theory is skewed towards the aff – a) the 2NR must cover substance and over-cover theory, since they get the collapse and persuasive spin advantage of the 3min 2AR, b) their responses to my counter interp will be new, which means 1AR theory necessitates intervention. Implications – a) reject 1AR theory since it can’t be a legitimate check for abuse, b) drop the arg to minimize the chance the round is decided unfairly, c) use reasonability with a bar of defense or the aff always wins since the 2AR can line by line the whole 2NR without winning real abuse

### 3

#### CP: The Supreme Court of the United States should request and accept an appeal for the case LAURA MURRAY CICCO, v. NATIONAL AERONAUTICS & SPACE ADMINISTRATION, and rule in favor of Cicco, on the basis of the ban on national appropriation in the Outer Space Treaty and the common law property rights regime. Relevant Courts should uphold this precedent.

#### Except for the appropriation of one vial of moon dust by Laura Murray Cicco, private entities should not appropriate lunar heritage sites.

#### Ruling in favor of Cicco realigns the US with the OST.

Chow 18 “Woman says Neil Armstrong gave her moon dust. She's suing NASA to keep it.” June 14, 2018 Denise Chow <https://www.nbcnews.com/mach/science/woman-says-neil-armstrong-gave-her-moon-dust-she-s-ncna883116> SM

In a case that mixes nostalgia with serious questions about who is allowed to own materials brought back from space, a Tennessee woman is suing NASA to maintain possession of what she says is a vial of moon dust that astronaut Neil Armstrong gave her when she was 10 years old.

In her lawsuit filed in federal court last week, Laura Cicco says Armstrong, the first human to walk on the moon, gave her the vial in the 1970s along with a handwritten note: “To Laura Ann Murray — Best of Luck — Neil Armstrong Apollo 11.”

Moondust

Cicco, then named Laura Murray, claims she received the memento while living with her family in Cincinnati. She maintains that Armstrong, who taught aerospace engineering at the University of Cincinnati at the time, had been a friend of her late father. Armstrong died in 2012.

A handwriting expert authenticated the signature on the note, said Cicco’s lawyer, Christopher McHugh of Kansas City, Missouri. Tests of the vial's contents found that "there is no evidence to rule out a lunar origin," according to the court documents, but terrestrial materials from Earth's crust were also identified in the sample.

Cicco told the Washington Post that she had lost track of the vial until five years ago, when she rediscovered it in her father’s belongings after his death, and that she had filed the suit in an effort to block NASA from trying to seize the moon dust.

The space agency declined a request by MACH to comment on the case, but it has a reputation for aggressiveness in its efforts to take possession of lunar samples held by private citizens. In one highly publicized case from 2011, NASA conducted a sting operation in Lake Elsinore, California, to seize paperweights containing slivers of moon rock that a 74-year-old woman was trying to sell.

“Lunar samples that have been collected by U.S. government missions are considered unique and limited natural resources,” said Michelle Hanlon, co-founder of For All Moonkind, a nonprofit dedicated to preserving the Apollo lunar landing sites. “NASA retains all lunar samples collected through U.S. government missions as NASA property.” Hanlon is not involved in the case.

McHugh said there is no law against private ownership of moon dust. “The law is silent on this — it’s still an open question,” he said. “NASA bases its position on the assumption that no lunar material ever left NASA unless it was stolen, but there is no law that says you can’t own lunar material.”

The outcome of Cicco's case will hinge on whether Armstrong or the government owned the dust at the time it was given, according to Christopher Johnson, a professor of law at Georgetown University in Washington, D.C. and a space law expert. “If it’s the property of the U.S. government, he could not have passed it along to somebody else — he didn’t have the correct chain of custody or title for that,” said Johnson, who is not involved in the case.

McHugh said the handwritten note from Armstrong gives Cicco a strong claim of ownership. “We get past that hurdle because we have proof that Laura was given it directly by Neil Armstrong,” he said. “Unless you call Neil Armstrong a thief,” he added, “he had the authority to own it and give it to people. I don’t think Neil Armstrong was a thief.”

If there are no federal statutes against private ownership of materials from space, other experts say international law may provide some guidance. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, signed in 1967 and commonly called the Outer Space Treaty, prohibits governments from claiming territory on the moon and other celestial bodies. It is recognized by 107 countries, including the U.S. and Russia.

“In international law, nobody can appropriate anything in space. That is very clear,” said Ram Jakhu, an associate professor of space law at McGill University in Montreal, Canada. But, he added, “There are some exceptions and tolerance of violations. Countries like the U.S. and Russia have been collecting these moon samples and have been keeping it, so there’s some kind of tolerance of violation of international law.”

#### Lunar basing isn’t prohibited under this interpretation of the OST and isn’t seen as appropriation as long as it doesn’t constitute sovereign control – means credible OST encourages peaceful collaboration for lunar research which turns the aff

OST, "Outer Space Treaty," United Nations Office for Outer Space Affairs, <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html> mvp mvp

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

There shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.

#### Exemptions from the OST endangers the credibility of the entire treaty.

Hickman and Dolman 2 John Hickman and Everett Dolman Volume 21 Number 1 2002 “Resurrecting the Space Age: A State–Centered Commentary on the Outer Space Regime” (associate professor in the Department of Government and International Studies at Berry College in Mt. Berry)//Elmer

Thus a state party need merely announce its intention to withdraw and then wait one year. Withdrawal of a single state party to the treaty, however, would not necessarily terminate the treaty between the other state parties. Yet, the decision of an important state not to be bound by a regime–creating treaty obviously endangers the entire treaty. The decision of the United States or China to withdraw from the OST would have far greater implications for the survival of the international space regime than the same decision by Bangladesh, Burkina Faso, or Papua New Guinea—the equality of states under international law remains nothing more than a useful fiction. For the OST to remain good international law, it must be accepted as such by the major space faring states of the 21st Century: the United States, Russia, the European Union, Japan, and China. One defection from the regime by a member of this group would no doubt lead to its effective collapse, as the remaining space faring states are unlikely to use the kind of coercion necessary to enforce the regime. A more likely response to such a defection is a scramble to make similar claims to sovereignty, based on historical precedent and effective occupation. Similar rushes to stake claims for territory sovereignty in other celestial bodies might follow.

#### Violations cause credibility spirals.

Jha 17 “US lawmakers seek review of Outer Space Treaty amid competition from India, China” May 26, 2017 Lalit K. Jha <https://www.livemint.com/Science/6uxgbhcNcRfBtbWyq63wTO/US-lawmakers-seek-review-of-Outer-Space-Treaty-amid-competit.html> SM

Outer Space Treaty which entered into force in 1967 forms the basis of international space law. While the treaty has been successful so far, lawmakers said some of the provisions have not been tested. For instance the treaty does not prohibit the placement of conventional weapons in orbit. It also states that the exploration of outer space shall be done to benefit all countries and that space shall be free for exploration and use by all the states.

Matthew Schaefer, co-director, Space, Cyber and Telecommunications Law Programme, University of Nebraska College of Law, said there is going to be some countries that oppose US interpretations of various OST provisions for matters of national interest regardless.

“But I think when we comply with Article 6 the OST, we increase the number of countries that we have credibility to lead towards the US inspired to the commercially friendly inspired interpretations of the treaty," he said.

“And when we don’t comply with Article 6 of the OST, what we do is we send some countries, China and Russia is—though China actually has been noticeably pretty quiet when it comes to asteroid mining and property rights. But as a general matter, we send countries their way and we also have less credibility to insist those countries when, again, a US company is a first mover," Schaefer said.

“If we don’t have as part of our criteria for authorising commercial companies looking at whether we’re doing harmful interference with a pre-existing activity with them, we won’t have the credibility to them, insist on them doing the same for us," Schaefer said.

#### Credible OST solves Space War.

Johnson 17 Christopher Johnson 1-23-2017 “The Outer Space Treaty at 50” , <http://thespacereview.com/article/3155/1> (graduate of Leiden University’s International Institute of Air and Space Law and the International Space University)//Elmer

As mentioned, many of the provisions of the Outer Space Treaty were borrowed from previous UN General Assembly resolutions. But as resolutions alone, these documents were non-binding and did not require states to alter their behavior. And while UN General Assembly resolutions are not normally law-making exercises, they do record the commonly-held expression of intentions by the states in the General Assembly, and make political recommendations to UNGA Members (or to the UN Security Council). UNGA Resolutions can also set priorities and mold opinion for inclusion in subsequent treaties. The prohibition on the placement of nuclear weapons and other weapons of mass destruction in outer space or their installation on celestial bodies was taken from UNGA Resolution 1884 of 1963. The resolution: [s]olemnly calls upon all States… [t]o refrain from placing in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, installing such weapons on celestial bodies, or stationing such weapons in outer space in any other manner. This prohibition was transferred to the Outer Space Treaty, and thereby remade into international treaty law. As President Johnson pointed out in his recommendation to Congress to ratify the Outer Space Treaty, “the realms of space should forever remain realms of peace.”5 He continued: We know the gains of cooperation. We know the losses of the failure to cooperate. If we fail now to apply the lessons we have learned, or even if we delay their application, we know that the advances into space may only mean adding a new dimension to warfare. If, however, we proceed along the orderly course of full cooperation we shall, by the very fact of cooperation, make the most substantial contribution toward perfecting peace.6 The agreement contained in Article IV of the Outer Space Treaty reflects an agreement between the US and the USSR, as obligations restricting their freedom of action. Why would a state intentionally place a restriction on itself? Isn’t it better to merely keep outer space as unregulated as possible? Since there were only two states then capable of venturing into outer space, why did either state agree to rules governing its actions? It may seem counterintuitive, but the deeper rationale behind security arrangements like this is that the parties actually benefit in the long-term from placing mutual restrictions on their behavior. Agreeing to restrict your freedom of action has deep links to the usefulness or utility of law itself. Consider driving a car: in order to get a license, you agree to observe certain rules, and the license signals your obligation to obey these rules. However, sometimes adhering to those rules is not only inconvenient (such as stopping at stop signs when there’s nobody else at the intersection), it is also against your short term-interests (you have an appointment or will otherwise suffer from observing the rules.) However, agreeing to operate within a system where your freedoms are sometimes restricted can have the effect of actually increasing your freedom over the long term. Wouldn’t you rather live in a state where traffic laws exist, and other drivers agree to observe them? Isn’t that system preferable to living in a state without traffic rules? Indeed, a system with traffic rules increases not just freedom in general, but overall safety and orderliness. Consequently, because the system with rules is preferable to the system without rules, your willingness to use the roads allows you to travel with greater security and ease. You are better assured of the likelihood that you will get to your intended destination without some other driver crashing into you. Knowing that safe travel is likely, you are more willing to take trips more often, and to farther destinations. Your freedom is actually increased over the long term because you are willing to suffer temporary, short-term restrictions such as inconvenient red lights. Long-term rationality warrants adherence to efficient systems of law. Correctly-balanced rules help increase long-term benefits (like safety and security) that would otherwise be unattainable without a system of rules. It is this rationale that also underpins international treaty-making. Today, the current absence of nuclear weapons or other weapons of mass destruction in outer space attests to the bargain struck in the Outer Space Treaty being a successful one, where security (and the liberty and freedom possible with security) were furthered by the mutual exchange of restrictions that states placed upon themselves. The more than 50 years of peaceful uses of outer space, including cooperation between states who remain rivals elsewhere, are the rich long-term gains resulting from the Outer Space Treaty.

#### Space war goes nuclear.

Johnson-Freese 17 Joan Johnson-Freese, Professor and chair of space science and technology @ Naval War College, 17, Space Warfare in the 21st Century, Routledge, ISBN 978131552917, p 18-20.

Space warfare runs two untenable risks: the creation of destructive debris and escalation to terrestrial, even nuclear, warfare. Kinetic warfare in space creates debris traveling at a speed of more than 17,000 miles per hour, which then in itself becomes a destructive weapon if it hits another object—even potentially triggering the so-called Kessler Syndrome,86 exaggerated for dramatic effect in the movie Gravity. Ironically, both China and the United States learned the negative lessons of debris creation the hard way. In 1985, the United States tested a miniature homing vehicle (MHV) ASAT launched from an F-15 aircraft. The MHV intercepted and destroyed a defunct US satellite at an altitude of approximately 250 miles. It took almost 17 years for the debris resulting from that test to be fully eliminated by conflagration re-entering the Earth’s atmosphere or being consumed by frictional forces, though no fragment had any adverse consequences to another satellite—in particular, no collisions. China irresponsibly tested a direct-ascent ASAT in 2007, destroying one if its defunct satellites. That test was at an altitude almost twice that of the 1985 US test. The debris created by the impact added 25 percent to the debris total in low Earth orbit87 and will dissipate through the low Earth orbit, heavily populated with satellites, for decades, perhaps centuries, to come. Perhaps most ironically, because of superior US debris-tracking capabilities, the United States—even though not required to do so—has on more than one occasion warned China that it needed to maneuver one of its satellites to avoid a collision with debris China itself had likely created.88 In 2013, a piece of Chinese space junk from the 2007 ASAT test collided with a Russian laser ranging nanosatellite called BLITS, creating still more debris.89 The broader point is that all nations have a compelling common interest in avoiding the massive increase in space debris that would be created by a substantial ASAT conflict. Gen. Hyten has said that not creating debris is “the one limiting factor” to space war. “Whatever you do,” he warns, “don’t create debris.”90 While that might appear an obvious “limiting factor,” preparing to fight its way through a debris cloud had been a Pentagon consideration in the past. Now, however, sustaining the space environment has been incorporated into Pentagon space goals. Beyond debris creation, MacDonald points out that as China becomes more militarily capable in space and there is more symmetry between the countries, other risks are created – specifically, escalation. That is, the United States could threaten to attack not just Chinese space assets, but also ground-based assets, including ASAT command-and-control centers and other military capabilities. But such actions, which would involve attacking Chinese soil and likely causing substantial direct casualties, would politically weigh much heavier than the U.S. loss of space hardware, and thus might climb the escalatory ladder to a more damaging war that both sides would probably want to avoid.91 MacDonald isn’t alone in concerns about escalation. Secure World Foundation analyst Victoria Samson has also voiced apprehension regarding US rhetoric that does not distinguish between actions against unclassified and classified US satellites, stating that “things can escalate pretty quickly should we come into a time of hostility.”92 Theresa Hitchens explained the most frightening, but not implausible, risk of space war escalation in a 2012 Time magazine interview. Say you have a crisis between two nuclear-armed, space-faring countries, Nation A and Nation B, which have a long-standing border dispute. Nation A, with its satellite capability, sees that Nation B is mobilizing troops and opening up military depots in a region where things are very tense already, on the tipping point. Nation A thinks: “That’s it, they’re going to attack.” So it might decide to pre-emptively strike the communications satellite used by Nation B to slow down its ability to move toward the border and give itself time to fortify. Say this happens and Nation B has no use of satellites for 12 hours, the time it takes it to get another satellite into position. What does Nation B do? It’s blind, it’s deaf, it’s thinking all this time that it’s about to be overwhelmed by an invasion or even nuked. This is possibly a real crisis escalation situation; something similar has been played out in U.S. Air Force war games, a scenario-planning exercise practiced by the U.S. military. The first game involving anti-satellite weapons stopped in five minutes because it went nuclear – bam. Nation B nuked Nation A. This is not a far-out, “The sky’s falling in!” concern, it is something that has been played out over and over again in the gaming of these things, and I have real fears about it.93 While escalation to a nuclear exchange may seem unthinkable, in war games conducted by the military, nuclear weapons are treated as just another warfighting weapon. Morgan also voiced concerns about escalation generally and nuclear escalation specifically in the 2010 RAND report, stating: The adversary would also likely be deterred from damaging U.S. satellite early-warning system (SEWS) assets to avoid risking inadvertent escalation to the nuclear threshold, but that firebreak would almost certainly collapse with the conclusion that such escalation is inevitable and that it is in the adversary’s interest to launch a preemptive nuclear strike.94

### Case

#### Their 1AC claimed that the aff was key to moon dust research and moon basing couldn’t happen without that research – we’re impact turning that –

#### First, defense --

#### Their author concludes moon dust doesn’t mess with moon-based observation.

Hamill 16, Patrick. "Atmospheric observations from the moon: A lunar earth-observatory." 2016 Ieee International Geoscience and Remote Sensing Symposium (Igarss). IEEE, 2016. (Department of Physics and Astronomy at San Jose State University) SM

The lunar surface is covered in electrostatically charged fine dust particles of diameter 70 µm. This dust has sharp edges (not having been exposed to weathering) and is expected to cling to surfaces to which it is exposed. It is believed that the dust is disturbed by the changing electric field at the terminator and rises to heights of several meters [9]. This effect may have been observed by the Apollo astronauts. The dust may damage unshielded equipment [10]. Some investigators have even suggested that the presence of dust would make telescopic observations impossible, but the evidence from Chang’e 3 shows that this is not the case. (It might be mentioned that the Chang’e 3 instrumentation is protected during sunrise and sunset.) Furthermore, the retroreflectors placed on the lunar surface by NASA Astronauts and Soviet robotic rovers over forty years ago still reflect laser beams, indicating that even over long periods of time optical surfaces are not completely degraded by the lunar dust [11].

#### But dust definitely still stops moon basing.

Niiler 21 Eric Niiler “The Next Big Challenge for Lunar Astronauts? Moon Dust” 08.19.2021 <https://www.wired.com/story/the-next-big-challenge-for-lunar-astronauts-moon-dust/> SM

AS NASA AND private space companies prepare to send equipment—and eventually astronauts—back to the moon, they are facing a nearly invisible threat to any future lunar outpost: tiny particles of dust. Ground-up lunar rock, known as regolith, clogs drills and other delicate instruments, and it's so sharp that it scratches space suits. Because the dust absorbs sunlight, it can also overheat sensitive electronics.

Dust particles also pose a health risk. Even though Apollo-era astronauts only went outside during a few days on each mission, some reported burning eyes and stuffy nasal passages when they returned from moon walks and took off their dust-covered space suits inside the capsule. Images from the Apollo 17 mission, which focused on geology and featured seven-hour trips in the lunar rover, show astronaut Gene Cernan’s face covered in dust, like some outer space coal miner. During a technical briefing when he returned to Earth, Cernan told NASA officials that lunar dust was nothing to sneeze at. "I think dust is probably one of our greatest inhibitors to a nominal operation on the moon,” Cernan said. “I think we can overcome other physiological or physical or mechanical problems, except dust."

The grit clogged the radiators that removed heat and carbon dioxide from space suits and wore a hole in the knee of Cernan’s outer space suit, according to Phil Abel, who researches moon dust as manager of the Tribology and Mechanical Components Branch at NASA’s Glenn Research Center. (Tribology is the study of wear and friction.) The Apollo 17 astronauts brought dust into the capsule, where it smelled like gunpowder and caused lunar module pilot Harrison Schmitt to have hay fever symptoms, according to a report from a NASA workshop on lunar dust in 2020.

Here’s how one Apollo 12 astronaut described what happened when he returned to the lunar module after a walk on the moon: “The [module] was filthy dirty and had so much dust that when I took my helmet off, I was almost blinded. Junk immediately got into my eyes.” (The quote appears in a 2009 NASA report entitled “The Risk of Adverse Health Effects From Lunar Dust Exposure.”)

Researchers at Stony Brook University exposed human lung and brain cells to lunar dust and found that it killed 90 percent of the cells, according to a study published in the journal GeoHealth in 2018. In fact, respiratory health is a top concern if and when humans return to the moon, according to Abel. “These particles get lodged down deep in your lungs, and that’s a long-term health risk,” Abel says. “There was some concern at the time that if we had needed to do more on the moon’s surface, some of the space suits would have started to leak at too high a rate. It’s something we have been working on to improve.”

#### \*\*\*Scenarios\*\*\*

#### AI prediction methods coming now and solve.

Joshi 19 “How AI Can And Will Predict Disasters” NAVEEN JOSHI [Naveen Joshi, columnist, is Founder and CEO of Allerin, which develops engineering and technology solutions focused on optimal customer experiences. Naveen works in AI, Big Data, IoT and Blockchain.] 3/15/2019 <https://www.forbes.com/sites/cognitiveworld/2019/03/15/how-ai-can-and-will-predict-disasters/?sh=57a309075be2> SM

How AI Can And Will Predict Disasters

Recently, the regions around the Dead Sea in Jordan were flooded, causing the death of 21 children who were on a school trip, and injuring 35 more. Such disasters affect millions of people every year and cause property damage worth hundreds of billions. In 2017 alone, almost 335 natural disasters have affected more than 95.6 million people, and killed 9,697, costing around US $335 billion.

But, the impact of these phenomena can be reduced if we were able to predict their occurrence. AI-powered systems can already predict the prices of stocks, which involve the analysis of numerous variables. Likewise, researchers are applying artificial intelligence to accurately predict natural disasters. By predicting the occurrence of natural disasters, we can save thousands of lives and take appropriate measures to reduce property damage.

Using AI to predict natural disasters

Artificial intelligence has been helping us in various applications such as customer service, trading and healthcare. And now, researchers have found that AI can be used to predict natural disasters. With enormous amounts of good quality datasets, AI can predict the occurrence of numerous natural disasters, which can be the difference between life and death for thousands of people. Some of the natural disasters that can be predicted by AI are:

Earthquakes

Researchers are collecting enormous amounts of seismic data for analysis using deep learning systems. Artificial intelligence can use the seismic data to analyze the magnitude and patterns of earthquakes. Such data can prove beneficial to predict the occurrence of earthquakes. For example, Google and Harvard are developing an AI system that can predict the aftershocks of an earthquake. Scientists have studied more than 131,000 earthquakes and aftershocks to build a neural network. The researchers tested the neural network on 30,000 events, and the system predicted the aftershock locations more precisely when compared to traditional methods.

Similarly, multiple researchers are creating their own applications to predict earthquakes and aftershocks. In the future, we may be able to foresee earthquakes and authorities can start evacuation operations accordingly. Currently, Japan is using satellites to analyze images of the earth to predict natural disasters. AI-based systems look for changes in the images to predict the risk of disasters such as earthquakes and tsunamis. Moreover, these systems also monitor aging infrastructure. Artificial intelligence systems can detect deformations in structures, which can be used to reduce the damage caused by collapsing buildings and bridges, or subsiding roads.

Floods

Google is building an AI platform to predict floods in India and warn users via Google Maps and Google Search. The data for training the AI system is collected with the help of rainfall records and flood simulations. Similarly, researchers are developing AI-based systems that can learn from rainfall and climate records and tested with flood simulations, which can predict floods better than the traditional systems. Alternatively, AI can also be used to monitor urban flooding. Researchers at the University of Dundee in the United Kingdom are monitoring urban flooding by collecting crowd-sourced data with Twitter and other mobile apps. The data contains images and information about the location and situations in a locality, which is recognized by the AI. Such systems can be used to monitor and predict the damage done by floods along with other methods. Likewise, applications based on artificial intelligence and deep learning is useful for disaster management.

Volcanic eruptions

Researchers have always struggled with finding methods to effectively predict natural disasters such as volcanic eruptions. But now, scientists are training AI to recognize tiny ash particles from volcanoes. The shape of the ash particles can be used to identify the type of volcano. Such developments can help in predicting eruptions and creating volcanic hazard mitigation techniques.

IBM is developing Watson that will predict volcanic eruptions using seismic sensors and geological data. IBM is aiming to forecast the locations and the intensity of eruptions with the help of Watson. Such applications can help to prevent the loss of life in areas surrounding active volcanoes.

Hurricanes

Every year hurricanes cost property damage worth millions of dollars. Hence, meteorological departments are looking for better techniques to predict natural disasters like hurricanes and cyclones, and track their path and intensity. With more effective prediction techniques, the concerned authorities can save more lives and reduce property damage.

Recently, NASA and Development Seed tracked Hurricane Harvey using satellite images and machine learning. The method proved to be six times better than the usual techniques, as the hurricane can be tracked every hour instead of every six hours with the traditional methods. Therefore, the developments in technology are helping in monitoring hurricanes and foreseeing the path of hurricanes, which can assist in mitigation efforts.

#### Solves extreme weather predictions specifically.

NERSC 21 “Deep-learning model speeds extreme weather predictions” DECEMBER 8, 2021 National Energy Research Scientific Computing Center [National Energy Research Scientific Computing Center] <https://phys.org/news/2021-12-deep-learning-extreme-weather.html> SM

Deep-learning model speeds extreme weather predictions

A depiction of digital twin Earth adapted from the EU's Destination Earth project.

Climate change is one of the greatest challenges facing humanity today. To help address this, researchers from Lawrence Berkeley National Laboratory (Berkeley Lab), Caltech, and NVIDIA trained the Fourier Neural Operator (FNO) deep learning model—which learns complex physical systems accurately and efficiently—to emulate atmospheric dynamics and provide high-fidelity extreme weather predictions across the globe a full five days in advance.

The researchers used decades of data from ERA5, the European Center for Medium-range Weather Forecasts' high-resolution Earth dataset, to train the FNO model, which was scaled up to 128 NVIDIA A100 GPUs on Perlmutter, the new HPC system at the National Energy Research Scientific Computing Center (NERSC). The team developed a global FNO weather forecasting model at 30-km resolution, an order of magnitude greater resolution than state-of-the-art deep learning Earth emulators. The model predicts wind velocities and pressures at multiple levels in the atmosphere up to 120 hours in advance with high fidelity. In a case study on the massive 2016 hurricane Matthew, the model's predictions of the hurricane's winds and track were within the uncertainties of the NOAA National Hurricane Center's forecast cones. In addition, the model can predict the behavior of certain classes of extreme weather events across the globe days in advance in just 0.25 seconds on a single NVIDIA GPU.

Physics-informed deep learning models such as the FNO offer the potential for accurate predictions of the spatio-temporal evolution of the Earth system orders of magnitude faster than traditional numerical models. This is an ongoing effort, and the team is investigating the comparative accuracy of deep learning and traditional numerical weather models in collaboration with experts in atmospheric modeling and numerical weather prediction.

The FNO model developed through the Berkeley Lab/Caltech/NVIDIA collaboration is a significant step toward building a digital twin Earth, the researchers noted. Digital twin Earths are digital replicas of planet Earth—simulators grounded in physics, driven by AI, and constrained by real-time data. As described in the ambitious 10-year EU project Destination Earth, a digital twin Earth will give both expert and non-expert users tailored access to high-quality information, services, models, forecasts, and visualizations in the realms of climate monitoring, modeling, mitigation, and adaptation. This video shows a demonstration of digital twin Earth using the FNO model.

The FNO climate collaboration was one of several science success stories described by NVIDIA co-founder and CEO Jensen Huang during a keynote presentation at the recent GPU Technology Conference. In his talk, Huang emphasized that the combination of accelerated computing, physics, machine learning, and giant computer systems can provide "a million-x leap" to enable simulating and predicting climate change reliably and accurately.

#### Data not key to solve warming – and it’s not used anwyays

Starr 14 - psychologist, journalist, and professor emeritus at the City University of New York, Brooklyn College (Bernard, “Our Oceans Are Dying: Mobilizing an Indifferent Public to Confront This Crisis,” Huffington Post, 6-27-14, http://www.huffingtonpost.com/bernard-starr/our-oceans-are-dying\_b\_5533322.html)

After an eighteen-month investigation, the Commission, made up of former heads of state, government officials, and prominent business leaders concluded that our oceans are dying from climate change, pollution, and over-fishing. The Commission proposes an eight point program to rescue the oceans over the next five years. Why should we be concerned? José María Figueres, Co-chair of the Commission and former president of Costa Rica, has summed up the dire situation with these words: "The ocean provides 50 percent of our oxygen and fixes 25 percent of global carbon emissions. Our food chain begins in that 70 percent of the planet." He added that "a healthy ocean is key to our well-being, and we need to reverse its degradation." He warned: "Unless we turn the tide on ocean decline within five years, the international community should consider turning the high seas into an off-limits regeneration zone until its condition is restored." A Commission video states the crisis even more starkly: "No ocean, no us!" In his brief talk at the reception, David Miliband, also co-chair of the Ocean Commission and former UK Foreign Secretary, urged politicians, scientists, journalists, and ordinary citizens to rally behind the salvation of our oceans and the planet -- and to get the message out to others. Will getting the message out turn the tide in the battle to save the planet? I doubt it. **We are swimming in information and messages**. Earlier the this year leading scientists declared that we are fast approaching the critical point of no return for climate change -- a point with predictable devastating consequences. But **who is listening?** The public continues to be **frighteningly indifferent**. Who among the public is willing to place the salvation of the planet over immediate personal concerns? That question was dramatically called to my attention recently when I presented a list of critical issues to a group of seniors enrolled in a life-long learning program and asked them which one they would place first. The list included: terrorism and national defense, global warming, jobs, vanishing icebergs, protecting Social Security, income inequality, ocean pollution, sustaining Medicare, protecting the Amazon rain forests, reducing fossil fuel emissions, regulating Wall Street and the banks, stopping fracking (shale gas drilling), protecting wildlife (elephants, lions, whales, etc.), eliminating genetically modified foods (GMOs), campaign finance reform, free college education for all, national healthcare (Medicare for all). I was particularly interested in the seniors' answers since popular wisdom says that seniors are more concerned than other age groups with the welfare of children, grandchildren, and future generations. And no issue is more vital for the well-being of future generations than the viability of life on the planet. Psychologist Erik Erikson called this concern of older adults "generativity." But the seniors defied conventional wisdom. Jobs, Social Security, and income inequality topped their listings. Only one person, toward the end of the discussion, cited climate change -- and his response seemed almost gratuitous in recognition that we were about to screen a documentary on the melting of icebergs. Perhaps I should not have been surprised. Politicians avoid talking about environmental issues for fear of losing favor with their constituents, who are clamoring for jobs, mortgage relief, and financial security. During the 2012 presidential debates between Barack Obama and Mitt Romney environmental issues took a far **back** seat; in fact, they were barely mentioned. Both candidates knew instinctively that in the throes of an economic crisis placing the salvation of the planet high on the national agenda would not generate votes. It might even take away votes from people who feared the candidate would be indifferent to their personal struggles. So where does this leave us? If more environmental studies and more alarming news will not mobilize leaders and the public for an all-out commitment to the preservation of our small vulnerable corner of the universe, what will? Perhaps we need to shift our focus from information to changing human behavior. Let's enlist leading behavioral scientists and psychological associations to address how to awaken the public to the urgency of protecting the planet. Let's launch a campaign to make this the number-one priority. And let's adopt these mantras: No planet, no jobs; no planet, no Social Security; no planet, no mortgages; no planet, no corporate bonus packages. No planet, no us.

#### ISS and space stations solve resources – only moon key warrant is lack of atmospheric interference

#### No impact – their ev says neutrino research has been lacking for decades BUT no second gen proliferators since North Korea – proves monitoring isn’t key and no impact to prolif it causes

#### New tech boosts sustainability and solves overfishing

Banks 8/20 [Martin Banks, 8-20-2021, "Catching up: How tech is creating new possibilities for sustainable seafood," Techaeris, https://techaeris.com/2021/08/20/catching-up-how-tech-is-creating-new-possibilities-for-sustainable-seafood/ || belle]

New Technology for Sustainable Seafood

Advances in technology will allow the fishing industry to improve its practices and act more sustainably. Below are some examples of the new tech emerging that will likely revolutionize the future of fishing.

Blockchain Technology

More industries across the country are using blockchain technology, and fishing has caught on to the trend. The implementation of blockchain tech makes it traceable, and customers can learn exactly when and where their fish was caught.

Everyone along the supply chain can access data captured by fishermen. Using digital, decentralized blockchain tags allows for more accountability and enables continuous monitoring of fishing practices.

This tech will help certify catches and hold fishers accountable — if they engage in bottom trawling or dredging, there’s no hiding it. This will help maintain current fish populations and urge fisheries to use sustainable methods, like cast-net fishing, spearfishing, and the traditional hook-and-line option.

Emerging Seafood Substitutes

Plant- and cell-based seafood are emerging as effective alternatives to traditional seafood. Companies like Kuleana are capable of producing sashimi-grade tuna. Producers can depend on environmentally friendly and nutrient-rich seaweed to create these substitutes, which helps overcome overfishing.

One of the goals of these substitutes is to alter consumer preferences. Companies like Impossible Burger and Beyond Meat are making their mark on the food industry, and shoppers will inevitably purchase seafood alternatives as well.

By producing substitutes, less fishing is needed — as a result; carbon emissions are naturally reduced.

Remote Electronic Monitoring (REM)

Cameras, GPS receivers, and sensors on a boat help fishers remotely monitor fish populations. This allows them to engage in more sustainable fishing practices.

#### No overfishing impact – fishies are vibing

Mossler 20 [Max Mossler (Max studied environmental perception & policy in grad school. He thinks a lot about how other people think about the planet. He is the managing editor at Sustainable Fisheries UW.), 1-13-2020, "Fish populations around the world are improving," Sustainable Fisheries UW, https://sustainablefisheries-uw.org/fish-populations-are-improving/ || belle]

Let’s enjoy some unequivocal, inarguable good news: a paper published today in PNAS, Hilborn et al. 2020, shows that on average, scientifically-assessed fish populations around the world are healthy or improving. And, for fish populations that are not doing well, there is a clear roadmap to sustainability. With Australia on fire and scares of World War III, the start of 2020 and the new decade has been awful; hopefully Hilborn et al. 2020 can kickstart a decade of ocean optimism.

Hilborn et al. 2020 counters the perception that fish populations around the world are declining and the only solution is closing vast swaths of ocean to fishing. Instead, Hilborn et al. 2020 argues that increasing scientific, management, and enforcement capacity will lead to more abundant and sustainable oceans. The major takeaway of the paper is that fishery management works—when fisheries are managed, they are sustained. The key is following the science-to-management blueprint. Scientific data collection and fishery assessment comes first, then fishing regulation and enforcement of fishing policies. With the blueprint in place, most fisheries around the world are sustainable or improving.

The paper uses updates to the RAM Legacy Stock Assessment Database, a decades-long project to assemble data on fish populations that are scientifically assessed. As of 2019, the database contains data on 882 marine fish populations, representing about half of reported wild-caught seafood. In 2009, the database contained data on only 166, representing a much smaller proportion of global seafood. Researchers have spent the last 10 years adding to the database, and with today’s publication, update the global status of fish stocks. They found that, on average, fish populations are above target levels. Not every stock is doing well, but on average, things are much better than they were 2 decades ago. How nice: an environmental story where things are better now than they were in the past!

The paper describes the global status of fish stocks, but it also tells the story of fishery sustainability from the past 50 years.

A brief history of commercial fishing and fishery science

A very general history of industrial fishing goes like this: before the 1950s, commercial fishing was a niche industry supplying a small proportion of the world’s protein. Then, starting in the 1950s, a global effort to increase food security led governments to invest heavily in fishing—often too heavily. Over the next few decades, it became clear that many fisheries were overcapitalized, meaning there were too many boats, too many fishermen, or some combination of the two. Put simply: fishing pressure was too high and eventually led to unsustainable, depleted fish stocks. In the 1990s, the collapse of several prominent fisheries and many high-profile media stories and scientific publications pressured governments to start taking action to protect their fish stocks. The U.S. in 1996 and the EU in 2002 began mandating their fishery policies to be based on fishery science. Take a look at the last 50 years of fish stocks:

You can see a big increase in fishing pressure and declining abundance through the mid-1990s, then a decrease in fishing pressure and recovery of abundance to the present day.

RAM Database: From Worm et al. 2009 to Hilborn et al. 2020

In 2009, Worm et al. was published. It was the first paper to put together and present global fish abundance data over time. It is now one of the most important and highly-cited fisheries paper in history. The data from that paper eventually became the RAM Legacy Stock Assessment database, where anyone could access information about specific stock assessments from around the world. When the paper was published, it showed a general trend of stabilization in the 166 fish populations it reported on. However, it was criticized for mainly including stocks from North America, Europe, and Oceania, painting a global picture with data from only a few regions. Hilborn et al. 2020 updates that work to 882 populations including a much broader global scope. The added decade of data also shows a more positive, upward trend: 78% of fisheries considered overfished in Worm et al. 2009 are improved in Hilborn et al. 2020.

#### Marine ecosystems are resilient to everything

Nield 17 [David Nield, freelance journalist who has been writing about technology, science, apps, gadgets and the web since 2002. Extensively citing "Impact of the Late Triassic mass extinction on functional diversity and composition of marine ecosystems," written by Alexander M. Dunhill, William J. Foster, James Sciberras, and Richard J. Twitchett. Marine Ecosystems Can Survive The Worst Mass Extinction Events, Study Shows. October 23, 2017. <https://www.sciencealert.com/marine-ecosystems-cling-on-to-life-through-some-of-the-worst-mass-extinction-events>]

Researchers have studied fossil records from the Late Triassic mass extinction, which happened around 201.3 million years ago, and found that marine life did not fundamentally change, even though the vast proportion of species were killed off.

The international team of researchers says that while marine species were still badly affected by the event, enough life survived underwater to keep the ecosystems functioning. The findings could help us understand more about how the changing climate of today could affect the planet.

"While the Late Triassic mass extinction had a big impact on the overall number of marine species, there was still enough diversity among the remaining species that the marine ecosystem was able to function in the same way it had before," says lead researcher Alex Dunhill from the University of Leeds in the UK.

It's thought that huge volcanic eruptions, and the subsequent warming of the planet caused by the greenhouse gases produced, was behind the Late Triassic extinction event.

At least half the species on Earth at that time were wiped out by the rise in temperatures, and in the event's aftermath, dinosaurs came to dominate life on our planet.

The researchers analysed fossils dated between the Middle Triassic to the Middle Jurassic periods, a time span of around 70 million years, covering life before and after the mass extinction event.

Ocean-dwelling animals were classified by how they moved, where they lived, and how they fed, and the study showed that none of these categories of life completely disappeared after the extinction event.

That said, there were major impacts on different regions and the environment as a whole, and some specific marine ecosystems were badly damaged.

"We're not saying nothing happened," says one of the researchers, palaeontologist William Foster from the University of Texas at Austin. "Rather, global oceans in the extinction's aftermath were a bit like a ship manned by a skeleton crew – all stations were operational, but manned by relatively few species."

The idea of a skeleton crew of lifeforms keeping the lights on in an ecosystem was first raised by Foster and his colleague Richard J. Twitchett in 2014, after another study focussed on the Late Permian mass extinction event about 252 million years ago.

The current study found one of the hardest-hit underwater organisms were corals, and the fossil record shows it took some 20 million years before tropical reef ecosystems recovered from the Late Triassic extinction, even though the ecosystem as a whole carried on functioning.

With corals again under threat from rising temperatures in the modern day, the new research could provide a blueprint for the potential damage we're going to see – and perhaps give us some clues for how to prevent it.

On a more positive note, it shows life underwater is incredibly resilient, and capable of surviving through even the worst times of environmental upheaval on our planet.

#### No marine tipping point

* Permian-Triassic extinction proves resiliency
* No data on tipping points
* Ecosystems never outright collapse
* 600 models prove no ecosystem collapse

Hance 18 [Jeremy Hance, wildlife blogger for the Guardian and a journalist with Mongabay focusing on forests, indigenous people, climate change and more. He is also the author of Life is Good: Conservation in an Age of Mass Extinction. Could biodiversity destruction lead to a global tipping point? Jan 16, 2018. https://www.theguardian.com/environment/radical-conservation/2018/jan/16/biodiversity-extinction-tipping-point-planetary-boundary]

Just over 250 million years ago, the planet suffered what may be described as its greatest holocaust: ninety-six percent of marine genera (plural of genus) and seventy percent of land vertebrate vanished for good. Even insects suffered a mass extinction – the only time before or since. Entire classes of animals – like trilobites – went out like a match in the wind.

But what’s arguably most fascinating about this event – known as the Permian-Triassic extinction or more poetically, the Great Dying – is the fact that anything survived at all. Life, it seems, is so ridiculously adaptable that not only did thousands of species make it through whatever killed off nearly everything (no one knows for certain though theories abound) but, somehow, after millions of years life even recovered and went on to write new tales.

Even as the Permian-Triassic extinction event shows the fragility of life, it also proves its resilience in the long-term. The lessons of such mass extinctions – five to date and arguably a sixth happening as I write – inform science today. Given that extinction levels are currently 1,000 (some even say 10,000) times the background rate, researchers have long worried about our current destruction of biodiversity – and what that may mean for our future Earth and ourselves.

In 2009, a group of researchers identified nine global boundaries for the planet that if passed could theoretically push the Earth into an uninhabitable state for our species. These global boundaries include climate change, freshwater use, ocean acidification and, yes, biodiversity loss (among others). The group has since updated the terminology surrounding biodiversity, now calling it “biosphere integrity,” but that hasn’t spared it from critique.

A paper last year in Trends in Ecology & Evolution scathingly attacked the idea of any global biodiversity boundary.

“It makes no sense that there exists a tipping point of biodiversity loss beyond which the Earth will collapse,” said co-author and ecologist, José Montoya, with Paul Sabatier Univeristy in France. “There is no rationale for this.”

Montoya wrote the paper along with Ian Donohue, an ecologist at Trinity College in Ireland and Stuart Pimm, one of the world’s leading experts on extinctions, with Duke University in the US.

Montoya, Donohue and Pimm argue that there isn’t evidence of a point at which loss of species leads to ecosystem collapse, globally or even locally. If the planet didn’t collapse after the Permian-Triassic extinction event, it won’t collapse now – though our descendants may well curse us for the damage we’ve done.

Instead, according to the researchers, every loss of species counts. But the damage is gradual and incremental, not a sudden plunge. Ecosystems, according to them, slowly degrade but never fail outright.

“Of more than 600 experiments of biodiversity effects on various functions, none showed a collapse,” Montoya said. “In general, the loss of species has a detrimental effect on ecosystem functions...We progressively lose pollination services, water quality, plant biomass, and many other important functions as we lose species. But we never observe a critical level of biodiversity over which functions collapse.”

#### Second, offense --

#### Moon basing causes US-China war due to competing property claims

Copp 21 If China and the US Claim the Same Moon-Base Site, Who Wins? TARA COPP [SENIOR PENTAGON REPORTER, DEFENSE ONE] AUGUST 8, 2021 <https://www.defenseone.com/technology/2021/08/if-china-and-us-claim-same-moon-base-site-who-wins/184352/> SM

If China and the US Claim the Same Moon-Base Site, Who Wins?

Relatively few craters are attractive, and there’s no consensus about avoiding conflict over them.

There’s a not-so-quiet race back to the moon underway, but the two largest factions, with China and Russia on one side, and the United States and its partners on the other, are not recognizing each others’ proposed rules on what’s allowed once they get there.

Lawmakers and space policy analysts are concerned: How do you avoid conflict in space if the international laws and policies on Earth no longer apply?

“Many terrestrial military doctrines are not applicable in space, or at least not as applicable. If you get beyond 50 miles, or at least 62 miles, suddenly different rules apply. We need to start being aware of that,” says Rep. Jim Cooper, D-Tenn.

There’s already some aggressive international elbowing over the rules of satellite operations. As with the moon, there’s no consensus yet on how to respond to aggression in Earth orbit, the head of U.S. Space Command Gen. James Dickinson told attendees at last week’s Sea Air Space conference.

“The behavior of some of our adversaries in space may surprise you,” Dickinson said. “If similar actions have been taken in other domains, they'd likely be considered provocative, aggressive, or maybe even irresponsible. And in response, the U.S. government would take corresponding actions using all levers of national power, a demarche, or a sanction or something to indicate we won't tolerate that type of behavior, but we're not quite there yet in space policy.”

In 1967, the U.N. General Assembly adopted a treaty on the use of outer space that promised cooperation and banned nuclear weapons, military maneuvers, and military installations off-planet. The agreement also requires countries to take “appropriate international consultations” before making any moves that would “cause potentially harmful interference” with other space programs, and allows countries to “request consultation” if they believe such interference is likely.

This treaty “forecasted very well” the issues that that might arise as space exploration expanded, said James Lake, a senior associate at Canyon Consulting who co-wrote an article on lunar security issues in this month’s Space Force Journal. “The question remains: is that text sufficient? That’s something we are going to find out fairly soon.”

Notably, a treaty annex that prohibits military activity on the moon went unratified by Russia, China, and the United States. It’s likely both the China-Russia and U.S.-led partnerships will begin their moon bases without any sort of agreement between them in place.

In June, the China National Space Agency and Russia’s Roscosmos announced they would begin surveying locations for their International Lunar Research Station this year, and pick a site by 2025.

In 2020, NASA, together with the nations partnering with the U.S. under the Artemis Accords, outlined its Artemis Base Camp project. The Artemis nations aim to to send astronauts back to the moon by 2024.

In addition to those two major alliances, private firms such as Blue Origin are also working on private moon bases.

But there may be only a few locations on the moon where it would make economic sense to build a base, said Bleddyn Bowen, a professor at the University of Leicester and author of War in Space: Strategy, Spacepower, Geopolitics.

“Water ice, for example, might be in limited pockets, for example, making the territories around certain craters on the polar regions, perhaps more desirable,” Bowen said.

So what happens if each decides on the same crater as the best spot to begin moon operations?

“If you have a situation like that, where you're trying to do something in the exact same spot, it’s essentially who gets there first,” said Alex Gilbert, a researcher and space resources doctoral student at the Payne Institute at the Colorado School of Mines. “And if you're not first, then the only alternative is to forcibly remove the current occupant.”

The Artemis nations have endorsed the idea of “safety zones” on the moon, to require communication between two space operations that want to operate in the same area.

“Even if you set up a base and you declare a safety zone, people can still go into that safety zone. It's just something that it's really to be used as a tool to get parties to talk to each other,” he said.

But there’s already a risk those zones will instead be used as a way to rope off sites from competitors, he said.

“One thing that is really kind of important to understand about safety zones is that everyone kind of has their own definition,” Gilbert said.

“Whoever gets there first can use the resources, but no nation can ‘claim’ the territory,” said Laura Duffy, a space systems engineer with Canyon Consulting who co-wrote “Cislunar Spacepower, The New Frontier,” with Lake with Lake in this month’s Space Force Journal.

It’s not just water, but rare earth metals and helium-3 that will be up for grabs on the moon, making a treaty for its peaceful use critical, Duffy said.

“The Moon must be available for open and free use, according to the Artemis Accords and Outer Space Treaty,” she said.

But neither Russia nor China are expected to join the Artemis Accords.

Until now, U.S. space defense has largely concentrated around the objects orbiting Earth. That changed this year, when the U.S. Space Force and U.S. Space Command were tasked with protecting U.S. assets up to 272,000 miles away, a volume called “cislunar space” that extends slightly beyond the Moon’s orbit.

They have some catching up to do, said Rep. Frank Lucas, R-Okla., the ranking member of the Science, Space and Technology Committee. Lucas believes the 2019 landing of China’s Chang'e-4 spacecraft on the far side of the moon should have been this generation’s Sputnik moment.

“But with all of the chaos in the world, and COVID-19, and all of this environment we're working in, we missed it,” he said.

Those far-side moon operations meant China had developed the technology to operate and communicate with its landed rover out of line of sight—and out of view of almost all of the U.S. ability to see what they’re doing.

The achievement allows China “to accomplish scientific, military, or other endeavors without observation or repercussion,” Duffy and Lake wrote. The authors urged that the U.S. needs to speed its monitoring efforts, such as the Cislunar Highway Patrol System, or CHPS, that is being developed by the Air Force Research Laboratory.

#### US-China war goes nuclear

Talmadge 18, Caitlin [**PoliSci PhD from MIT**, Government BA from Harvard, Prof of Security Studies at Georgetown’s Walsh School of Foreign Service.] “Beijing’s Nuclear Option.” Foreign Affairs. October 15, 2018. <https://www.foreignaffairs.com/articles/china/2018-10-15/beijings-nuclear-option> TG

As China’s power has grown in recent years, so, too, has the risk of war with the United States. Under President Xi Jinping, China has increased its political and economic pressure on Taiwan and built military installations on coral reefs in the South China Sea, fueling Washington’s fears that Chinese expansionism will threaten U.S. allies and influence in the region. U.S. destroyers have transited the Taiwan Strait, to loud protests from Beijing. American policymakers have wondered aloud whether they should send an aircraft carrier through the strait as well. Chinese fighter jets have intercepted U.S. aircraft in the skies above the South China Sea. Meanwhile, U.S. President Donald Trump has brought long-simmering economic disputes to a rolling boil.

A war between the two countries remains unlikely, but the prospect of a military confrontation—resulting, for example, from a Chinese campaign against Taiwan—no longer seems as implausible as it once did. And the odds of such a confrontation going nuclear are higher than most policymakers and analysts think.

Members of China’s strategic com­munity tend to dismiss such concerns. Likewise, U.S. studies of a potential war with China often exclude nuclear weapons from the analysis entirely, treating them as basically irrelevant to the course of a conflict. Asked about the issue in 2015, Dennis Blair, the former commander of U.S. forces in the Indo-Pacific, estimated the likelihood of a U.S.-Chinese nuclear crisis as “somewhere between nil and zero.”

This assurance is misguided. If deployed against China, the Pentagon’s preferred style of conventional warfare would be a potential recipe for nuclear escalation. Since the end of the Cold War, the United States’ signature approach to war has been simple: punch deep into enemy territory in order to rapidly knock out the opponent’s key military assets at minimal cost. But the Pentagon developed this formula in wars against Afghanistan, Iraq, Libya, and Serbia, none of which was a nuclear power.

China, by contrast, not only has nuclear weapons; it has also intermingled them with its conventional military forces, making it difficult to attack one without attacking the other. This means that a major U.S. military campaign targeting China’s conventional forces would likely also threaten its nuclear arsenal. Faced with such a threat, Chinese leaders could decide to use their nuclear weapons while they were still able to.

As U.S. and Chinese leaders navigate a relationship fraught with mutual suspicion, they must come to grips with the fact that a conventional war could skid into a nuclear confrontation. Although this risk is not high in absolute terms, its consequences for the region and the world would be devastating. As long as the United States and China continue to pursue their current grand strategies, the risk is likely to endure. This means that leaders on both sides should dispense with the illusion that they can easily fight a limited war. They should focus instead on managing or resolving the political, economic, and military tensions that might lead to a conflict in the first place.

#### Independently causes space militarization

O’Donnell 19 “The Political Realities behind Establishing a Moon Base” Wes O’Donnell [Managing Editor, Edge] 2/26/2019 <https://amuedge.com/the-political-realities-behind-establishing-a-moon-base/> SM

International Conflicts May Expand to Space

No nation has placed weapons in orbit, but some advanced military nations have become dependent on space-based systems for everything from weapons targeting and navigation to intelligence collection. As nations look to establish a semi-permanent presence on the moon, conflict will become inevitable with the lunar surface having a role in how events on Earth play out. In much the same way as the Wright brothers’ plane evolved into a strategic bomber, earthly conflict will expand to spacecraft and a manned presence on the moon.

It seems far-fetched to think in these terms, but mankind has proven adept at turning many scientific achievements into weapons of war. For example, during the past 30 years, Internet access has become nearly omnipresent. But the Internet also serves as a venue for disinformation campaigns and cyberattacks.

It’s also relevant to point out that the systems that maintain human life in space would work equally well for soldiers. All of these advancements to further scientific research and maintain life aboard the International Space Station can easily be adapted to military purposes. It’s now just a matter of funding to build military space systems based on established technology.

In 1959, the U.S. Army conducted a study called Project Horizon that considered establishing a moon base with construction occurring throughout the 1960s. The formal establishment of NASA in February 1958 shelved the project. However, the study demonstrated the military’s long-held desire for a permanent space presence.

Repairing and Protecting Technological Assets in Space

With space-based systems now ubiquitous, there is a need for platforms in space to protect technological assets and repair them when necessary. That will mean having humans in space to manage these systems.

The U.S., China and Russia have the capability to shoot down satellites. Replacing these satellites would require rocket launches with replacement equipment on board.

With space-based systems, however, those assets could be repaired or replaced faster from orbiting stock or from a lunar base. From a U.S. perspective, this would save time and money. Also, it would lessen the potential impact of losing launch centers at Vandenberg AFB and Cape Canaveral in an international conflict involving missile attacks.

Militarization of the Moon

It is certainly a possibility that the moon will be militarized in some fashion. China’s questioning the limits of national sovereignty in space puts in doubt Beijing’s adherence to the 1967 Outer Space Treaty.

That treaty defines the moon as the “province of all mankind” and reserves it for peaceful purposes. But the speed with which contemporary leaders have forsaken international treaties could throw this status into doubt.

Some Chinese legal scholars, for instance, claim that the space above China, at least that which is in geosynchronous orbit, is sovereign Chinese territory. Clearly, by including anything within that geosynchronous orbit, these scholars are referring to the moon in much the same way that China makes claims to nearby territorial waters.

Currently, there is no treaty that delineates the vertical extent of a nation’s sovereignty into space. However, the Chinese claim suggests that Beijing might ignore existing international norms if they conflict with China’s interests.

The Unspoken Moon Race

The first manned mission to the moon was for the benefit “of all mankind.” Today’s extension of military affairs into space suggests that the once-peaceful endeavor of a lunar landing will eventually take on a combat dimension.

Scientific breakthroughs are currently taking the headlines and attention away from the pressing matter of preventing space-based military moves. The U.S., Russia and China have lunar missions planned into the 2030s. Whether those missions will actually take place largely depends on political will and national budgets.

A conventional conflict involving the U.S., Russia or China would be an impetus for the expansion of space-based military assets. That would make the current ventures to the moon ever more pressing during peacetime.

In essence, the current race to the moon certainly appears peaceful. But the potential to use the lunar body for war is certainly not lost on political or military leaders.

#### Unknown legal thresholds make inadvertent space escalation highly likely

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Another dimension of the problem is the issue of the scale of the attack, both qualitatively and quantitatively. While jamming one or two satellites in isolation appears unlikely to quickly escalate into all-out space war (given the longstanding role of electronic warfare in past conflicts), attacking multiple intelligence-gathering satellites would carry a far higher risk of escalation. Somewhere between these two extremes, however, is an uncertain and unknowable boundary that divides offensive space actions that modestly threaten stability from those that are clearly destabilizing and escalatory. In this unpredictable environment, a country with no desire to spark an all-out space war may still prompt rapid escalation with modest offensive actions that inadvertently cross an unknown threshold. In addition, for technological, commercial, and other reasons the space and cyber domains are evolving far more rapidly than the conventional and nuclear domains, potentially rendering space and cyber strategies ineffective or irrelevant within a few years. In both space and cyberspace, we may learn firsthand how much escalation is too much only after it is too late to stop. Evolving space dynamics could undermine whatever current understanding we may have of crisis and strategic stability in space, and this imperfect grasp of general principles can only add to our uncertainty about the space and cyber offensive capabilities of particular adversaries. Therefore, uncertainty, bluffs, and worst-case thinking are bound to remain prominent forces in the strategic landscape of space. For example, rendezvous and proximity operations on satellites will become more common in the years to come, but they could easily be viewed in a crisis as potentially hostile acts—or in fact be used to commit hostile acts.

#### Lunar basing causes collisions and space junk – independently turns the aff.

Mann 13 “Space: The Final Frontier of Environmental Disasters?” Adam Mann 7/15/2013 <https://www.wired.com/2013/07/space-environmentalism/> SM

Commercial or scientific bases on the lunar surface will need satellites for communication and navigation. Because of the moon’s size and mass, there aren’t stable orbits that hover above a certain spot analogous to the geostationary orbits around Earth. In order to provide a continuous link or GPS-like triangulation, there will need to be a constellation of satellites around the moon. Multiple satellites with multiple operators increase the chance of collision.

Unlike our planet, the moon lacks an atmosphere and it isn’t covered in oceans. This means that nothing can burn up and there’s no good way to dispose of dead satellites. The atmospheric friction that naturally drags down objects around Earth doesn't exist around the moon. And anything that is commanded to fall down to the lunar surface will remain intact until it impacts the ground, potentially hitting an astronaut or Apollo-era artifact. Mars, with its very thin atmosphere, could have similar problems with orbital debris. If nothing is done, space junk might be exported beyond low-Earth orbit, potentially endangering our exploration of other worlds.

#### Collisions cause miscalc and go nuclear.

Blatt 20 [Talia, joint concentration in Social Studies and Integrative Biology at Harvard, specialization in East Asian geopolitics and security issues] “Anti-Satellite Weapons and the Emerging Space Arms Race,” Harvard International Review, May 26, 2020, <https://hir.harvard.edu/anti-satellite-weapons-and-the-emerging-space-arms-race/> TG

Despite their deterrent functions, ASATs are more likely to provoke or exacerbate conflicts than dampen them, especially given the risk they [pose](https://thebulletin.org/2019/06/arms-control-in-outer-space-the-russian-angle-and-a-possible-way-forward/) to early warning satellites. These satellites are a crucial element of US ballistic missile defense, capable of [detecting missiles](https://www.globalsecurity.org/space/world/japan/warning.htm) immediately after launch and tracking their paths.

Suppose a US early warning satellite goes dark, or is shut down. Going dark could signal a glitch, but in a world in which other countries have ASATs, it could also signal the beginning of an attack. Without early warning satellites, the United States is much more susceptible to nuclear missiles. Given the strategy of counterforcing—[targeting](https://www.belfercenter.org/sites/default/files/files/publication/isec_a_00273_LieberPress.pdf) nuclear silos rather than populous cities to prevent a nuclear counterattack—the Americans might believe their nuclear weapons are imminently at risk. It could be [twelve hours](https://books.google.com/books?id=ET8lDwAAQBAJ&pg=PA1&lpg=PA1&dq=%22Protecting+Space+Assets%22+johnson-freese&source=bl&ots=6Oq0IdeBjw&sig=ACfU3U1G6Hj8QdP4JlCRNxA6i5XplZwHyg&hl=en&sa=X&ved=2ahUKEwj1n-jT2YzpAhUugnIEHUuMCu4Q6AEwA3oECAkQAQ#v=onepage&q=%22Protecting%20Space%20Assets%22%20johnson-freese&f=false) before the United States regains satellite function, which is too long to wait to put together a nuclear counterattack. The United States, therefore, might move to mobilize a nuclear attack against Russia or China over what might just be a piece of debris shutting off a satellite.

Additionally, accidental warfare, or strategic miscalculation, is uniquely likely in space. It is [much easier](https://books.google.com/books?id=VyXTDwAAQBAJ&pg=PA339&lpg=PA339&dq=space+offense+dominant&source=bl&ots=Mw0bgJ51qf&sig=ACfU3U3DeZiEHpr9nfszlCbJZIoyyssIpg&hl=en&sa=X&ved=2ahUKEwjrs-WD3IzpAhVulHIEHbL0AE4Q6AEwCXoECAoQAQ#v=onepage&q=space%20offense%20dominant&f=false) to hold an adversary’s space systems in jeopardy with destructive ASATs than it is to [sustainably defend](https://www.cnas.org/publications/commentary/the-us-military-should-not-be-doubling-down-on-space) a system, which is expensive and in some cases not technologically feasible because of limitations on satellite movement. Space is therefore [considered](https://books.google.com/books?id=VyXTDwAAQBAJ&pg=PA339&lpg=PA339&dq=space+offense+dominant&source=bl&ots=Mw0bgJ51qf&sig=ACfU3U3DeZiEHpr9nfszlCbJZIoyyssIpg&hl=en&sa=X&ved=2ahUKEwjrs-WD3IzpAhVulHIEHbL0AE4Q6AEwCXoECAoQAQ#v=onepage&q=space%20offense%20dominant&f=false) offense-dominant; offensive tactics like weapons development are prioritized over defensive measures, such as [improving GPS](https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067) or making satellites more resistant to jamming.

As a result, countries are left with poorly defended space systems and rely on offensive posturing, which increases the risk that their actions are perceived as aggressive and incentivizes rapid, risky counterattacks because militaries cannot rely on their spaced-based systems after first strikes.

There are several hotspots in which ASATs and offensive-dominant systems are particularly relevant. Early warning satellites [play](https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067) a central role in US readiness in the event of a conflict involving North Korea. News of North Korean missile launches comes from these satellites. Given North Korea’s [history](https://www.bbc.com/news/world-asia-pacific-11813699) of nuclear provocations, unflinchingly hostile rhetoric towards the United States and South Korea, and diplomatic opacity, North Korea is always a threatening, unknowable adversary, but recent developments have magnified the risk. With the health of Kim Jong-un [potentially in jeopardy](https://apnews.com/f5d302ae65b03838173e40848223b771), a succession battle or even civil war on the peninsula [raises the chances](https://www.express.co.uk/news/world/1273890/Kim-Jong-un-dead-North-Korea-nuclear-weapon-news-latest-death-US) of loose nukes. If the regime is terminal, traditional MAD risk calculus will become moot; with nothing to lose, North Korea would have no reason to hold back its nuclear arsenal. Or China [might decide](https://foreignpolicy.com/2020/04/28/kim-jong-un-china-north-korea/) to seize military assets and infrastructure of the regime. If the US does not have its early warning satellites because they have been taken out in an ASAT attack, the US, South Korea, and Japan are all in imminent nuclear peril, while China could be in a position to fundamentally reshape East Asian geopolitics.

The South China Sea is another hotspot in which ASATs could risk escalation. China [is developing](https://missiledefenseadvocacy.org/missile-threat-and-proliferation/todays-missile-threat/china-anti-access-area-denial-coming-soon/) Anti-Access Area Denial (A2/AD) in the South China Sea, a combination of long range radar with air and maritime defense meant to deny US freedom of navigation in the region. Given the disputed nature of territory in the South China Sea, the United States and its allies do not want China to successfully close off the region.

#### Moon basing key to China-Russia counterbalancing – guts US space dominance.

Goswami 21 “The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement” [Dr. Namrata Goswami is an independent scholar on space policy, great power politics, and ethnic conflicts.] March 19, 2021 <https://thediplomat.com/2021/03/the-strategic-implications-of-the-china-russia-lunar-base-cooperation-agreement/> SM

The Strategic Implications of the China-Russia Lunar Base Cooperation Agreement

With their agreement, the partners are signalling an alternative to a U.S.-led order in space.

On March 9, 2021, the China National Space Administration (CNSA) and Russian Space Agency (ROSCOSMOS) signed a Memorandum of Understanding (MoU) for the joint construction of an autonomous lunar permanent research base. Employing the language of the Outer Space Treaty of 1967, China and Russia emphasized that the MoU is about scientific discovery as well as the use of lunar terrain. The agreement describes the planned International Lunar Research Station (ILRS) as “a comprehensive scientific experiment base with the capability of long-term autonomous operations, built on the lunar surface and/or on the lunar orbit that will carry out multi-disciplinary and multi-objective scientific research activities such as the lunar exploration and utilization, lunar-based observation, basic scientific experiment, and technical verification.”

These two major space faring nations have agreed to promote the ILRS to gain international partners for their joint lunar mission, especially by broadcasting China’s lunar South Pole environment and resource survey mission, the Chang’e 7 and Russia’s Luna-Resurs-1 Russian Orbital Spacecraft (OS) Mission.

That China and Russia would cooperate on exploration and utilization of lunar resources comes as no surprise. Both countries, especially Russia, keenly watched as the United States announced the Artemis Accords for creating an international mechanism for lunar development led by the U.S. and partner nations. ROSCOSMOS, in reaction to the Artemis Accords and especially former President Donald Trump’s April 6, 2020 executive order on the utilization of space resources for international partnerships stated, via its deputy director for international cooperation, Sergei Savelyev, that “attempts to expropriate outer space and aggressive plans to actually take over other planets” go against the principle of international cooperation. The Kremlin likened Trump’s executive order to the colonization of space, with Kremlin spokesman Dmitry Peskov coming out strong, stating that it would be “unacceptable” for the U.S. to privatize and colonize space.

While China officially did not respond to the Artemis Accords, the CNSA’s Space Law Center Deputy Director Guoyu Wang argued in an article in The Space Review that the accords cannot be viewed as an extension of the OST, but are instead an attempt to create norms outside of established international regulatory frameworks.

The Moon Is Strategic

The moon is no longer seen as a dead rock where humanity lands for a few days, shows off technology, and then journeys back to Earth. Today the discourse on the moon is about its resource potential, including the presence of water ice, solar power, and rare earth elements like platinum, titanium, scandium, and yttrium. Chinese space scientists and engineers have long recognized the economic potential of space resources to include a $10 trillion return on investments from the Earth-moon zone annually by 2050.

All the way back in 2002, Ouyang Ziyuan, lead scientist and founder of China Lunar Exploration Program (CLEP) specified that “China’s long-term aim and task is to set up a base on the moon to tap and make use of its rich resources.” His perspective was supported at the highest level of CNSA leadership. China’s subsequent demonstrations of lunar capacity include a far side lunar landing in 2019 and an autonomous lunar sample return mission in 2020.

Other benefits highlighted by Chinese scientists are the potential of lunar propellant made from water-ice lowering the cost of access and movement throughout the entire volume of cislunar space. Launching from the moon is 22 times more efficient than launching from Earth due to Earth’s gravity well. In order to access those lunar resources, a long-term permanent presence, first robotic, then human, will be necessary. This aspect of first mastering autonomous robotic lunar basing capacities is highlighted in the China-Russia MoU.

Similar to China’s long-term plans for a permanent presence on the moon and a lunar research base by 2036, Russia in 2018 announced its own lunar plan, which included resource extraction ambitions, backed by a three phase base construction plan between 2025 and 2040. The first stage is a lunar orbiter module (2025); the second phase will be the construction of a lunar base (2025-2034); and the third phase (2040) will involve the construction of an “integrated manned moon exploration system.” The former chief designer of Russia’s manned space programs, the late Yevgeny Mikrin, in an interview with state run RIA Novosti news in November 2018, specified that the construction of the moon colony was to begin in 2025.

The strategic recognition of the critical role of the Earth-moon economic zone for future space development and utilization is the first peg on which the China-Russia MoU stands. Besides that, there are two other specific geopolitical and regime constriction considerations at play here.

Geopolitical Considerations

The future of space is its economy, with possible returns in the trillions of dollars. And robust economic growth leads to military and other power projection capacities. Both China and Russia understand the impact of space on the future of global leadership. China wants to become the foremost space power by 2045, in time for the centenary of the establishment of the People’s Republic in 2049. President Xi Jinping has repeatedly highlighted the intrinsic contribution of space to Chinese global leadership. The idea behind China’s space philosophy is to demonstrate high-end technology, including human missions, lunar soft landings (near and far side), lunar sample returns, and Mars missions, to be followed by construction of a permanent space station, space-based solar power satellites, and deep space probes.

For China, the MoU with Russia came at the appropriate geopolitical moment, especially after it has successfully demonstrated high end indigenous space capacity like lunar far side landing, autonomous lunar sample return, and a Mars mission. China no longer has to worry about the age-old cliché that all Chinese space technology is reengineered Russian space technology.

For Russia, joining in with China’s lunar base goal, even as a junior partner, means that the two nations can pool their joint international resources to register opposition to a U.S.-led space order, something both sides are uncomfortable with. For Russia and especially President Vladimir Putin, it is about taking back the space leadership position it enjoyed as the erstwhile Soviet Union.

This lunar MoU is a continuation of the two nations’ geopolitical behavior on Earth, where China and Russia have established alternative security systems like the Shanghai Cooperation Organization and the Chinese-led Belt and Road Initiative (BRI), of which Russia is a participating country. By establishing an alternative lunar base development effort, China and Russia are questioning the legitimacy of the Artemis Accords and signaling that they do not view U.S. efforts, both public and private, as the only mechanism for cooperation in space. Basically, this is clear indication that leadership in space is contested. Once they draw in enough partners and signatories to their lunar research base, China and Russia will have the power and influence to create an alternative state-centric preamble and lunar accord crafting the regulatory regime around lunar exploration and development. Both wield enormous clout internationally via their U.N. Security Council permanent memberships and veto power as well as advocacy in U.N. space bodies.

Signing an MoU for lunar development has several long-term strategic implications for both as well. First, Russia gets access to an international structure already in place under China’s BRI, in which nearly 140 countries are now participating. Both sides get access to launch sites, ground stations, and receiver stations in China and Russia, as well as access to a universal scientific talent pool, to include growing Chinese and Russian space expertise, and burgeoning employment opportunities in China where aerospace salaries are becoming globally competitive. They will also be able to divide the long-term costs of research and development. Finally, the MoU offers a rather flexible international partnership for countries. A decision on inclusion lies primarily with either Xi or Putin, unlike U.S. space partnerships, which have to pass through several interagency clearance processes and time-consuming bureaucratic procedures.

Strategic Regime Constriction

China and Russia have expressed opposition to the U.S. policy moves to enable the private sector and commercialization of space in Artemis Accords signatory countries, as well as national legislation like the U.S. Commercial Space Launch Competitive Act 2015 (CSLCA). Beijing and Moscow are especially worried by the prospect of the private space sector taking the lead in developing space technology breakthroughs. This implies fast enhancement of capability (think SpaceX and Blue Origin reusable rockets, lunar landers), truly democratizing space beyond just the state-owned institutions currently at the forefront of space policy, technology development, and missions. This has serious economic consequences in a globally competitive trillion-dollar space market. This aspect was evident in Kremlin spokesperson Dmitry Peskov’s vocal opposition to the U.S. focus on the privatization of space.

China, and to a larger extent Russia, do not yet have a vibrant private space sector capable of competing with the U.S. private sector globally, even though China under Xi has created enormous financial and ideological incentives for Chinese private space startups since 2014. China has, however, excelled in and utilized state-based policies to rein in its own private space sector under its strict Civil-Military Fusion Strategy and its new National Defense Law 2021.

The CSLCA, which supports U.S. private citizens’ ownership of space resources; the Artemis Accords’ emphasis on commercial activities on the moon, establishment of safety zones, and utilization of space resources; and the April 6, 2020 executive order calling for space resource utilization efforts based on international partnerships have galvanized the China-Russia MoU, an alternative lunar development mechanism led by authoritarian state-owned space agencies. Both China and Russia fear that with the Artemis Accords, the private space sector has been strengthened legally to invest in lunar breakthroughs that would take their own state-owned space agencies years to compete with or catch up to. They also fear that the Cold War-based space governance mechanisms that limit private development of space might be unraveling, especially if today’s leading space-faring states become flexible on the regulatory mechanisms set up during the Cold War that have stifled private innovation in space by creating incentives for state funded and owned space activities.

Innovation in technology will be a game changer in space going forward, and both China and Russia realize the impact of, say, SpaceX’s reusable heavy lift rocket, Starship, scheduled for launch by 2023, with plans for crewed missions to the moon and Mars (with orbital refueling). Starship will be the world’s most advanced reusable rocket, with a lift capacity of 100 metric tonnes to low earth orbit (LEO). In comparison, China has plans for a reusable Long March 8 rocket (with a lift capacity of 8.4 metric tonnes to LEO) designed by the state-owned China Academy of Launch Vehicle Technology (CALT), but this is clearly not in the same class of rockets like Starship.

Their vocal oppositions to the entry of the U.S. private space sector buys time for China and Russia to catch up over the next decade or so. By 2030, China has its own plans for a heavy lift rocket, the Long March 9, which will have a lift capacity of 140 metric tonnes to LEO, and also aspires to master reusability in the next 20 years. However, time is of the essence in space power projection and a single technology can change the game, as reusability has done for launch infrastructure.

A Changed Reality

China and Russia’s lunar base MoU has changed the alignment structures around space cooperation and sends a clear signal to the United States and the seven other Artemis Accords partners that space is contested. China and Russia are offering avenues for alternate partnership, especially to encourage countries like Saudi Arabia and Turkey to join, both of whom have aspirations to develop their space sector. Turkish President Recep Tayyip Erdogan recently announced Turkish ambitions to make first contact with the moon by 2023 (the 100th year celebration of the establishment of the Turkish republic) with the help of international partnerships.

Despite the U.S. private space sector advantages identified above, the U.S. suffers from a lack of continuity and emphasis in its space sector at the policy level due to changing space priorities across presidential administrations. We saw such uncertainty creep in with regard to its Artemis Accords (established under the Trump administration), the Space Force, and the reconstitution of the National Space Council after President Joe Biden was sworn in. Biden has offered little insight into his administration’s space priorities, including on critical concepts like space resource utilization and development. Such uncertainties can stifle international partnerships and technology development.

In contrast, despite lacking a similarly vibrant private sector, China’s clear articulation of its long-term steady lunar missions, and its ability to commit resources without having to worry about a change in missions with a change in administrations, showcases its long-term assurance that it can meet its goal of establishing a lunar base, now in partnership with Russia. While technology is a game changer, a nation cannot succeed in space without long-term strategic vision.

#### US space dominance prevents global war

**Zubrin 15** [(Robert Zubrin, president of Pioneer Energy, a senior fellow with the Center for Security Policy) “US Space Supremacy is Now Critical,” Space News, 1/22/15, https://spacenews.com/op-ed-u-s-space-supremacy-now-critical/] TDI

The United States needs a new national security policy. For the first time in more than 60 years, we face the real possibility of a large-scale conventional war, and we are woefully unprepared. Eastern and Central Europe is now so weakly defended as to virtually invite invasion. The United States is not about to go to nuclear war to defend any foreign country. So deterrence is dead, and, with the German army cut from 12 divisions to three, the British gone from the continent, and American forces down to a 30,000-troop tankless remnant, the only serious and committed ground force that stands between Russia and the Rhine is the Polish army. It’s not enough. Meanwhile, in Asia, the powerful growth of the Chinese economy promises that nation eventual overwhelming numerical force superiority in the region. How can we restore the balance, creating a sufficiently powerful conventional force to deter aggression? It won’t be by matching potential adversaries tank for tank, division for division, replacement for replacement. Rather, the United States must seek to totally outgun them by obtaining a radical technological advantage. This can be done by achieving space supremacy.To grasp the importance of space power, some historical perspective is required. Wars are fought for control of territory. Yet for thousands of years, victory on land has frequently been determined by dominance at sea. In the 20th century, victory on both land and sea almost invariably went to the power that controlled the air. In the 21st century, victory on land, sea or in the air will go to the power that controls space. The critical military importance of space has been obscured by the fact that in the period since the United States has had space assets, all of our wars have been fought against minor powers that we could have defeated without them. Desert Storm has been called the first space war, because the allied forces made extensive use of GPS navigation satellites. However, if they had no such technology at their disposal, the end result would have been just the same. This has given some the impression that space forces are just a frill to real military power — a useful and convenient frill perhaps, but a frill nevertheless. But consider how history might have changed had the Axis of World War II possessed reconnaissance satellites — merely one of many of today’s space-based assets — without the Allies having a matching capability. In that case, the Battle of the Atlantic would have gone to the U-boats, as they would have had infallible intelligence on the location of every convoy. Cut off from oil and other supplies, Britain would have fallen. On the Eastern front, every Soviet tank concentration would have been spotted in advance and wiped out by German air power, as would any surviving British ships or tanks in the Mediterranean and North Africa. In the Pacific, the battle of Midway would have gone very much the other way, as the Japanese would not have wasted their first deadly airstrike on the unsinkable island, but sunk the American carriers instead. With these gone, the remaining cruisers and destroyers in Adm. Frank Jack Fletcher’s fleet would have lacked air cover, and every one of them would have been hunted down and sunk by unopposed and omniscient Japanese air power. With the same certain fate awaiting any American ships that dared venture forth from the West Coast, Hawaii, Australia and New Zealand would then have fallen, and eventually China and India as well. With a monopoly of just one element of space power, the Axis would have won the war. But modern space power involves far more than just reconnaissance satellites. The use of space-based GPS can endow munitions with 100 times greater accuracy, while space-based communications provide an unmatched capability of command and control of forces. Knock out the enemy’s reconnaissance satellites and he is effectively blind. Knock out his comsats and he is deaf. Knock out his navsats and he loses his aim. In any serious future conventional conflict, even between opponents as mismatched as Japan was against the United States — or Poland (with 1,000 tanks) is currently against Russia (with 12,000) — it is space power that will prove decisive. Not only Europe, but the defense of the entire free world hangs upon this matter. For the past 70 years, U.S. Navy carrier task forces have controlled the world’s oceans, first making and then keeping the Pax Americana, which has done so much to secure and advance the human condition over the postwar period. But should there ever be another major conflict, an adversary possessing the ability to locate and target those carriers from space would be able to wipe them out with the push of a button. For this reason, it is imperative that the United States possess space capabilities that are so robust as to not only assure our own ability to operate in and through space, but also be able to comprehensively deny it to others. Space superiority means having better space assets than an opponent. Space supremacy means being able to assert a complete monopoly of such capabilities. The latter is what we must have. If the United States can gain space supremacy, then the capability of any American ally can be multiplied by orders of magnitude, and with the support of the similarly multiplied striking power of our own land- and sea-based air and missile forces be made so formidable as to render any conventional attack unthinkable. On the other hand, should we fail to do so, we will remain so vulnerable as to increasingly invite aggression by ever-more-emboldened revanchist powers. This battle for space supremacy is one we can win. Neither Russia nor China, nor any other potential adversary, can match us in this area if we put our minds to it. We can and must develop ever-more-advanced satellite systems, anti-satellite systems and truly robust space launch and logistics capabilities. Then the next time an aggressor commits an act of war against the United States or a country we are pledged to defend, instead of impotently threatening to limit his tourist visas, we can respond by taking out his satellites, effectively informing him in advance the certainty of defeat should he persist. If we desire peace on Earth, we need to prepare for war in space.