# 1

#### Commercial space stations are the future of tourism and commerce---NASA and countries is transitioning to private stations.

Frey 1-6 (, T., 2022. Private Space Stations: The Future Portals for Private Space Commerce and Tourism. [online] Futurist Speaker. Available at: <https://futuristspeaker.com/future-trends/private-space-stations-the-future-portals-for-private-space-commerce-and-tourism/> [Accessed 30 January 2022].)-rahulpenu

Private Space Stations: The Future Portals for Private Space Commerce and Tourism

The future of space research and development is tied to private enterprise – specifically private space stations. Now that government-funded programs have proven basic concepts about getting to and living/working in space, NASA and agencies from other countries will continue to turn many aspects of space station work over to private companies.

The International Space Station (ISS) will be unusable by the end of this decade and at that point NASA and other countries will resort to renting space on privately owned, earth orbiting stations.

NASA is hedging its bets and providing grants to several private companies in hopes of jump starting and accelerating their development of private space stations. No doubt any of these companies will be honored to have NASA as a primary tenant, but they’re setting their sights even higher – literally.

Space Flight Tourism Has Begun

We’ve already broken the public-private barrier with tourist excursions for low-earth, brief or multi-day orbital flights. The Russians have been making their Soyuz vehicle available for ferrying private citizens to the ISS for more than a decade.

Now, in addition to ferrying crews to the ISS for NASA, SpaceX also is using its equipment to provide multi-day orbital flights for private citizens. Late last year, SpaceX hosted four space tourists for a three-day orbiting tour.

Space Destination Tourism

Axiom Space, one of the companies supported by NASA, is planning to rent out the SpaceX vehicle from Elon Musk’s team to transport company clients to an eight-day literal “around the world” orbital flight cruise aboard the ISS. This represents the second phase of the space tourism industry – to deliver space tourists to orbiting modules and stations. We’re there already of course, but these programs are in their infancy.

When the ISS goes out of commission, we’ll see private space stations take up the slack – both for NASA’s important work and for wealthy space tourists’ once-in-a-lifetime experiences. Axiom has a leg up on this venture, as it’s planning to attach a module to the ISS for several years before detaching it to form the basis of its own private space station.

Orbital Vacations

Over time, space station tourists won’t be content to live even for a few days in a lab-like environment – the kind we’re used to seeing on videos from the ISS.

Private, orbiting space stations will be upgraded. They won’t be luxurious at first, but they’ll have slightly upgraded sleeping pods and small common areas for lounging instead of working.

NASA will still have its labs and astronaut quarters on board. The tourists will need to stay in their own area, although some will want to do more than look out the window for days at a time and will volunteer to participate in research after receiving some on-the-ground training before liftoff.

The Next Frontier

The next step in the space tourism progression is to break beyond the Earth orbit and place space facilities in other locations – orbiting the Earth’s moon or on the moon itself.

We’ll also see space vacations and research destinations in non-planet orbiting space.

Supporting Space Commerce

Down the road even further, space workers for commercial ventures will become another category of private citizen astronauts. These workers will be hopping from one private space station to the next as space station entrepreneurs place facilities at ever-more distant waypoints in space. Tasks like asteroid mining will be done by robots, of course, but in some cases, human intervention at the mining location may be needed to keep things progressing. These private space stations will serve as staging areas, regional offices, and warehouses.

Space Highways

It’s not too hard to imagine that eventually, along well-established routes to commercial areas in space and to other planets, we’ll see the emergence of additional space structures – hardly space “stations” anymore – with specific functions. Passing vehicles will dock to resupply, make deliveries, make repairs, refresh crews and passengers, and provide almost the same variety of services you’d expect to see along a U.S. interstate highway.

Even further into the future, we’ll see scheduled flights from earth to the larger space communities and then between those locations, similar to the familiar hub and spoke arrangements used by the world’s airlines today. As we scale these operations, space recreation and tourism will be open to far more of Earth’s citizens.

These flights will be even more necessary when people (originally workers on those remote outposts) choose to remain in space-based facilities indefinitely, purchasing or renting accommodations – maybe as retirement destinations.

Will Space Remain International?

At this time, the U.S., China, India, Russia, the UK, Japan, the UAE and maybe a few other nations have or conceivably could develop the capability to push into space for tourism or commerce.

But who owns space? Will we see any borders or territorial claims? Back in 1960, the United Nations determined that space was truly wide open. No country could lay claim to any areas or create any borders.

Will today and tomorrow’s nations abide by that? This neutrality principle might be tested as structures emerge on the moon and Mars and as we’re able to easily reach areas of space with valuable resource-laden asteroids. We may also come across some entities that come from other parts of the universe who would beg to differ about that jurisdiction of the UN!

Baby Steps So Far Are an Exciting Promise of What’s to Come

With these kinds of futuristic images in mind, it’s easy to see that what’s happened in the past decade and what will take place in the next few years are important steps, but they’re still just baby steps.

What needs to and will happen, though, is that as more and more tourist space flights occur on private vehicles and more and more private residents spend a few days at a time on the ISS and later the private space stations, people and investors will be convinced that futuristic, recreational space travel and residency is no longer science fiction but a legitimate, future personal and business opportunity. The Jetsons won’t seem as far fetched as they did 60 years ago.

In 2022, we’ll see a remarkable surge in this direction with more visitors going to space and to the ISS, along with breakthroughs in how to build and integrate structures in space. As long as we don’t see any major catastrophes (unfortunately, they’re almost inevitable and it’s important we keep them in perspective and learn from them when they happen), we’ll see growing confidence in the viability of recreational space travel.

Ten years from now, even if you’re not ready to book a hotel stay near Mars, you should buy a ticket for an Earth orbit trip or make reservations for a once-in-a-lifetime space station vacation. That’s where you’re going to see the greatest shows off Earth.

#### Tourism makes low-gravity research accessible which results in critical physiological science innovation.

Caplan and Lindsay 17 Nick Caplan and Kirsty Lindsay 7-29-2017 "Space Tourism Could Help Boost Science and Health Research — Here's How" <https://www.space.com/37503-space-tourism-could-help-boost-science-health-research.html> (Nick graduated from the University of Birmingham with a PhD in Biomechanics)//Elmer

Perhaps one day we will see research teams launching groups of participants to spend a few weeks or months aboard a space hotel in order to study medical interventions that would slow the ageing process on Earth, and to help the human species colonise the Moon or even Mars. Research dating back to the early years of the space race has led to technologies that benefit us all. Many scientific discoveries have come since the arrival of inhabitable space stations that act as orbital laboratories. NASA’s first space station Skylab helped understand the effects on the human body of spending months in space and paved the way for the International Space Station. A huge number of research studies have been completed on the ISS since the year 2000 in the areas of human physiology, biology, biotechnology, physical science and earth and space science. These studies have led to discoveries such as enhanced protein crystal growth for drug development, efficient combustion of fuel droplets, and an understanding of the effects of long duration exposure to microgravity on the human body, revealing that spaceflight has effects similar to ageing on Earth. Despite much human physiological research being carried out in space, it has one major limitation – there are simply not enough humans currently going to space to act as research participants, leading to difficulties in research design. In fact, only 550 or so humans have ever been into space since Russian cosmonaut Yuri Gagarin first orbited the Earth in 1961. Human physiological experiments in space tend to have very small participant numbers (for example, the NASA twins study) or they have to take place over many years. Could the boom in commercial human spaceflight accelerate the speed of human physiological discoveries in space? We certainly think so.

#### Physiology key to manage new Diseases.

APS 20 5-21-2020 "How Physiologists Are Helping Patients Recover from COVID-19" <https://ispyphysiology.com/2020/05/21/how-physiologists-are-helping-patients-recover-from-covid-19/> (American Physiology Society)//Elmer

Understanding Physiology Is Critical to Fighting COVID-19 For each of the new treatments and devices created to combat COVID-19, it is critical to make sure they are safe to use in people. This is where understanding of human physiology is very important. For instance, treatment with remdesivir can reduce the amount of the virus in your body and has helped people who are severely ill with COVID-19 recover faster. But the drug is known to damage the liver and the immune system, so it is very important to know how well a patient’s liver and immune system are functioning before using it as a treatment. Even as I write this, there are new findings that COVID-19 directly affects not only the lungs but also the brain, kidneys, blood vessels and blood cells. This makes treatment of COVID-19 very difficult. Scientists and bioengineers need to take into consideration how the different organs of the body coordinate to keep you alive and healthy—the knowledge of how all the organs, tissues and cell work together in health and disease is the basis of physiological study. The trouble with finding the best treatment for COVID-19 is that the symptoms are so different from one person to the next. Children seem to be less vulnerable to COVID-19, older people are more vulnerable and some young adults are dying from strokes caused by the coronavirus rather than respiratory issues. As we find out more about how COVID-19 affects the body, it is clear that there will be more than one best way to fight it. In my eyes, the COVID-19 pandemic has highlighted the value of scientific research, especially research that helps us understand human physiology. In a few short months, scientists have sequenced the genome of the virus, discovered how SARS-CoV-2 infects cells by attaching its “spikes” to a protein on cells and developed new potential treatments. It will be the research physiologist’s job to study and understand how to best use these medicines and devices to treat COVID-19 patients.

#### Disease causes Extinction.

Bar-Yam 16 Yaneer Bar-Yam 7-3-2016 “Transition to extinction: Pandemics in a connected world” <http://necsi.edu/research/social/pandemics/transition> (Professor and President, New England Complex System Institute; PhD in Physics, MIT)//Elmer

Watch as one of the more aggressive—brighter red — strains rapidly expands. After a time it goes extinct leaving a black region. Why does it go extinct? The answer is that it spreads so rapidly that it kills the hosts around it. Without new hosts to infect it then dies out itself. That the rapidly spreading pathogens die out has important implications for evolutionary research which we have talked about elsewhere [1–7]. In the research I want to discuss here, what we were interested in is the effect of adding long range transportation [8]. This includes natural means of dispersal as well as unintentional dispersal by humans, like adding airplane routes, which is being done by real world airlines (Figure 2). When we introduce long range transportation into the model, the success of more aggressive strains changes. They can use the long range transportation to find new hosts and escape local extinction. Figure 3 shows that the more transportation routes introduced into the model, the more higher aggressive pathogens are able to survive and spread. As we add more long range transportation, there is a critical point at which pathogens become so aggressive that the entire host population dies. The pathogens die at the same time, but that is not exactly a consolation to the hosts. We call this the phase transition to extinction (Figure 4). With increasing levels of global transportation, human civilization may be approaching such a critical threshold. In the paper we wrote in 2006 about the dangers of global transportation for pathogen evolution and pandemics [8], we mentioned the risk from Ebola. Ebola is a horrendous disease that was present only in isolated villages in Africa. It was far away from the rest of the world only because of that isolation. Since Africa was developing, it was only a matter of time before it reached population centers and airports. While the model is about evolution, it is really about which pathogens will be found in a system that is highly connected, and Ebola can spread in a highly connected world. The traditional approach to public health uses historical evidence analyzed statistically to assess the potential impacts of a disease. As a result, many were surprised by the spread of Ebola through West Africa in 2014. As the connectivity of the world increases, past experience is not a good guide to future events. A key point about the phase transition to extinction is its suddenness. Even a system that seems stable, can be destabilized by a few more long-range connections, and connectivity is continuing to increase. So how close are we to the tipping point? We don’t know but it would be good to find out before it happens. While Ebola ravaged three countries in West Africa, it only resulted in a handful of cases outside that region. One possible reason is that many of the airlines that fly to west Africa stopped or reduced flights during the epidemic [9]. In the absence of a clear connection, public health authorities who downplayed the dangers of the epidemic spreading to the West might seem to be vindicated. As with the choice of airlines to stop flying to west Africa, our analysis didn’t take into consideration how people respond to epidemics. It does tell us what the outcome will be unless we respond fast enough and well enough to stop the spread of future diseases, which may not be the same as the ones we saw in the past. As the world becomes more connected, the dangers increase. Are people in western countries safe because of higher quality health systems? Countries like the U.S. have highly skewed networks of social interactions with some very highly connected individuals that can be “superspreaders.” The chances of such an individual becoming infected may be low but events like a mass outbreak pose a much greater risk if they do happen. If a sick food service worker in an airport infects 100 passengers, or a contagion event happens in mass transportation, an outbreak could very well prove unstoppable.

# 2

#### Extending the ISS trades off directly with other NASA projects - ISS funding is a black hole with insubstantial performance gains

Thornton 18 (David, “NASA’s impending dilemma: Fund the ISS, or new deep space missions?”, Federal News Network, 9/7/18, <https://federalnewsnetwork.com/nasa/2018/09/nasas-impending-dilemma-fund-the-iss-or-new-deep-space-missions/>)

The 2019 budget proposal request tees up a confrontation with Congress over NASA funding. The proposal calls for cutting funding to the International Space Station, but some lawmakers disagree, and want to continue funding for the ISS. In a recent report, NASA’s Office of Inspector General said the agency won’t be able to continue to fund the ISS and pursue missions outside low-earth orbit without significantly more funding. The agency has spent more than $75 billion on the ISS, which has continuously held occupants since 2000 and was not completed in 2011. The cuts would also include space shuttle flights for purposes of construction and resupply. Astronaut Drew Feustel prepares to close a door to an atmospheric experiment during a space walk outside the International Space Station on Thursday, June 14, 2018. NASA is authorized to continue funding the ISS through Oct. 1, 2024, at a projected cost of $3 billion-$4 billion annually, or half of the agency’s human spaceflight budget. Despite the 2019 budget request, Sens. Ted Cruz (R-Texas) and Bill Nelson (D-Fla.) have introduced legislation to extend that funding until 2030, arguing that it’s a unique resource NASA can’t afford to lose. But NASA Inspector General Paul Martin said that priority is at loggerheads with the administration’s stated goal of returning to the moon, and preparing for a mission to Mars. Insight by Infor: Learn how DoD is overcoming readiness challenges in this exclusive executive briefing. “A decision to continue operating the International Space Station through 2028 or even beyond, as the current legislation might propose, would just kick out and extend the date before NASA could realistically send any type of crew well beyond the late 2030s and early 2040s, that folks had hoped where we might see the first at least orbit of Mars,” Martin said on Agency in Focus: NASA. “It’s just going to push it out because half of NASA’s exploration budget is going to be spent on sustaining the ISS.” But balanced against that, he said, is that the ISS offers a unique research opportunity to test technologies for deep space exploration and study human health risks involved in space travel. “The station’s microgravity environment offers an ideal place to conduct this kind of research, which is essential if humans are to safely explore space beyond current low-earth orbit,” Martin told the Federal Drive with Tom Temin. For example, NASA is using the ISS to test new life support systems, a new space suit, and ways to grow food in outer space, so a potential Mars mission won’t have to carry nearly two years’ worth of food. Although some health issues can’t even be prepared for on the ISS. “When you’re on a station, you can look down below — you’re 26 miles up — you can still see Earth,” Martin said. “When you take a nine month, one-way trip to Mars, you’re in a very small capsule for at least nine months. And you have all those physical issues, the things that we’ve all heard about: the radiation exposure, the ocular concerns, balance impairments, changes to immune systems from a prolonged lack of gravity. But you also have the significant interpersonal and psychological concerns of a trip.” Get your daily dose of Mike Causey's Federal Report delivered to your inbox. Subscribe now. Martin said when OIG auditors interviewed four-time astronaut and former NASA Administrator Charlie Bolden, he said his primary concern with deep space exploration is potential psychological issues. What happens if NASA stops funding ISS? The Trump administration wants it privatized and for NASA to become a customer of the ISS rather than its proprietor. But it’s unclear who would take it over. The cost is the primary sticking point: a projected $1.2 billion to operate in 2024, and that’s not taking resupply launches into account. It’s also unclear what privatization would look like. Would industry install new, private modules? Would they launch a new platform altogether? The ISS is about 20 years old, and while it’s functional, it does require more maintenance as it ages. Of course, Congress could always decide to increase funding for NASA, enough to cover both the ISS and build toward future missions. But that would be a huge increase, and Martin said it’s unlikely to happen. “The point we’re making in our audit is that absent a significant, extraordinary bump in NASA’s budget, this is the reality,” he said. The audit also pointed out, among other issues, problems with NASA’s science portfolio. Cost, schedule and performance are big concerns with the science portfolio, which has a budget of $5.3 billion annually, and covers research into astrophysics, earth science, heliophysics and planetary science. Latest Budget News Continuing resolution keeps federal contractors on edge before holidays Federal Drive Federal contractors preparing for 2020 budget uncertainty Federal Drive CSIS International Security Program looks to 2020 budget for defense strategy Federal Drive“It’s all about choosing the right missions at the right time, and developing realistic budgets and schedules for them, and keeping to those budgets and schedules,” Martin said. “NASA’s project management has had a whole series of challenges throughout its history. It’s a very ambitious agency, but we and others have cautioned against excessive optimism.” That kind of optimism can lead to unrealistic timetables and budgets. The James Webb Telescope is a prime example, Martin said. Original estimates had it costing $1-$3.5 billion and launching sometime between 2007 and 2011. Currently, it’s already cost $8 billion and is projected to rise to $9.6 billion before 2021, the most recent projected launch date. This has largely been due to technical complexity and human error, Martin said. But the question is, if Congress had known the actual cost and timetable when they originally authorized it, would they still have done so? “If you do a $9 billion James Webb, you’re probably not doing 5 or 6 other very significant projects as well,” Martin said. And that same dilemma is now taking shape around the ISS.

#### NASA needs more funding to land on the moon in 2024 - otherwise, Chinese landing threatens US space dominance and allows for a monopoly on rare earth minerals

Einhorn et al 19 (Bruce, Hong Kong reporter, justin bachman, aviation/aerospace reporter, Hannah Dormido and Adrian Leung, data viz journalists, “The Next Neil Armstrong May Be Chinese as Moon Race Intensifies”, 7/17/19, Bloomberg, <https://www.bloomberg.com/graphics/2019-us-vs-china-moon-race/>)

Fifty years after Neil Armstrong took his one small step, there’s a renewed race to put human beings back on the moon⁠—and the next one to land there may send greetings back to Earth in Chinese. China, which didn’t have a space exploration program when Apollo 11 landed in the Sea of Tranquility on July 20, 1969, is planning a series of missions to match that achievement. China could have its own astronauts walking on the moon’s surface and working in a research station at its south pole sometime in the 2030s. On the way there, they may stop over at a space station scheduled for assembly starting next year. America’s Lunar Lead Manned missions and moon probes U.S. China Source: NASA/GSFC/LROC, School of Earth and Space Exploration, Arizona State University Those ambitions trouble President Donald Trump’s administration, which is locked in trade and technology-transfer disputes with China that raise fears of a new Cold War like the one between the U.S. and the Soviet Union that spawned the Apollo program in the 1960s. With the U.S.-China rivalry extending into the cosmos, Trump wants to create a military branch called the Space Force and accelerate NASA’s timetable for returning to the moon. “Make no mistake about it: We’re in a space race today, just as we were in the 1960s, and the stakes are even higher,” U.S. Vice President Mike Pence said in March. Chinese officials are just as emphatic about the importance of the space program to their national identity. A moon shot is intended to open the heavens for more-distant missions as China strives to be a dominant space power by the time the Communist Party celebrates its centennial anniversary of rule in 2049. “I wouldn’t be at all surprised if the next voice from the moon is speaking Mandarin,” said Joan Johnson-Freese, a professor and space-policy expert at the U.S. Naval War College in Newport, Rhode Island. TK Buzz Aldrin, with Neil Armstrong reflected on his visor during the Apollo 11 mission. Source: NASA Trump’s New Timetable China already is a galactic pioneer after landing the first probe on the far side of the moon in January. It’s plotting lunar missions to bring back crust samples, and it intends to send a probe to Mars by next year. When Armstrong and Buzz Aldrin walked on the lunar surface, they fulfilled President John F. Kennedy’s 1961 call to put an American on the moon by the end of that decade. Trump wants U.S. boots back there by 2024, shaving four years off the previous timetable and empowering NASA to use contractors such as Elon Musk’s Space Exploration Technologies Corp. and Jeff Bezos’s Blue Origin LLC to make it happen. The proposed landing at the lunar south pole—the same region China is eyeing for its research station — would be a precursor to a sustained presence by 2028. NASA’s current budget is $21.5 billion, and the Trump administration is seeking another $1.6 billion for the current fiscal year to fund its lunar return, a program called Artemis. NASA will need billions of dollars more to meet the 2024 deadline. Shoot for the Moon Science, space and technology outlays as a percentage of total U.S. government spending John F. Kennedy announced goal of manned lunar mission Apollo 11 moon landing Mercury, the first U.S. human space program, initiated Launch of the first space shuttle SpaceX launched its first rocket Estimates Source: United States Office of Management and Budget “We’re building an architecture that enables us to go to the moon to stay for long periods of time with commercial partners and international partners,” NASA Administrator Jim Bridenstine said in a July 2 interview. “It’s my intent to make sure that we remain the preeminent spacefaring nation.” NASA hasn’t had its own rockets for launching crews into orbit since the space shuttle program ended in 2011, so it pays Russia more than $80 million a seat for rides to the International Space Station. The rocket that’s supposed to meet Pence’s new timeline–Boeing Co.’s Space Launch System—is struggling with years of delays and billions of dollars in cost overruns. It won’t be ready for what was a planned June 2020 mission orbiting the moon. China Catches Up Spacecraft deployed by country or region U.S. China Others Source: Space Launch Report Bridenstine stands behind the SLS, which has strong political support, and said it’s the only vehicle suitable for getting NASA back to the moon. The agency will consider using commercial companies for a lunar lander and key aspects of the Lunar Gateway orbiting platform, which may help lower the estimated $20 billion-$30 billion price tag for a moon mission, he said in the interview. Reusable rockets from Hawthorne, California-based SpaceX already are deploying satellites and resupplying the space station, and are contracted to ferry astronauts there. Kent, Washington-based Blue Origin signed an agreement with NASA to develop commercial lunar-lander systems. Bezos unveiled the Blue Moon lander in May and said he hoped missions could commence by 2024. TK Chinese astronaut Zhai Zhigang conducts the nation's first spacewalk in 2008. Source: Beijing Space Command and Control Center via Xinhua/AP Why China May Be First NASA had several manned spaceflight programs after Eugene Cernan stepped off the moon in 1972 as the last visitor, but none returned humans there. President Barack Obama in 2010 canceled the Constellation mission to reach the space station, moon and Mars because he said it was over budget and behind schedule. He favored seeding private space transportation to help lower costs. That didn’t sit well with Armstrong. “Other nations will surely step in where we have faltered,” he told Congress in 2010. Mission whiplash continues to this day. After urging NASA to speed up its moon schedule, Trump then tweeted in June that the agency should focus on other missions, including Mars. TK Jeff Bezos introduces Blue Origin’s Blue Moon lunar lander on May 9 in Washington. Photographer: Patrick Semansky/AP While U.S. space policy is subject to swings of the political pendulum, that’s not the case in a nation with one-party rule. Interstellar research and exploration are linchpins of Chinese President Xi Jinping’s blueprint for boosting high-technology manufacturing and reducing reliance on the U.S. and other countries. Xi said earlier this year the party will “pursue the nation’s unyielding dream of flying into the sky and reaching for the moon.” China’s State Council in 2016 outlined a five-year space strategy that included developing a super-heavy rocket to carry big payloads into orbit, launching a telescope to study black holes and building a space station. That station is expected to be fully operational by about 2022, according to the state-run China Daily. TK Yang Liwei waves after returning from first flight in space in 2003. Source: Sovfoto/Universal Images Group via Getty Images The strategy also called for manned spaceflight, exploring and sampling the moon and eventually sending probes near Mars and Jupiter. The country will send its first rover to Mars next year, the Communist Party newspaper People’s Daily reported in April. China wants to place a scientific research station near the moon’s south pole in about 10 years and conduct missions with astronauts on the lunar surface, Zhang Kejian, head of the China National Space Administration, said during the annual Space Day celebration in April, according to China Daily. “It’s entirely plausible that China will have a more sophisticated space program than NASA or SpaceX or Blue Origin,” said Blaine Curcio, founder of Orbital Gateway Consulting in Hong Kong. China’s first man in space, Yang Liwei, was a fighter pilot who orbited the Earth in 2003. Just five years later, Zhai Zhigang conducted the nation’s first spacewalk and, in 2012, Liu Yang became the first Chinese woman blasted into orbit. Now China is embarking on more ambitious missions. The Chang’e 4 probe touched down on the far side of the moon in January. Chang’e 5’s launch, scheduled by year’s end, will be China’s first try at collecting samples and returning them to Earth. What China Wants Up There The sampling program signals that China is interested not just in planting its flag in the lunar soil but also in exploiting the resources underneath, analysts said. The State Council’s plan repeatedly references using the program to further economic development. Water submerged at the moon’s poles could help sustain human life and propel spacecraft further into the universe, and elements rare on Earth—such as helium-3—could be shipped back to generate almost unlimited energy. China isn’t alone in looking at moon mining. The U.S., the European Space Agency, India and others have expressed similar interests, as has Bezos. India also announced plans last year to become the fourth nation to launch humans into space. Chang’e 3 Panorama Shot from the Moon Touch and drag to view 👆 Source: Image from CAS/CNSA, stiched by Andrew Bodrov/360cities.net via Getty Images The state-run enterprises and government agencies overseeing China’s space program didn’t reply to faxes seeking comment. Given the complexities of rocket science, China still faces many challenges in reaching for the moon. The program suffered a major setback in 2017 when a Long March-5 heavy-lift rocket failed within six minutes of liftoff. China may try again this month, the official Xinhua News Agency reported in January, citing the vice president of China Aerospace Science and Technology Corp., Yang Baohua. The failure is a reminder of the difficulty China faces in closing the gap with NASA. Any Chinese astronaut stepping on the moon would be doing so more than half a century after Armstrong and Aldrin were there. Ambitious Space Plans U.S. China Sources: U.S.-China Economic and Security Review Commission, Xinhua, Chinese government “I have heard a lot of people talk about China landing on the far side of the moon, but it’s important to remember that a few months before that happened we landed on the far side of Mars,” Bridenstine said, referring to the InSight lander. “The United States of America is well ahead. I don’t see it as a race.” Yet Johnson-Freese said China likely will sort out the glitches and have a heavy-launch rocket capable of propelling astronauts to the moon. China may be able to put astronauts on the moon in about a decade, she said. A Space Silk Road China’s space spending last year was an estimated $8.48 billion—less than half of NASA’s—though actual spending may be higher and likely includes military research, said Rich Cooper, a vice president at Colorado Springs, Colorado-based researcher Space Foundation. U.S. law curtails NASA from working with China for fear of espionage. To compensate, China is spanning the globe to attract space partners. The China National Space Administration signed an agreement with Pakistan in April to cooperate on manned missions. Chinese scientists also are working with counterparts from the ESA, Brazil and France. At home, the government is encouraging private-sector startups to emulate SpaceX and Blue Origin by testing rockets and planning orbital launches. TK The Chang’e-4 lunar probe launches at the Xichang Satellite Launch Center on Dec. 8, 2018. Photographer: Jiang Hongjing/Xinhua “China’s growth strategy is focused on establishing a Space Silk Road,” Michael Gold, a vice president of satellite provider Maxar Technologies Inc., told the U.S.-China Economic and Security Review Commission in April. Relations between the U.S. and China haven’t deteriorated to the levels that motivated the 1960s space race, but some analysts say it’s inevitable the two countries will compete for supremacy in the cosmos. In an interview with state TV, Ye Peijian, a top official with the lunar exploration program, explained why China wanted to go to the moon. “If we are now capable of going but we don’t go, future generations will blame us,” he said. “If others go there, then they will take over.”

#### Chinese mining and energy dominance ensures their geopolitical domination and makes war inevitable

Malcolm Davis 19---a senior analyst at ASPI, Real Clear Defense, "Space-Based Solar Power and 21st-Century Geopolitical Competition", 4/2/19, https://www.realcleardefense.com/articles/2019/04/02/space-based\_solar\_power\_and\_21st-century\_geopolitical\_competition\_114302.html

So it’s interesting that, 50 years later, China seems very interested in building solar power satellites of its own. The move is important for a number of reasons, and not just in terms of pure space exploration. Simply put, space solar power satellites (SSPS) are designed to gather energy from the sun—which is uninterrupted in space and isn’t affected by the earth’s atmosphere or by day and night cycles—and beam that energy back to earth where it can power national power grids. Like commercial nuclear fusion power (that other big idea that is forever 30 years away), space-based solar power opens up the prospect of clean, limitless energy. China is now indicating a desire to develop an SSPS capability in coming decades, emphasising a gradual approach of developing larger and more powerful satellites that are assembled in orbit by large space-based 3D printers. Using on-orbit manufacturing reduces the challenges of transporting large structures from earth into space. China’s investment in heavy-lift launch vehicles like the Long March IX, which will carry 140 tons into low-earth orbit, and its accelerating development of reusable rockets and spaceplanes, as well as the growth of its commercial space sector, could also support a Chinese SSPS network. The timetable for developing this capability, originally published in China’s Science and Technology Daily, extends through the next decade. Work has already begun on building a ground station in Chongqing to receive the microwave energy gathered by the SSPS. The next step is to test the system using high-altitude ‘stratospheric’ solar power balloons between 2021 and 2025, and then deployment of the first space-based SSPS in the second half of the next decade. The goal would be to construct megawatt-class satellites by 2030, and gigawatt-class satellites before 2050, which could weigh up to 1,000 tons. With on-orbit manufacturing for building large structures, the raw materials would need to come from mining lunar regolith rather than from earth. That ties in with China’s plans for a lunar base by the 2030s. China’s interest in pursuing SSPS has some significant geopolitical implications for 21st-century energy competition. Fundamentally, the country that achieves a viable SSPS network first can potentially reshape global energy markets and, in turn, have much greater control over economic activity on earth from space. I’ve noted previously that China has been promoting a ‘space Silk Road’ via its Beidou global navigation system to states that have signed up to its Belt and Road Initiative. That campaign appears to be designed to deepen those states’ dependency on China as a provider of information infrastructure provider. Adding an energy dimension would dramatically deepen Chinese control of any recipient society. China’s SSPS would be promoted as contributing towards interdependent co-development—the ‘win–win’ rhetoric of China’s foreign ministry—as well as easing dependency on fossil fuels that contribute to climate change. However, there’s no disguising the fact that it would be China that provides the energy to keep recipient states prosperous. That implies serious political leverage. A Chinese SSPS network would also need large rectenna farms at key locations to receive the beamed energy from orbit and then distribute it to local grids. Such facilities would clearly be critical infrastructure, constructed and operated by China within recipient states. That would further deepen Chinese investment and influence in BRI states.

#### Chinese Minera Dominance hurts readiness and causes conflict.

Parthemore 11, Christine. "Elements of security: mitigating the risks of US dependence on critical minerals." (2011). (Fellow at Center for a New American Security)//Elmer

Minerals are a subject of much contention. On one hand, the United States remains less prepared for supply disruptions, price spikes and trade disagreements related to the global minerals trade than most experts realize. On the other hand, public concern over reliable access to the minerals required in key sectors of the U.S. economy, in particular those needed to produce military equipment, is growing. Too frequently, however, such concerns are based on inaccurate assumptions. A sober and informed analysis suggests there are real vulnerabilities, which place critical national security and foreign policy interests at risk. In worst-case scenarios, supplies of minerals that the United States does not produce domestically may be disrupted, creating price spikes and lags in delivery. Even short of major supply disruptions, supplier countries can exert leverage over the United States by threatening to cut off certain key mineral supplies. The United States may also lose ground strategically if it continues to lag in managing mineral issues, as countries that consider assured access to minerals as far more strategically important are increasingly setting the rules for trade in this area. China’s rising dominance is at the heart of this growing public debate. Its 2010 cutoff of rare earth elements2 – a unique set of minerals that are difficult to process yet critical to many hightech applications – attracted particular attention. After Japan detained a Chinese trawler captain over a skirmish in the East China Sea, Japanese companies reported weeks of stalled shipments of rare earths from China amid rumors of an official embargo. This may sound like a minor trade dispute, but China currently controls production of about 95 percent of the world’s rare earths, which are critical to building laser-guidance systems for weapons, refining petroleum and building wind turbines. Coinciding with possessing this incredible leverage over the rest of the world, China has also reduced its export quotas for these minerals. For its part, the Chinese government contended that it did not put any formal export embargo in place, and that its plans to reduce exports simply reflect the need to meet growing domestic demand for rare earths. Japan-China relations experienced further strain in their already tense relationship. In the United States, many reporters, policy analysts and decision makers did not foresee this challenge. Feeling blindsided, some in the United States characterized the situation in a manner that demonized China rather than using the opportunity to better understand the true nature of U.S. supply chain vulnerabilities. The 2010 rare earths case and others are increasing interest in critical minerals among U.S. policymakers. Congress held hearings on the strategic importance of minerals between 2007 and 2010, and the 2010 National Defense Authorization Act required DOD to study and report on its dependence on rare earth elements for weapons, communications and other systems.3 During a 2009 hearing on minerals and military readiness, Republican Representative Randy Forbes of Virginia called minerals, “one of those things that no one really talks about or worries about until something goes wrong. It’s at that point – the point where we don’t have the steel we need to build MRAPs [Mine Resistant Ambush Protected vehicles] or the rhenium we need to build a JSF [Joint Strike Fighter] engine that the stockpile becomes critically important.”4 In October 2010, Secretary of State Hillary Rodham Clinton stated that it would be “in our interests commercially and strategically” to find additional sources of supply for rare earth minerals, and stated that China’s recent cuts to rare earth exports “served as a wakeup call that being so dependent on only one source, disruption could occur for natural disaster reasons or other kinds of events could intervene.”5 In January 2011, Sen. Mark Begich, D-Alaska, Sen. Lisa Murkowski, R-Alaska, and Rep. Mike Coffman, R-Colo., wrote a letter to Defense Secretary Robert Gates expressing concern for minerals required for producing defense equipment such as Joint Direct Attack Munitions (JDAMs), which stated, “Clearly, rare earth supply limitations present a serious vulnerability to our national security. Yet early indications are that DOD has dismissed the severity of the situation to date.”6 Additionally, the Department of Energy (DOE) launched a multiyear effort to explore potential vulnerabilities in supply chains for minerals that will be critical to four distinct areas of energy technology innovation. While concern is growing, the media and policymakers often focus too narrowly on what may seem the most compelling indicators – usually import dependence or scarcity – in prescribing solutions to reduce U.S. vulnerabilities, in particular to supply disruptions in critical minerals such as rare earths. This focus is sparking protectionist attitudes, with some worrying that import dependence poses an inherent risk to the U.S. economy. Discussion of minerals also frequently focuses on supply scarcity and resource depletion in absolute terms. However, both the rhenium and rare earth minerals disruptions of the past five years were triggered by deliberate decisions made by political leaders to leverage their positions of strength, not by market forces, disorder or scarcities of these minerals. Countries often revert to hoarding, pressuring suppliers and otherwise behaving as if scarcities are present even when they are not, based solely on concerns that shortages are likely in the near term. In fact, neither scarcity nor import dependence alone is sufficient to signal vulnerability, and a combination of factors including concentration of suppliers is most often required for mineral issues to become security or foreign policy problems. This report, based on two years of research, site visits and discussions with stakeholders, explores how the supply, demand and use of minerals can impair U.S. foreign relations, economic interests and defense readiness. It examines cases of five individual minerals – lithium, gallium, rhenium, tantalum and niobium – and rare earth elements, such as neodymium, samarium and dysprosium, as a sixth group in order to show the complexity of addressing these concerns. Each of these minerals is critical for defense technologies and U.S. economic growth plans. They share characteristics with minerals that have caused important political or economic concerns for the United States in the past. Additionally, lithium is frequently cited in the media and in discussions of how clean energy supply chains are critical to meeting America’s future economic, energy and environmental goals. Within the past five years, two of these cases – rhenium and rare earth minerals – have involved supply disruptions or important threats of disruptions for the United States and its allies. Each of these minerals will require federal government attention in the coming years. Pg. 6-10

#### Impact is your Elvevold ev

# 3

#### JCPOA passes now, but it’s close and diplomacy is key

Joseph **Ataman et. al.**, Camille Knight, Adam Pourahmadi and Tamara Qiblawi, Cnn, **2-16**-2022, "Decision on Iran nuclear deal 'days away,' says French foreign minister ," CNN, <https://www.cnn.com/2022/02/16/middleeast/iran-nuclear-agreement-conclusion-intl/index.html> //SR

#### Paris, France (CNN)Negotiations over the revival of a 2015 deal that would see Iran curb uranium enrichment in exchange for sanctions relief will conclude in days, French Foreign Minister Jean-Yves Le Drian told the country's lawmakers on Wednesday. "We are coming ... to the hour of truth," Le Drian said of ongoing negotiations in Vienna to salvage the landmark deal -- which former President Donald Trump abandoned in 2018, and Tehran began to withdraw from a year later. "It's not a matter of weeks, it's a matter of days," he said. Later on Wednesday, Iran's chief negotiator Ali Bagheri Kani struck an unusually optimistic note, saying that parties to the deal were "closer than ever to an agreement." But Kani warned that negotiations could still fall through. "Nothing is agreed until everything is agreed," he said in a tweet. "Our negotiating partners need to be realistic, avoid intransigence and heed lessons of past 4yrs." "Time for their serious decisions," Kani added. Iran and the United States are engaged in a final round of indirect talks -- mediated by China, Russia and European parties to the agreement -- over a return to the 2015 nuclear agreement, known as the Joint Comprehensive Plan of Action (JCPOA). Analysts believe that failure to reach an agreement could lead violence in the crisis-ridden region to spiral out of control, with Iran fast approaching the nuclear threshold that would enable it to develop a nuclear weapon. Tensions in the Middle East have escalated in recent weeks, with Iran-backed Houthi militants launching unprecedented missile and drone attacks on the United Arab Emirates, considered a haven of security in the volatile region. Saudi-led coalition forces fighting the militant group retaliated with the deadliest offensive on Houthi-held parts of northern Yemen in years, killing scores of people and knocking out the country's internet. In his comments Wednesday, Le Drian warned that a breakdown in the Vienna talks would trigger a "serious crisis." "Either [the Iranians] trigger a serious crisis in the days to come -- we could do without that -- or else they accept the agreement which respects the interests of all parties and particularly the interests of Iran," he said. Le Drian said the two and half months of negotiations in Vienna was "exhausting diplomatic work." Iran returned to indirect negotiations with the US shortly after President Joe Biden -- who promised to return to the deal as a presidential nominee -- took office. Iran had rejected repeated overtures by the Trump administration to return to the negotiations after the former president withdrew from the deal.

#### Space diplomacy directly trades off with nonproliferation agreements – finite manpower, money, and political will within the AVC

Johnson-Freeze 16 [(Joan, Professor and former Chair of National Security Affairs at the US Naval War College, Newport, Rhode Island) “Space Warfare in the 21st Century: Arming the Heavens,” Cass Military Studies, 11/8/2016] JL

 \*The plan is legislated in the AVC (same bureau of the State Department that’s concerned with the JCPOA)

Proactive policymaking takes commitment, manpower, and money. A quick look at the money and manpower devoted to diplomacy in the US State and Defense departments compared to the resources available for the hardwareproducing military–industrial complex efforts described in Chapter 5 is enlightening. The Assistant Secretary of State for Arms Control, Verification, and Compliance (AVC) leads space-related diplomacy in the State Department. The AVC Bureau is responsible for “all matters related to the implementation of certain international arms control, nonproliferation, and disarmament agreements and commitments; this includes staffing and managing treaty implementation commissions.”34 The AVC arms control portfolio includes nuclear, biological, and chemical weapons and all related issues. The AVC section charged with space issues is the Office of Emerging Security Challenges; this office also handles missile defense issues and the promotion of transparency, cooperation, and building confidence regarding cybersecurity. As of financial year 2013, AVC had a budget of $31.2 million and 141 employees35 to be active participants and leaders in all of these issues.

By way of comparison, the Space Security and Defense Program, a joint program of the DoD and the Office of the Director of National Intelligence (ODNI) was programmed for a similar budget amount in financial year 2015: $32.3 million. That program is described as a “center of excellence for options and strategies (materiel, non-materiel, cross-Title, cross-domain) leading to a more resilient and enduring National Security Space (NSS) Enterprise.”36 A majority of SSDP funding is allocated to the development of offensive space control strategies. So basically, the same budget is allocated for all US global space diplomacy efforts as for an in-house Pentagon think tank to devise counterspace strategies.

Within the Pentagon, the Deputy Assistant Secretary of Defense for Space Policy is charged with all issues related to space policy, including diplomacy. The responsibilities of the Space Policy office are to:

• Develop policy and strategy for a domain that is increasingly congested, competitive, and contested

• Implement across DoD — plans, programs, doctrine, operations — and with the IC and other agencies

• Engage with allies and other space-faring countries in establishing norms and augmenting our capabilities.37

The breadth of those responsibilities, which includes reviewing space acquisitions, means that there may be only a handful of individuals actually engaged in multilateral diplomatic efforts, acting, for example, as advisors to diplomatic discussions such as those through the United Nations. Additionally, the expanse of the Pentagon results in a chain of command that makes organizational competition for attention to subject matter challenging at best. The Deputy Assistant Secretary of Defense for Space Policy reports to the Assistant Secretary of Defense for Homeland Defense, who then reports to the Principle Deputy Secretary of Defense for Homeland Defense and Global Security, who then reports to the Under Secretary of Defense for Defense Policy. There are also a multitude of space players in other governmental organizations to coordinate and contend with, particularly within the Air Force and intelligence communities. Personnel are spread thin.

US government-wide space diplomacy needs a mandate, manpower, and a supporting budget. Diplomacy, especially multilateral diplomacy, can be timeconsuming, manpower-intensive, and frustrating; and patience is not a strong American virtue. The recent experience in the UN LTS Working Group is emblematic of everything that causes the United States to shun multilateralism. Under the auspices of this group, countries had worked in good faith over the past five years to develop technical guidelines as reciprocal constraints, as insisted upon by the developing countries when they rejected the ICOC. Yet group success appeared thwarted at the February 2016 meeting of the LTS Working Group by one country, Russia.

#### Iranian proliferation goes nuclear – causes regional war and spurs proliferation cascades across the Middle East

Chilton and Hoshovsky 20 – [(Kevin, led U.S. Strategic Command and has participated in the Jewish Institute for National Security of America’s Generals and Admirals Program; Harry, policy analyst at JINSA’s Gemunder Center for Defense and Strategy) "Avoiding a nuclear arms race in the Middle East," Defense News, 2-13-2020, <https://www.defensenews.com/opinion/commentary/2020/02/13/avoiding-a-nuclear-arms-race-in-the-middle-east/>] TDI

This raises two immediate concerns. First, **should Iran race for the bomb, it is** almost inevitable that the United States and/or Israel will take preventative military action **to stop it from crossing that fateful threshold**. This could easily spiral into a regional war as Iran activates its various proxy forces against the United States and its allies.

Second, **an Iranian nuclear breakout attempt could** spur a proliferation cascade throughout the Middle East, **beginning with Saudi Arabia.**

Mohammed bin Salman, **the Saudi crown prince, openly stated in 2018 that if Iran developed nuclear weapons**, Riyadh would quickly “follow suit.” **One suggested approach would see Saudi Arabia purchase a nuclear power reactor from a major supplier like South Korea and then build a reprocessing plant that would yield enough weapons-grade plutonium in five years**.

A half-decade delay isn’t optimal, however, when the goal is achieving nuclear deterrence quickly. Thus, there is the so-called Islamabad option.

This refers to Riyadh’s role in financing Pakistan’s nuclear weapons program and an alleged commitment from Islamabad that it would repay the favor. While Pakistani and Saudi officials have denied any such understanding, **there is the possibility that the two could work out an arrangement where Islamabad could deploy some of its nuclear arsenal on Saudi soil following a successful Iranian breakout.**

Although this maneuver would draw sharp, international criticism, in theory, it would allow Riyadh to remain in good standing vis-a-vis the nuclear nonproliferation treaty. Nevertheless, Pakistan might not be willing to play spoiler against a nuclearized Iran. If it is, Middle Eastern geopolitics would become extremely unstable.

**If Saudi Arabia acquires nuclear weapons**, many believe Turkey would follow suit. Last September, Turkish President Recep Tayyip **Erdogan declared that he “cannot accept” the argument from Western nations that Turkey should not be allowed to attain nuclear weapons.** In 1958, Charles de Gaulle proclaimed that a nation without nuclear weapons “does not command its own destiny”; two years later, France tested its first bomb. Erdogan’s comments echo those earlier remarks and raise the possibility that Ankara could become the second NATO member to leave the alliance’s nuclear umbrella in favor of its own independent arsenal.

#### Prolif cascades undermine deterrence and cause nuclear war – this is predictive of what a multi-nuclear Middle East would look like

Krepinevich 13 – [(Dr. Andrew F, the President of the Center for Strategic and Budgetary Assessments) “Critical Mass: Nuclear Proliferation in the Middle East,” 2013, <https://csbaonline.org/uploads/documents/Nuclear-Proliferation-in-the-Middle-East.pdf>] TDI

As more countries over time develop nuclear capabilities and build up their nuclear arsenals, the competition will evolve from an Israeli-Iranian affair to a multi-state rivalry. For illustrative purposes **we will assume that** in the 2025-2030 timeframe, **Iran**, **Saudi Arabia, Turkey, and perhaps Egypt** and/or Iraq **have nuclear arsenals** in the low double-digit range (i.e., ten to forty weapons). What form might a nuclear competition among these powers and Israel assume? The remainder of this chapter attempts to shed some light on this issue, and its potential implications, with emphasis on those affecting regional stability.

The challenge of preserving stability when confronted with military competition among five nuclear-armed states within the Middle East and with other powers external to the region engaged in a Great Game for influence is formidable. At first blush, one thing seems apparent: **many** Cold War-era metrics **for assessing the competition and gauging where it might be headed** appear to be of little utility; in fact, **they may actually prove misleading and dangerous**. The same can be said of those looking to apply Cold War-era arms control metrics as a way of keeping the peace in general and avoiding nuclear use in particular.

**During the Cold War, many nuclear strategists came to view nuclear parity** (the possession of roughly equivalent arsenals capable of inflicting roughly equivalent levels of destruction) **between the United States and the Soviet Union as stabilizing**. The perception of these strategists is that the rough equivalence contributed to the tradition of non-use of nuclear weapons, and was thus desirable. Parity enabled both sides to avoid the perception of being inferior to their rival, and perceptions are critical to deterrence and to preserving the confidence of one’s allies and security partners. If accepted by both sides, parity could enable them to avoid the cost and instability associated with “racing” toward ever-larger arsenals. Accordingly, maintaining parity was a major objective of U.S.-Soviet (and later U.S.-Russian) arms control negotiations. Yet irrespective of its merits, parity is not an option for states engaged in an n-player competition. Each competitor cannot have a nuclear force equivalent to all the others. Even if the competition should solidify into two coalitions so as to mimic the two-player Cold War competition, questions would almost certainly arise regarding the willingness of a coalition partner that has not been attacked to risk its own destruction by using its nuclear weapons in response to an attack on its ally. Indeed, these concerns were raised during the Cold War, and formed a major justification for France pursuing its own force de frappe. 93

**In a Middle Eastern “n-player” competition, all nuclear powers would be** challenged to establish an “assured destruction” capability **against all the other regional nuclear powers**, another Cold War desideratum, **given their relatively modest economies. An “assured destruction” capability in an n-state competition would require that each state have weapons sufficient to survive an initial attack by all potential rivals and still be able to devastate the countries of all attackers**. It would also require that the source of the attack be reliably identified. As noted earlier, this may prove difficult given likely limitations on these states’ ability to field advanced early warning systems. For example, would Israel be able to determine with confidence the owner of a ballistic missile launched from a location along the Iranian-Turkish border? The origin of any cruise missile launched from a sea-based platform? Even assuming a state could identify the source (or sources) of an attack, could its command and control systems survive the attack sufficiently intact to execute a retaliatory strike? **A decapitation strike could preclude an “assured destruction” retaliatory strike even if sufficient weapons survive to execute one.**

**This, in turn,** raises the possibility of a “catalytic” war**—one that is initiated between two states by a third party. Given a proliferated Middle East as described above, the chances that a regime would incorrectly attribute the source of an attack cannot be easily dismissed. To the extent** cyber weapons can introduce false information **into a state’s decision-making process, the risks of catalytic war only increase.**

Further complicating matters, **the early warning requirement following a proliferation cascade could be multidirectional, and at some point perhaps 360 degrees**, especially if nuclear rivals begin deploying a portion of their nuclear forces at sea. **Early warning requirements would be stressed even further** (and the costs of such a system increase correspondingly) **if a neighboring state** (e.g., Iran in the case of Turkey or Iraq; Turkey in the case of Israel; etc.) **were to acquire nuclear weapons**. In this case warning times would be even more compressed than in an Israeli-Iranian competition. Owing to its proximity to Iran, **Saudi Arabia**, for example, **could have less than five minutes to react to an Iranian ballistic missile attack no matter how advanced its early warning and command and control systems are.**

As noted earlier in this assessment, regardless of what assumptions are made regarding a regional nuclear power’s early warning system, given the short ballistic missile flight times it seems likely that preserving command and control of the state’s nuclear forces while under attack will prove challenging. **States might be tempted to adopt a launch-on-warning posture**, but this requires both early warning and a highly responsive command and control system. Should a state determine that it will not be able to launch-on-warning and instead attempt to “ride-out” a nuclear first strike and retaliate, it would still need its command and control system to function effectively in the wake of the nuclear attack. **Absent a highly resilient command and control system,** a state’s ability to launch a retaliatory **nuclear strike** may require nuclear release authority to be diffused to lower-level commanders. But again, absent an effective early warning system it may not be possible to determine the attack source with confidence in a region with multiple nuclear powers.

# case

#### Listen – this Aff makes zero sense – three Top-Level Issues that should render a Neg Ballot on Presumption –

#### 1] Companies will just build Space Stations that aren't explicitly meant to “replace the ISS” – there’s no Brightline or way to verify meaning the Plan effectively does nothing cause companies have incentives to be sketch.

#### 2] The Plan ONLY effects Space Stations “replacing” the ISS - if Space Stations aren’t multilateral and used for government based research they’re not “replacing the ISS” which means the Plan wouldn’t affect them OR they ARE which means the Aff links to itself since those stations are used multilaterally.

#### 3] If Government’s hiring Private Companies isn’t private appropriation – then they can’t solve the ISS being replaced since the US is funding those Private Companies meaning it’s not Private entities.

4] conceded in cx – if ISS goes down then only companies try to replace

#### No an I/L – they haven’t read a Reverse Causal Arg that a Commercial Replacement causes an Extension – NASA isn’t ending the ISS since it wasts Commercial Stations, its ending because it's falling apart – NASA is looking to other opportunities based on structural factors regarding the ISS.

#### 1] ISS fails to spur Global Cooperation – it excluded China which causes shift to Chinese dominance ABSENT US replacements.

Young 19 (Makena Young, research associate with the Aerospace Security Project at the Center for Strategic and International Studies (CSIS). Prior to joining CSIS, Ms. Young worked for the Federal Aviation Administration as an aerospace engineer, focusing on automatic dependent surveillance-broadcast certification and integration in small aircraft.)(“Bad Idea: The Wolf Amendment (Limiting Collaboration with China in Space)”, December 4, 2019, https://defense360.csis.org/bad-idea-the-wolf-amendment-limiting-collaboration-with-china-in-space/)//ASMITH

In 2011, Representative Frank Wolf (R-VA) introduced what is now commonly referred to as the Wolf Amendment into the annual commerce, justice, and science (CJS) appropriations bill. This amendment limits U.S. government agencies, such as the National Aeronautics and Space Administration (NASA), from working with Chinese commercial or government agencies. Although Rep Wolf retired in 2014, the amendment has perpetuated and continues to be [included](https://appropriations.house.gov/sites/democrats.appropriations.house.gov/files/FY2020%20CJS%20Sub%20Markup%20Draft.pdf) in the annual CJS appropriations bill. Though the amendment does not prohibit all collaboration between the two countries, the result has proven to be a significant hindrance to bilateral civil space projects. Keeping the Wolf Amendment language is in every sense a bad idea: it does nothing to promote human rights and it hands China an opportunity to challenge NASA’s leadership in civil space exploration.

The [language](https://www.govinfo.gov/content/pkg/PLAW-112publ55/html/PLAW-112publ55.htm) of the Wolf Amendment says that no government funding for NASA, the White House’s Office of Science and Technology Policy (OSTP), or the National Space Council can be used to collaborate with, host, or coordinate bilaterally with China or Chinese-owned companies without certification from the Federal Bureau of Investigations (FBI). The FBI must certify that there is no risk of information sharing and that none of the Chinese officials involved have been determined by the United States to have direct involvement with violations of human rights. In a [2013 letter](https://www.theepochtimes.com/frank-wolfs-letter-on-nasa-controversy_312410.html) to former NASA Administrator Charles Bolden, Representative Wolf stated his “efforts to limit new collaboration with China until we see improvements in its human rights records.”

However, in the eight years since the first iteration of this amendment, the U.S. has not seen the desired changes in Chinese human rights policies that the Wolf Amendment was intended to spur. And during that time, China’s economy, global influence, and space capabilities have continued to grow. Being left out of U.S.-led international missions has not deterred China in space, but instead has pushed China to develop parallel capabilities on its own. Without a way to contribute to the International Space Station (ISS), China began development and testing its own modular space station. China launched the Tiangong-1 and Tiangong-2 [space laboratories](https://chinapower.csis.org/chinese-space-station/) in 2011 and 2016, respectively, as testbeds for a permanent space station. The China National Space Administration (CNSA) has announced that the permanent Chinese Space Station (CSS) should be fully operational by the year 2022.

With the ISS slated for retirement in 2024, other countries that want a long-term human presence in low Earth orbit may be lured into partnering with China on the CSS. Combined with a growing commercial space sector in China that promises to offer [frequent launches](https://www.technologyreview.com/s/612595/china-launched-more-rockets-into-orbit-in-2018-than-any-other-country/) at lucrative prices to foreign entities, China is positioning itself to be the partner nation of choice for future space exploration missions. As NASA enters into a new era of exploration with its Moon-to-Mars projects, it is [touting](https://twitter.com/JimBridenstine/status/1049063320668573696) international collaboration as an integral part of its plans. The [Artemis](https://www.nasa.gov/feature/nasa-gains-broad-international-support-for-artemis-program-at-iac) and [Lunar Gateway](https://www.geekwire.com/2019/worlds-space-agencies-focus-roles-gateway-moon-missions/) programs are working to establish partnerships with Canada, Australia, the European Space Agency, Japan, and possibly Russia. Closing China off from cooperating in these projects could be a strategic mistake.

Both NASA and CNSA share a common goal of exploring the moon for scientific purposes—as is evident by China’s Chang’e 4 rover that landed on the far side of the moon this year. NASA cooperated with CNSA to monitor the landing of the Chinese rover—the first major act of cooperation between the two space agencies in eight years. CNSA provided the planned location and time of the landing, and NASA observed the lander and shared the images that were produced. NASA was able to cooperate on this mission because it certified to Congress that this activity “[did not](https://www.scientificamerican.com/article/farside-politics-the-west-eyes-moon-cooperation-with-china/) pose a risk of resulting in the transfer of technology, data or other information…with China; and [did] not involve knowing interactions with officials who have been determined by the U.S. to have direct involvement with violations of human rights”. To ensure no private data sharing between the two nations, they agreed that any significant findings would be shared globally. This cooperation was a benefit for both space agencies, and although conducted as a one-time informal agreement, it could set precedent for continued cooperation between these two major space powers. Information sharing, even in small instances, can start to build confidence and trust and ultimately could be a tool used to prevent or de-escalate future conflicts in space.

Collaborating with non-allied countries in space is not a foreign concept for NASA. In the height of the Cold War, the U.S. and Soviet space agencies agreed to work together. President Eisenhower pursued these cooperative initiatives in early [letters](https://www.nasa.gov/50th/50th_magazine/coldWarCoOp.html) to Soviet leadership to showcase the peaceful uses of space. Collaborating on missions like the [Apollo-Soyuz](https://www.nasa.gov/apollo-soyuz/overview) test project and later the [Shuttle-Mir](https://www.nasa.gov/mission_pages/shuttle-mir/) program helped propel human space exploration and established a mutually beneficial area of cooperation and communication between the two rivals. This collaboration proved invaluable for both countries in understanding the capabilities and organization of each other’s civil space agencies, and it continues today on the ISS.

As China grows as a space power, U.S. cooperation in selected civil space projects could be one of the best ways to understand the goals and capabilities of the Chinese space agency. Moreover, it would establish avenues of communication and trust between the two nations that could be mutually beneficial in the future. The Wolf Amendment’s statutory exclusion of U.S. – Chinese bilateral cooperation in space has only incentivized China to accelerate its space development programs, creating a serious challenger to U.S. leadership in this vital domain of exploration. History has shown that when the U.S. cooperates with foreign competitors in civil space projects, it enhances NASA’s leadership role. The Wolf Amendment has neither discouraged Chinese space ambitions or altered China’s behavior on human rights—it has only muddled our relationship with China and created an opening for a challenger to NASA’s leadership role in space exploration. The provisions of the Wolf Amendment are not needed to protect technology transfer and only serve to stifle mutually beneficial cooperation for science and exploration. It is time to stop howling at the thought of cooperating with China for exploration missions to the Moon and revise the Wolf Amendment.

#### 2] Doesn’t say Private forecloses opportunities – the only difference is Commercial Space Stations have paid customers from governments BUT that’s non-unique since Governments already pay to get to Space – the US literally pays Russia to get to the ISS – doesn’t stop multilateralism.

#### AT Zarkadakis - They haven’t read an I/L to Space Colonization – we’ll hijack it - ISS funding trades off with private sector funding — key to colonization.

Irene **Klotz ’17**, 3/22/17, “Congress Mulls Options for Space Station Beyond 2024,” *Space,* <https://www.space.com/36179-congress-international-space-station-beyond-2024.html>] KS

The United States' ability to send astronauts to Mars in the mid-2030s depends in part on cutting back or ending government funding for the International Space Station (ISS) after 2024, the head of a congressional subcommittee that oversees NASA said Wednesday (March 22).

"We ought to be aware that remaining on the ISS [after 2024] will come at a cost," U.S. Rep. Brian Babin, a Texas Republican who chairs the House Science and Technology's Subcommittee on Space, said during a hearing about options and impacts for station operations beyond 2024.

"Tax dollars spent on the ISS will not be spent on destinations beyond low Earth orbit, including the moon and Mars," Babin said. "What opportunities will we miss if we maintain the status quo?" In Pictures: NASA's Vision for a Crewed Mars Base]

NASA currently spends about $3.5 billion a year on the space station program, including about $1.7 billion to transport crews and cargo, between $700 million and $800 million on research, and $1 billion on operations. An additional $1 billion comes from station partners Russia, Europe, Japan and Canada, NASA Associate Administrator Bill Gerstenmaier told the committee.

NASA's space station budget makes up roughly half of the agency's total spending on human space exploration programs, with the development of the Space Launch System (SLS) heavy-lift rocket and the Orion deep-space capsule accounting for most of the rest. The SLS and Orion costs are expected to continue at about the same levels beyond development and into manufacturing and operations, with a projected flight rate of about one per year beginning around 2023.

Gerstenmaier, who oversees NASA's human exploration programs, urged Congress to plan a smooth transition from the station to beyond-low-Earth-orbit initiatives, with an eye on preserving U.S. leadership in space, especially with China planning to launch a new space station in 2023.

A clear path forward also would allow NASA to better leverage the remaining time for station research and commercial initiatives, other participants in Wednesday's hearing said.

#### AT Davenport –

#### Answering Private Stations Bad – 1] We flip U/Q for “Unproven” since we obviously haven’t built one BUT the ISS is falling so there isn’t an alternative and 2] “Decades away” is power-tagged – it says “years” which matters because we have 6 years until the ISS is ending meaning this isn’t offense.

#### Won’t take Decades – they re-purpose useful ISS infrastructure – your 1AC Evidence

1AC Heilwell 12/03 Rebecca Heilweil, Updated 12-03-2021, "NASA gave Jeff Bezos money to build his office park in space", Vox, https://www.vox.com/recode/2021/10/27/22747509/blue-origin-orbital-reef-office-park-bezos, (Reporter for Open Sourced, covering emerging technologies, artificial intelligence, and logistics) //Miller

After more than two decades in orbit, NASA is preparing to retire the International Space Station. The habitable satellite only has permission to operate until 2024, and while it’s likely that the space station’s funding could be extended until 2028, NASA plans to decommission the ISS and find a replacement by the end of the decade. Cue Jeff Bezos. The billionaire’s spaceflight company, Blue Origin, has proposed a new commercial space station called Orbital Reef, which would provide a “mixed use business park” in space. This concept now has the support of NASA. The agency announced on Thursday that it would award Blue Origin and its partner companies $130 million to develop the space station, which NASA hopes will launch before 2030. With the help of several other companies, including Sierra Space and Boeing, Blue Origin plans to build a satellite that’s slightly smaller than the ISS and houses up to 10 people. The design includes desk space, computers, laboratories, a garden, and 3D printers. The goal, the company says, is to lease out office space to interested parties, including government agencies, researchers, tourism companies, and even movie production crews. Blue Origin’s plan is predicated on the idea that the end is coming for the ISS, which NASA is still figuring out how exactly to remove from orbit. While space stations have been helpful for space exploration, Blue Origin senior vice president Brent Sherwood argued in an October op-ed that private companies now have the capabilities to take over much of the burgeoning economy in low-Earth orbit, or LEO. Blue Origin is even building a space tug, a transport vehicle that moves cargo between different orbits, that could reportedly be used to salvage parts from the ISS and incorporate them into Orbital Reef’s systems. NASA doesn’t mind the corporate takeover of low-Earth orbit. The agency’s first space station, SkyLab, was only in orbit for a few months before NASA let the vehicle descend and decompose into the atmosphere. The space agency has been weighing defunding the ISS, which is full of aging hardware, for several years, and NASA’s investment in Orbital Reef is part of more than $400 million in funding that the agency has set aside to develop new, privately built and operated space stations through its Commercial LEO Destinations program. Eventually, NASA hopes that it can send its astronauts to these stations instead of paying to maintain the ISS. Overall, the plan could save the government more than $1 billion every year. “This is technology that is over 20 years old at this point. When you expose that infrastructure to radiation, solar weather ... things are going to break down,” Wendy Whitman Cobb, a professor at the US Air Force’s School of Air and Space Studies, told Recode. “Having these commercial space stations will be a way of America keeping their foot in low-Earth orbit while focusing more of their resources on moon and Mars exploration.” In the meantime, NASA is currently focusing on the Artemis program, an ambitious plan to establish a long-term human presence on the moon. The agency intends to send people to the moon for the first time in decades as soon as 2025, and hopes the project will eventually serve as a stepping stone to future exploration of Mars. Private companies, including Blue Origin, have desperately fought for a role in this prestigious mission, and especially a lucrative contract to develop pivotal moon landing technology. SpaceX won that contract earlier this year, prompting Bezos’s company to sue NASA and lobby the Senate to reverse the decision. Those efforts have yet to bear fruit, so Bezos now seems to be turning his attention back to the low-Earth orbit economy, where there are more customers and less competition from Elon Musk. “Most, if not all, of the problems or the challenges that need to be worked to have a commercial LEO destination have already been solved by the International Space Station program,” Sherwood, of Blue Origin, said in a Thursday press conference. “That’s the explanation for why we can develop a commercial space station for so much less than it cost NASA the first time.” But there’s reason to believe that the Orbital Reef project may not succeed in the near future — or at all. Blue Origin still hasn’t launched humans into orbit, a feat SpaceX achieved last month during the Inspiration4 mission. Blue Origin also lists its New Glenn reusable launch system and Boeing’s Starliner crew vehicle as pivotal parts of the Orbital Reef plan, but both vehicles have yet to conduct a problem-free spaceflight. Blue Origin isn’t the only company vying to replace the ISS. NASA has also awarded funding to two other space station concepts, which were selected from 11 proposals sent to the agency’s Commercial LEO Destinations program. NASA awarded $160 million to a company called Nanoracks, which is developing a space station called Starlab in partnership with its majority owner Voyager Space and Lockheed Martin. Starlab will house up to four people at any one time, and will include a specialized research laboratory. Northrop Grumman, an aerospace company that frequently collaborates with NASA, will also receive $125.6 million to develop its space station concept, which is designed to house four astronauts and last at least 15 years. At the same time, NASA has already agreed to pay the space company Axiom Space $140 million to help build at least one module, or detachable space station component, that will be conjoined to the ISS. That module will eventually be spun out and attached to several other modules to form a separate, fully functional space station when the ISS winds down operations. That approach is supposed to make it easier to transfer the hardware that’s currently aboard the ISS onto a new vehicle. A NASA spokesperson has described the current moment as “a renaissance for human spaceflight.” In an October statement, the spokesperson said, “As more people fly to space and do more things during their spaceflights, it attracts even more people to do more activities in low-Earth orbit and reflects the growing market we envisioned when we began NASA’s Commercial Crew Program 10 years ago.” For NASA, it’s also critical that at least one of these companies succeeds, and it’s possible that more than one is ultimately launched into orbit. After all, time is running out on the ISS, where malfunctions and outdated technology and equipment are common. Without private companies stepping in to build an alternative, the US government risks a future where it has a human presence on the moon and Earth, and nowhere in the middle.

#### They say ISS resiliency

#### 1] ISS failure inevitable.

Foust 21 Jeff Foust 12-1-2021 "NASA inspector general warns of space station gap" <https://spacenews.com/nasa-inspector-general-warns-of-space-station-gap/> (Jeff Foust writes about space policy, commercial space, and related topics for SpaceNews. He earned a Ph.D. in planetary sciences from the Massachusetts Institute of Technology and a bachelor’s degree with honors in geophysics and planetary science from the California Institute of Technology.)//Elmer

WASHINGTON — Concerns about the long-term viability of some existing International Space Station modules and the potential of delays in development of commercial space stations heighten the risk of a gap in low Earth orbit destinations, a new report warns. The Nov. 30 report by NASA’s Office of Inspector General (OIG) said that any gap in LEO destinations between the retirement of the ISS and beginning of operation of commercial stations would heighten risk for future human missions beyond Earth orbit by halting research and threaten the collapse of the LEO commercial space economy. NASA’s current plans call for operating the ISS through the end of the decade, pending a formal authorization from Congress and approvals from international partners. At the same time, NASA is working to support development of commercial stations with the goal of having at least one in service in 2028, enabling a two-year transition before the ISS is retired. One threat to that schedule, the report concluded, is the health of the ISS itself. It noted in particular air leaks in the Zvezda service module, the third-oldest module and in orbit since 2000. Those leaks were first detected in September 2019 and, at one point, caused the rate of air loss on the station to increase by a factor of five to 1.35 kilograms per day. Those leaks were traced to a transfer tunnel between the module and a docking port, but repair work to seal a crack found there did not solve the problem, with the air loss rate still double the baseline rate of about 0.27 kilograms per day. “This elevated rate suggests that additional undiscovered leaks may still exist in the Service Module Transfer Tunnel,” the OIG report concluded. While efforts to locate the source of the leaks in that module continue, the report said that the cause of the cracks remains unclear, other than that impacts by micrometeoroids and orbital debris had been ruled out. “Potential causes of the cracks and leaks being explored include fatigue, internal damage, external damage, and material defects,” it stated. Those cracks are in a “low stress part” of the module, the report added, heightening concerns. “Notably, based on the models and design mission dynamic loads NASA used to characterize the structure, the cracks should not have occurred,” the OIG stated. “NASA engineers are also reviewing whether the analysis of other segments may need to be updated based on these observations because until the root cause of the cracks is identified the situation raises potential implications for the Station’s long-term structural health.” In an agency response included in the report, Kathy Lueders, NASA associate administrator for space operations, said that NASA and Roscosmos are continuing to study the cracks, including work on the station itself as well as ground-based testing. Preliminary results of that investigation should be done by the end of March, she said. At worst, that tunnel could be sealed off, halting the overall loss of air but also losing access to that docking port. Lueders said with that work to address the Zvezda air leak, “NASA is confident in moving forward with plans to extend the ISS, noting that we will continue to monitor and evaluate ISS health as we go forward.” The OIG report also raised questions about the ability of commercial stations to be ready by the end of the decade. NASA’s LEO commercialization efforts “show promise,” the report said, but highlighted issues about the viability of commercial markets for such stations, costs to develop those facilities, uncertain NASA funding, schedules and requirements. The report was particularly skeptical about schedules. “In our judgment, even if early design maturation is achieved in 2025 — a challenging prospect in itself — a commercial platform is not likely to be ready until well after 2030,” it stated, noting it took eight years for the commercial crew program to go from early design maturation to first crewed flight. “We found that commercial partners agree that NASA’s current timeframe to design and build a human-rated destination platform is unrealistic.” That means further extensions of the ISS beyond 2030 may be needed to avoid a gap, assuming the station is technically able to continue operations into the next decade. “However, the Agency faces significant challenges with executing its commercialization plan by 2028 or even 2030 — meaning that without further extension of the ISS, a gap in availability of a low Earth orbit destination is likely,” the report concluded.

#### 2] Leaks make failure likely now rather than later – independently means countries leave wrecking Multilat.

BBC 21 9-1-2021 "International Space Station facing irreparable failures, Russia warns" [https://www.bbc.com/news/world-europe-58408911#:~:text=International%20Space%20Station%20facing%20irreparable%20failures%2C%20Russia%20warns,-1%20September%202021&text=The%20International%20Space%20Station%20(ISS,a%20Russian%20official%20has%20warned.&text=Russia%20has%20often%20raised%20concerns,leave%20the%20ISS%20after%202025](https://www.bbc.com/news/world-europe-58408911#:~:text=International%20Space%20Station%20facing%20irreparable%20failures%2C%20Russia%20warns,-1%20September%202021&text=The%20International%20Space%20Station%20(ISS,a%20Russian%20official%20has%20warned.&text=Russia%20has%20often%20raised%20concerns,leav). //Elmer

The International Space Station (ISS) could suffer "irreparable" failures due to outdated equipment and hardware, a Russian official has warned. At least 80 percent of in-flight systems on the Russian segment of the ISS had passed their expiry date, Vladimir Solovyov told state media. He also said small cracks had been discovered that could worsen over time. Russia has often raised concerns over hardware and has suggested it could leave the ISS after 2025. The station was built in 1998 as part of a joint project between Russia, America, Canada, Japan and several European countries and was originally designed for a 15-year lifespan. Mr Solovyov, the chief engineer at the space company Energia, which is the leading developer of Russia's section of the ISS, said: "Literally a day after the [in-flight] systems are fully exhausted, irreparable failures may begin." He warned last year that much of the equipment on the station was starting to age and would soon need to be replaced. The former cosmonaut also announced that "superficial" cracks had been discovered on Russia's Zarya cargo module. Launched in 1998, it is one of the oldest modules of the ISS and is now primarily used for storage. "This is bad and suggests that the fissures will begin to spread over time," Mr Solovyov told the RIA news agency. In April, Russia's Deputy Prime Minister Yuri Borisov told state TV that aging metal on the station could "lead to irreversible consequences - to catastrophe. We mustn't let that happen". And Roscosmos, the Russian space agency, said last year that structural fatigue meant the ISS would not be capable of operating beyond 2030.

#### 3] The Line about “Good years Left” is citing the Boeing ISS Manager who is the contractor for the ISS - obviously biased.

#### Private Companies are key to build Space Stations – only they have money and capabilities to both build and beat the end of the ISS.

Davenport 1-21 Christian Davenport 1-21-2022 "NASA Looks to Private Sector for Successor to the International Space Station" <https://www.wilsoncenter.org/article/nasa-looks-private-sector-successor-international-space-station> (Former Public Policy Scholar)//Elmer

For more than 20 years, the ISS has served as a continuously inhabited foothold in low Earth orbit, a way for space agencies around the world to study how humans live off the Earth for extended periods. A total of 19 countries have sent astronauts there, binding them into an international consortium that has transcended politics and the geopolitical tensions that have roiled relationships on Earth. To build the ISS, the United States and Russia combined forces with Canada, Japan and the European Union. The program has been such a profound tool of diplomacy, as well as science and engineering, that many in the space community think it should be awarded the Nobel Peace Prize. At the very least, they think the life of the ISS should be extended. And late last year, the White House backed NASA’s plan to keep the ISS operating to 2030. But it’s not clear that that the station will last that long. In recent years, it has sprung a series of leaks and has been rattled by errant thruster firings that have sent it spinning wildly. Despite its incredible durability, it cannot survive in the harsh vacuum of space forever. The extreme hot and cold temperatures take their toll. So do the bits of micrometeorite debris that the space station dodges a few times a year and occasionally gets hit. At some point, it will reach the end of its life, and NASA and its partners will be forced to coordinate its demise by deorbiting it to Earth and crashing it into the ocean. Knowing that day may soon come, NASA is racing to find its successor. But the space agency won’t be building it. After investing billions of dollars into the ISS, NASA cannot afford to build another space station in Earth orbit, especially as it is embarking on an effort to return humans to the moon, under a program called Artemis. Instead, it is looking to the private sector to develop next-generation habitats that would be owned and operated by the companies, not NASA. The space agency has recently taken the first major steps in that direction, reaching an agreement with Axiom Space, a Houston-based company that has hired Starck, to send a module of its space station to attach to the ISS as a test bed as soon as 2024. Late last year, NASA awarded contracts to develop commercial space stations, worth $415.6 million combined, to Jeff Bezos’ Blue Origin, Nanoracks, which helps companies fly science experiments and other payloads to the ISS, and Northrop Grumman, the longtime defense contractor. The contracts are yet another sign that NASA is willing to place enormous bets on the growing commercial space industry, which has been eroding governments’ long-held monopoly on space activity. Driven by the investments and ambitions of the so-called “space barons,” Elon Musk, Jeff Bezos and Richard Branson, who have invested heavily into their space ventures, the industry has taken off. Musk’s SpaceX in particular has demonstrated the commercial ventures can be successful and help bolster NASA. For years SpaceX has flown cargo and supplies for the space agency to the ISS. NASA has expanded that public-private partnership, allowing SpaceX to fly its most precious resources—its astronauts—to the space station as well. The company also recently won a $3 billion contract to develop the spacecraft that would ferry astronauts to and from the surface of the moon. NASA is now extending this relatively new model to space stations, hoping the private sector can take on an even greater task—building destinations in space—that presents a host of even greater challenges. And it comes as some are warning that unless NASA and its partners can build the stations quickly, it could be faced with the ignominious prospect of the ISS retiring before its successor is ready. That would leave the United States with nowhere to send its astronauts, a problem exacerbated by the fact that China has started to build a station of its own. “I think it would be a tragedy if, after all of this time and all of this effort, we were to abandon low Earth orbit and cede that territory,” former NASA Administrator Jim Bridenstine told a Senate panel in 2020. The cost of a new space station is enormous. And so are the technical and engineering hurdles. Keeping people alive and healthy in space requires enormous vigilance: making sure they have enough to eat and drink; that they get along and don’t kill each other; that they don’t get hit by a micrometeorite; that they can communicate reliably to people on the ground; that they can handle sickness or injury on their own; or repair any number of problems for extended periods. It is such a daunting task that it’s something of a miracle that after more than two decades there has not been any major incidents on the ISS. Whether the private sector can build commercial stations and operate them safely, then, remains to be seen. And if it can’t do that before the ISS finally reaches the end of its life, NASA would have a gap that would be even more severe than the period after the Space Shuttle was retired in 2011 with no alternative to launch its astronauts from United States soil. Instead, Russia flew NASA’ astronauts to the ISS, and charged a hefty price for the service, nearly $90 million a seat, before SpaceX restored human spaceflight for NASA in 2020. “ISS won’t last forever & incentivizing the private sector to begin follow-on capabilities are needed now,” Lori Garver, who served as NASA deputy administrator in the Obama administration, warned on Twitter in 2020. “This concept isn’t hard. Have we learned nothing in the last 10 years?”

#### AT Mason – Listen they have NO I/L to Multilat – if I win this arg, then the entire Case goes away since their only Impact Scenario is Multilat – the Aff says ISS solves Mulitlat now BUT 1AC Mason is about the need for newer, more robust multilateralism efforts – its prescriptive NOT descriptive – here’s a re-cutting.

Mason 21 [Paul, author of several books, and a visiting professor at the University of Wolverhampton, “How to halt the space arms race”, 11-17-2021, New Statesman, [https://www.newstatesman.com/comment/2021/11/how-to-halt-the-space-arms-race]//pranav//re-cut](https://www.newstatesman.com/comment/2021/11/how-to-halt-the-space-arms-race%5d//pranav//re-cut) by Elmer

Could space be demilitarised? Not a chance, say the experts, who point out that – in contrast to the space exploration of the popular imagination, where it is still seen as a benign, trans-national endeavour – the entire history of space technology, from the Nazi V2 rocket to the recent Russian anti-satellite strike, has been driven by the military. Yet military activity in space could be made more orderly and transparent. The two most authoritative annual reports on military space capabilities are both reliant on open-source information and acknowledge that there are huge gaps in what even the experts know. We know how many satellites are up there: we do not know much about what weapons they might carry. This stands in contrast to the way the rival superpowers have managed both nuclear and conventional deterrence since the onset of the Cold War, with a series of treaties signed by Russia and the West to minimise or regulate aggression – for example, limiting the possession of nuclear weapons or the deployment of armoured vehicles. But there is almost no such framework for regulating the space arms race, or for achieving basic transparency about who’s doing what, still less for avoiding conflict. US and Russian space commanders convened in Vienna last July, agreeing to “enhance communications between the two countries about space-related operational issues in order to reduce the risks of misunderstanding, help prevent or manage space-related incidents, and prevent inadvertent escalation”. This did not stop Russia’s surprise launch of an anti-satellite missile on 15 November, nor did it avert the war of words that followed it. In truth the US-Russia space dialogue, a hangover from the Cold War, is a long way from the multilateral and comprehensive framework needed to bring China, India, Israel and Iran around the table. Lacking any formal international treaty beyond the anti-nuclear one, space has, in effect, become a demonstration zone for geopolitical realism. Those who have real power on Earth have untrammelled power in space. They will zap their own satellites at will, buzz the satellites of others, launch “projectiles” from existing satellites – as Russia allegedly did last year – and unleash spoofing attacks to disorient civilian shipping, all without acknowledgement or explanation. The emerging field of space war looks, in other words, exactly like terrestrial conflict would if there were no treaties and deployment patterns, or journalists and NGOs to observe them. This year the UK launched its own space command, with military chiefs acknowledging space as a domain of conflict co-equal with air, land, sea and cyber. Britain is late to the space war game and, after years of offshoring and outsourcing, lacks the expertise and resources to compete with the big four space powers: it doesn’t figure in either of the monitoring reports on space militarisation documenting significant offensive capabilities. As a medium-sized power, self-excluded from large parts of the EU’s space programmes, it is in Britain’s interest to promote order, multilateralism and transparency in space, and to resist its further militarisation. And, to an extent, haltingly, it has done so, promoting the first real debate at the UN over a new space treaty.

#### Multilat in Space fails:

#### 1] Different Priorities

Hitchens 15 (Theresa Hitchens is a senior research scholar at the Center for International and Security Studies in the School of Public Policy at the University of Maryland, where she focuses on space security, cyber security, and governance issues surrounding disruptive technologies. Prior to joining CISSM, Hitchens was the director of the United Nations Institute for Disarmament Research (UNIDIR) in Geneva from 2009 through 2014. “Forwarding Multilateral Space Governance: Next Steps for the International Community.” CISSM Working Paper, August 2015. https://drum.lib.umd.edu/bitstream/handle/1903/19733/ForwardingMultilateralSpaceGovernance%20-%20080615.pdf?sequence=1&isAllowed=y)

As the number and diversity of space actors grows, the challenges to multilateral approaches to space governance are increasing. Established space powers have different priorities than do emerging space powers; military space powers have fundamentally conflicting goals (i.e. to do harm to each other if considered necessary) and different understandings of their legal constraints; and capacity to uphold international legal and political commitments varies widely. While there is widespread (if not universal) agreement on the problems facing the space domain, there is not consensus on what should be done or what should be done first. The explosion in the number of commercial space actors—who have less stake in (indeed even some antipathy to) current or future governance regimes—complicates interactions between states. A growing commercial presence will require states to put in place new or modified national laws, policies, and regulatory regimes to ensure against chaos. The priorities of commercial actors—such as would-be asteroid mining ventures and micro-sat operators—are already forcing states to re-examine existing regulatory and legal regimes (both national and multilateral) with an eye to potential adaptation. The stovepiped nature of multilateral fora and their sometimes-conflicting priorities and needs complicate addressing these challenges, which are by and large cross-cutting. Certain issues fall through the cracks, and others are debated through such a narrow lens that discussions fail to take into account potential second-order or cross-sectoral consequences. This is apparent, for example, in the Cold War-created mandates of COPUOS and the Conference on Disarmament, which seek to create a separation from issues of peaceful uses of space and military ones— despite the fact that those uses and functions have largely converged. Private and civil sector actors are also largely absent from these fora (with the exception of the ITU). Instead, these actors have sought and gained influence directly with their national governments regarding legal and regulatory regimes to support their own priorities, which may not coincide with international security needs. These factors in part account for the international community’s current focus on voluntary measures, norms of behavior, and transparency and confidence-building measures. The current environment is simply not ripe for the pursuit of legally binding treaties, nor, given the uptick in tensions among the three major space powers—China, Russia, and the United States—is it likely to be any time soon. Despite these growing tensions, there are still steps that states or groups of states could—and should—take to move toward improved multilateral governance of outer space activities. The first should be endorsing and enacting the already-agreed-upon recommendations of the UN GGE on transparency and confidence-building. Transparency and confidence-building measures are likely to be necessary precursors to an eventual multilateral accord. Unilateral actions by States would also create forward momentum and establish the foundation for future multilateral agreements. The joint meeting of the UNGA’s First and Fourth Committees (slated for October 2015) provides an opportunity for states to propose additional or follow-on initiatives. For starters, they could initiate a review of the implementation of the current space regime. States could commit to developing lists of contacts and focal points for space governance issues, in order to underpin transparency and provide avenues for discussion when worrisome situations arise. States can also commit to improving compliance with the Registry Convention, especially major space-faring states who have little excuse for failing in their obligations. The registry could also be expanded, or an ad hoc process could be developed, to broaden notification of specific space activities such as pre-launch notifications and notification of satellite maneuvers.

#### 2] Free-riding

Knopf 18 - professor at the Middlebury Institute of International Studies at Monterey, chair of the M.A. program in Nonproliferation and Terrorism Studies (Jeffrey, After diffusion: Challenges to enforcing nonproliferation and disarmament norms, *Contemporary Security Policy*, Vol. 39, Issue 3, February 9th, pages 367-398)

A second challenge that **complicates efforts to enforce** international **norms** is the well-known **collective action problem** (Olson, 1965). In many cases, effective enforcement will require the participation of more than one actor. Unless one state has unusual economic leverage, for example, economic sanctions usually **require multilateral enforcement** to be effective. Otherwise, the target state can evade sanctions by trading with those states that choose not to participate in the sanctions effort. **Even military enforcement** often **depends on** the involvement of **multiple states**. Take the U.S.-led invasion of Iraq in 2003 for example. Although often seen as a case of U.S. unilateralism, this is not entirely accurate. The United States relied on earlier UN Security Council resolutions for legal justification, so at minimum the United States needed other members of the Security Council to have voted in favor of relevant resolutions. It also sought a so-called second resolution that would have explicitly authorized the use of force, and the U.S. failure to obtain Security Council passage of this authorization reduced international support for the U.S.-led operation (Thompson, 2009). In addition, the United States sought to enlist other partners in the “coalition of the willing” that conducted the military operation. The United States could have gone it alone if it chose to, but it clearly had a strong preference to obtain as much legitimacy as it could from the presence of coalition partners. In short, effective unilateral enforcement is likely to be **rare**; norm enforcement will typically be more effective as a multilateral enterprise. **Multilateral cooperation is not automatic** however. By the familiar logic of collective action, states will be tempted to **free ride** on the enforcement efforts of others. As long as others enforce the nonproliferation or disarmament norm in question, free riders still enjoy the benefits. But free riders do not have to pay the costs of enforcement, in trade forgone, in diplomatic frictions with the target or its friends, or in potential casualties should military force come into play. If all states give in to the temptation to free ride, however, then **effective enforcement will not happen.** In some cases, a lack of participation in collective action may arise less from states deliberately free riding than from a **lack of consensus** about whether or not a particular state is actually violating a particular norm. There can be ambiguity about the standards for ascertaining norm compliance or about the evidence of a violation. When this occurs, states can come to **different interpretations** of whether the situation even calls for an effort at enforcement (for examples involving NPT safeguards, see Goldschmidt, 2010) The end result will be similar to when free riding occurs, in that many **states will choose not to join in collective action**. The collective action problem is accentuated by **global power asymmetries**. The **U**nited **S**tates is so much more powerful than most other states, and has demonstrated such an obvious commitment to enforcing nonproliferation in certain cases, **that other states may hope that the** **U**nited **S**tates **will shoulder the entire burden** of enforcement. This creates an especially strong temptation to free ride. To the extent that the **U**nited **S**tates cannot on its own bring about **norm compliance**, however, the collective action problem will become a major barrier to enforcement of nonproliferation norms.

#### Group 1AC Ortega and Tisdall –

#### 1] Frame this thorugh U/Q – if the ISS works, then why are countries militarizing and making space forces…

#### 2] No space war – prefer data over political rhetoric

Klimas interviewing Weeden 18 [Brian Weeden, smart space guy. Is the space war threat being hyped? August 3, 2018. https://www.politico.com/story/2018/08/03/space-war-threat-hype-force-760781]

There’s been increasing rhetoric...about the militarization of space and the potential for conflicts on Earth to extend into space. That’s driven in part by reports about anti-satellite testing in Russia and China...The report really grew out of our frustration at the level of publicly available information on this topic. A lot of what you get are public statements from military leadership or politicians, or sometimes news articles talking about something and it’s really hard to get down to details and...sort through what might be real, what might be hype. Our goal was to dig into the open source material and see what we could determine from a factual standpoint was really going on -- what types of capabilities were being developed and how might they be used in a future conflict. Ultimately we hoped that would lead to a more informed debate about what U.S. strategy should be to address those threats. What sort of feedback have you gotten so far? A lot of the feedback has been either informal or private because a lot of the issues we talk about, people in the government research using classified materials. So it’s difficult for them to give detailed feedback. In general, the feedback we’ve gotten has been pretty positive. People have said they like the fact that this sort of stuff is being put in the public domain and encouraged us to continue. Were your findings better or worse than the picture public discourse paints? In general, it’s a little bit better. A lot of political rhetoric and news stories focus on the most extreme examples, so using kinetic weapons to blow up satellites. While there is research and development going on to develop those capabilities, what we found is there’s yet to be any publicly-known example of them being used. What is being used and what seems to be of the most utility are the non-kinetic things, like jamming and cyber attacks. The good news is we have yet to see the most destructive kinetic attacks that can cause really harmful long-term damage to the space environment, but unfortunately we are seeing non-kinetic attacks being used, and that’s likely to continue.

#### There isn’t an I/L to this Impact – no Mulitlat/ISS key Warrant – don’t let them spin out of no-where – Russia is literally an ISS partner which proves the ISS doesn’t solve counter-space capabilities

#### Private Space Stations solve multilateral and international agreements better while maintaining US Space dominance

Davenport 21 Justin Davenport, 10-27-2021, "Blue Origin, Sierra Space, and Boeing announce Orbital Reef", NASA Space Flight, https://www.nasaspaceflight.com/2021/10/announce-orbital-reef/, (Writer for NASA Spaceflight. Focuses on astronomy, model building, and aviation) //Miller

Amid a year of momentous developments in commercial spaceflight, including the all-civilian Inspiration4 mission and the first feature film to be shot in space, a consortium led by Blue Origin and Sierra Space has announced a commercial space station project known as Orbital Reef. The project is billed as a “mixed-use business park” that would use a 500-kilometer altitude orbit inclined 51.6 degrees to the equator. The orbital altitude would be higher than that of the International Space Station, and the inclination would be the same as the ISS, allowing the project to use a Blue Origin-built space tug to collect usable ISS resources for Orbital Reef. This inclination would take Orbital Reef over most of the world, including launch sites in the United States, Kazakhstan, China, Japan, India, and South America.Orbital Reef’s elements are planned to be launched by the New Glenn rocket currently being developed by Blue Origin, while the Boeing Starliner is planned to provide crew transportation services to the station. Sierra Space is planned to provide node and LIFE ((Large Integrated Flexible Environment) modules as well as the Dream Chaser spacecraft for cargo and crew transport. Boeing not only would be tasked with providing Starliner for crew transportation but also science modules and station operations and maintenance. Jacksonville, Florida-based Redwire Space, a contractor that has provided sensors and components for many missions, is tasked with providing deployable structures, payload operations, and microgravity research support. Genesis Engineering Solutions, a company based in Lanham, Maryland, is planning on developing the Single Person Spacecraft, a spacecraft designed to accommodate a single human being in a shirt-sleeve environment, supplanting traditional spacesuits for station servicing and tourist excursions away from Orbital Reef. Genesis does have experience with avionics and other components for space missions. Arizona State University in Tempe, Arizona is leading a consortium of 14 universities that would provide research advisory services and public outreach. Vice president of the ASU Interplanetary Initiative and Psyche mission principal investigator Lindy Elkins-Tanton stated, “ASU’s going to bring together this international group of 14 universities to work with Orbital Reef on the ethics and guidelines of research on how they can bridge all of our expertise.” Initial CGI impressions of the Orbital Reef station show three core modules containing large windows and docking ports, with a Dream Chaser and multiple Boeing Starliners docked, along with six additional modules for science or other purposes attached to the sides of the station core. A truss with four radiators is mounted on the underside of the station core, along with eight pairs of large solar panels similar in appearance to the iROSA arrays recently installed on the ISS. The Orbital Reef is planned to start operations in the second half of this decade, though it remains to be seen exactly when the first element launch would occur, as the New Glenn, Starliner, and Dream Chaser programs have all encountered significant delays. The station design will no doubt be continuously evaluated as the project progresses, with elements like the large core module windows and add-on inflatable modules needing to be designed to survive the debris environment in low Earth orbit. The Orbital Reef, in its fully built-up configuration, will feature a living and working space containing 90 percent of the internal volume of the International Space Station (830 cubic meters) as well as a crew of ten. Planned uses for this station include space tourism, manufacturing, and microgravity research. Orbital Reef is also pitched as a location where countries and companies that want to start a presence in space can send experiments, facilities, or people. Industries that have not really had a presence in space are being targeted as potential users. NASA is planned to be the anchor tenant, but Orbital Reef is envisioned to be opened to many users. International involvement is strongly emphasized in the station’s marketing, and the project aspires to make the station accessible to all nations. However, space law was not really designed for commercial operations, and legal as well as financial issues are expected to be more difficult for the project to overcome than engineering hurdles, according to Redwire Space’s Mike Gold, who remarked on this at the 2021 International Astronautics Congress in Dubai. The Orbital Reef is the latest commercial space station to be announced, joining the Axiom and Nanoracks/Lockheed Martin offerings. Sierra Space would be using its involvement in Orbital Reef in lieu of its earlier independent station offering, as per remarks made at the IAC in Dubai. Sierra Space’s president Janet Kavandi, a former shuttle astronaut, also stated that Sierra Space wanted NASA to have a station to use when the ISS is retired. The Orbital Reef project gives Starliner and Dream Chaser potential business outside NASA crew and cargo contracts, once these systems become operational and if the Orbital Reef comes to fruition. New Glenn is also planned to be compatible with the Starliner and Dream Chaser spacecraft, although no plans by Boeing nor Sierra Space have indicated New Glenn as a planned launcher for either vehicle. The International Space Station is currently scheduled to retire by 2028, though that retirement date is under evaluation. As it approaches, the commercial sector is beginning to work on follow-on stations that would allow the United States to continue a permanent human presence in space for its astronauts, as well as to continue the scientific research that has been taking place aboard ISS. One or more of these stations could take flight in the latter half of this decade.

#### The ISS shreds Dominance – Russia pockets Cooperation to sustain itself as a revisionist space power.

Dinerman 14 [Taylor Dinerman, writer for The National Review, April 15, 2014. “The U.S. and Russia: No Better Together in Space Than on Land.” https://www.nationalreview.com/2014/04/us-and-russia-no-better-together-space-land-taylor-dinerman/]

As the crisis in Ukraine drags on, it becomes more and more evident that Vladimir Putin intends to grab as much of Stalin’s old empire as possible. In spite of the 2009 “reset” and all the Obama administration’s efforts to appease the ruler of the Kremlin, Putin and his team really are America’s worst “geopolitical enemy,” as Mitt Romney explained during the 2012 campaign. One of the most sensitive aspects of the Russia–U.S. relationship — the one concerning what the two countries launch into space — is being urgently reexamined in Washington and throughout the U.S. space industry. Today, Russia, with its Soyuz rocket-and-capsule combination, has total control over human access to the International Space Station (ISS), and unless plans change that will remain the case until at least 2017. The U.S. relies on Russian space technology in other important ways as well. Carrying on without Russian cooperation is an unpleasant prospect for NASA, for our military, and for our space industry. But our political, military, and space-industry leaders need to start examining their options without delay. Almost from the beginning of the Space Age, shortly after the Soviet launch of Sputnik in October 1957, some Americans (especially liberals) promulgated the idea that the U.S. and the USSR should cooperate rather than compete in the realm of space exploration. In creating NASA as a civilian agency, Eisenhower wanted to avoid giving the impression that the U.S. was in a “space race” with the USSR, while at the same time forging ahead with his No. 1 priority, the world’s first spy satellite, the Corona. This program completed its first successful mission in the summer of 1960, at the same time that JFK and the Democrats were complaining about the “missile gap.” The Corona failed to see any of the hundreds of missile bases that the Democrats claimed existed. After winning the 1960 election, Kennedy made the first major gesture toward space cooperation with the Soviet Union when he wrote to Khrushchev, in March of 1962, that “the exploration of space is a broad and varied activity and the possibilities for cooperation are many.” The president proposed cooperation in weather satellites, earth-science satellites, communications satellites, and unmanned probes to the moon, Mars, and Venus. Khrushchev wrote back — accepting the idea but adding, ominously, “Both you and we know, Mr. President, that the principles for designing and producing military rockets and space rockets are the same.” No one in Moscow is ever likely to forget that truth. All of Russia’s space activities are carried out with an eye to their military and politico-military value. Americans, by contrast, often seem to regard space operations as a type of international psychotherapy. This was most famously on display when, in 2010, NASA Administrator Charles Bolden claimed that one of the most important missions he had been given by President Obama was to make Muslims feel good about themselves. During the era of “détente” in the 1970s, the Nixon administration, which had little interest in space, promoted the 1975 Apollo–Soyuz mission, a handshake in space that did little other than to emphasize that the U.S. was no longer in the moon-rocket business. That mission was the last time any of the hardware built for the moon race flew into space. While the U.S. pursued the Space Shuttle, largely because of Nixon’s supposed reluctance to “be the president who grounded the astronauts,” Russia continued to build a series of Salyut orbital outposts, one of which was equipped with a 23mm automatic cannon, which, according to space legend, was fired once, with nearly disastrous effect. The possibly apocryphal story is that the recoil from the cannon caused the whole station to do a backflip in orbit. NASA, meanwhile, had wanted its own space station since shortly after its founding in 1958. Between May 1973 and February 1974, Skylab, a station cobbled together from surplus Apollo hardware, was manned by three-astronaut crews. Then it was abandoned, and in 1979 it was destroyed as it crashed to Earth uncontrolled. However, NASA and its political and industrial allies did not give up. After the shuttle’s first flight in 1981, NASA set to work convincing Ronald Reagan to support a space-station program. In 1984 it succeeded, and with a classic Reagan quip to the cabinet about Queen Isabella (who, the story has it, hocked her jewels to fund Christopher Columbus’s trip to America), he authorized the venture. President Reagan invited America’s friends and allies to join the program, which was called “Space Station Freedom.” NASA, moving at the speed of government, had accomplished nothing other than a set of design studies by 1993, when Bill Clinton was inaugurated. Under pressure from the New York Times, which was on a jihad against so-called “big science,” Clinton canceled the Superconducting Super Collider, which was then being built in Texas, and he nearly canceled the space station. But with his usual sharp political instincts, President Clinton realized the space program had more supporters than particle physics, and that, in any case, he didn’t have much to fear from the physicists: They would, on the whole, burn Isaac Newtons’ and Albert Einsteins’ collected works in a bonfire in Harvard Yard before they would vote Republican. So he killed their program and kept NASA’s space station. At the same time, in order to satisfy his liberal base, he recast the space station as “outreach” to Russia. #page#Space Station Freedom was dead and buried, and in its place Clinton ordered NASA to work with Russia to build the International Space Station. NASA also agreed to fly a number of shuttle missions to the existing Russian orbital station Mir (the Russian word both for “world” and for “peace”). The first shuttle flight to Mir arrived in July 1995 and the final one in June 1998. All this was accompanied by large dollops of U.S. money, some of which disappeared into the pockets of various Russian officials. Many Americans actually believed that it was somehow helpful to treat Russia as an equal in space while paying its space professionals to remain engaged in theoretically civil space programs. The condescending U.S. and Western attitude toward ex-Soviet space officials didn’t make things easy. In particular, the officials resented NASA pressure to abandon Mir and let it crash, rather than allow it to be privatized by Walt Anderson, an eccentric American libertarian tycoon. #ad#While most Russians may have been happy to drop the Communism that had impoverished their lives, they deeply and bitterly detested the loss of Moscow’s superpower status. Depending on the U.S. to keep their cherished national space program alive was galling, and this showed up in the nasty ways that the first American astronauts who trained at Star City outside Moscow were treated. It may very well be that former NASA administrator Mike Griffin was thinking of that experience in Russia when, in 2006, he said: “On many occasions since assuming my role as administrator I have been asked about opportunities for ‘partnership’ when what is really being sought is American investment in the aerospace industries of other nations. I must be clear on this; ‘partnership’ for us is not a synonym for ‘helping NASA to spend its money.’” Today, after the end of the shuttle program, and without an operational American manned-space-transport system, NASA pays Russia something like $70 million each time an American astronaut flies to the ISS onboard the Soyuz. If the U.S. has not by then built a new spacecraft to get people back and forth to the ISS, it will have to go negotiate a new deal when the current one expires at the end of 2017. Aside from the ISS, the U.S. uses Russian-made rocket engines on two of its space-launch vehicles, the Antares, built by the Orbital Sciences Corporation, and, even more importantly, the Atlas V. It’s a lesson in how internationalism and cost control can override national-security interests. After a series of failed military space launches, most notably the crash of a Titan IV with a very expensive spy satellite on board in 1998, the U.S. Air Force put in place the Evolved Expendable Launch Vehicle (EELV) program. This was designed to give the military two separate and highly reliable rockets that could carry national-security payloads into orbit without relying on the unpredictable shuttle or on dangerous existing systems. This program produced the all-American Delta IV family of launch vehicles, including the heavy rocket that is now used to put America’s biggest and most capable intelligence-gathering satellites into orbit, but it also created the Atlas V rocket, which has become the vehicle of choice for NASA’s science missions and is often used for military missions as well. However, the Atlas V relies for its effectiveness on a Russian-made RD-180 rocket engine, which is fueled by liquid oxygen and kerosene. The engine is superbly efficient, a good example of how the Russians have come to produce genuinely world-class hardware. As a precaution, the U.S. tries to keep at least two years’ worth of RD-180s on hand and has bought the rights to manufacture them domestically. Building rocket engines is, however, an art as well as a science, and the art part of manufacturing RD-180s was not transferred. According to one knowledgeable source, an American company did try to build a copy of the engine once, but it failed because of overheating. The Russians are masters of the metallurgy involved, and the U.S. has not, so far, made the effort to match their expertise. So, today, the U.S. relies on Russia for human access to the ISS and for the rocket engines for one of its most important space-launch systems. This situation is largely due to the ultimate failure of the space-shuttle program, especially the Columbia disaster of February 2003. After decades of trying to do too much with too few resources, NASA has become, at least in some ways, an old and tired organization. America does have some alternatives and could, with the right leadership, reduce its reliance on Russia. Back in the George W. Bush years, NASA implemented a program called Commercial Orbital Transportation Services (COTS). This program sought to develop a pair of vehicles that could deliver cargo and fuel to the ISS on a commercial basis, bypassing NASA’s cumbersome regulatory and bureaucratic system. This program could be the key to bringing people into space without help from Russia. Today, two companies have had notable success through COTS. SpaceX, based in California and controlled by Elon Musk, has already sent two Dragon capsules to resupply the station. Another one was scheduled to launch on a SpaceX Falcon 9 rocket yesterday, but the launch has been postponed till Friday; it might yet be further delayed. Meanwhile, Orbital Sciences, based in Virginia, has successfully launched the first of its Cygnus cargo ships from Wallops Island on an Antares rocket, and hopes to launch another one in May or June. Under a Bush-era “COTS D” plan, SpaceX hoped to sign a deal with NASA to carry people to and from the station, and the company has never lost sight of this goal. The Dragon capsule may have carried only cargo so far, but it is equipped with a porthole and will eventually be capable of carrying seven astronauts into orbit. After the Obama administration canceled NASA’s return-to-the-moon Constellation program, it reworked the COTS D idea into the current Commercial Crew Program. This program is funding the development of three manned spacecraft, the SpaceX Dragon, the Boeing CST capsule, and the Sierra Nevada mini-shuttle Dreamchaser. Of these, the Dragon is by far the furthest along. According to current plans, NASA and SpaceX hope to fly the first manned Dragon sometime in 2017. It might be possible to accelerate this program, but that would of course take money — from NASA’s already-reduced budget, from another agency, or through increased spending. Meanwhile, the Air Force will have to find the money to replicate the RD-180. This will not be easy; it is estimated that $1 billion will be needed. It would be surprising if the job could be done in less than two years. Fortunately, the SpaceX Falcon 9, which is in the process of being certified to carry national-security payloads into space, is available. It should even be cheaper than the Atlas V, through it still lacks the excellent safety and reliability of the older rocket. Shifting future Defense Department satellites from the Atlas to the Falcon can be done, but only if the decision to make the change is made soon; otherwise we will have to radically adjust our carefully planned launch program. America’s space engagement with Russia has been, like so many other foreign-policy initiatives, beset by wishful thinking and by the desire to ignore the hard facts of power politics. No party or faction in Washington comes out of this looking good: not the George H. W. Bush realists who made Moscow’s space program dependent on U.S. funds; not the policymakers from the Clinton and Bush II eras, who embedded Russia into the ISS and the EELV programs; and certainly not the current administration, which seems to be even more lost in space than its predecessors.

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