## 1

#### Xi is tightening control over the PLA but completing goals are critical.

Krishnan 21 – Ananth, 11/18/21, [‘Xi tightened control over the PLA’, TheHindu, <https://www.thehindu.com/news/international/xi-tightened-control-over-the-pla/article37549460.ece>] Justin

The new resolution on history passed last week by China’s ruling Communist Party has said that President Xi Jinping had tightened control over the military to address the party’s “obviously lacking” leadership of the armed forces under his predecessors.

The full text of the resolution, released on Tuesday evening, listed some of the actions taken by the People’s Liberation Army (PLA) under Mr. Xi, who is also the chairman of the Central Military Commission. These included what the document described as “major operations related to border defence”.

No specifics

It did not specify what those major operations were. China has unresolved land borders with India and Bhutan. In April 2020, the PLA mobilised two divisions and carried out multiple transgressions across the Line of Actual Control (LAC) in Eastern Ladakh, sparking the worst crisis along the border in many years. Talks to resolve the tensions are still on-going.

“The armed forces have remained committed to carrying out military struggles in a flexible manner to counter military provocations by external forces, and they have created a strong deterrent against separatist activities seeking ‘Taiwan independence,’” the resolution said.

“They have conducted major operations related to border defence, protecting China’s maritime rights, countering terrorism and maintaining stability, disaster rescue and relief, fighting COVID-19, peacekeeping and escort services, humanitarian assistance, and international military cooperation.”

Last week’s resolution on history was only third such document putting forth the official view on party history, following resolutions passed by Mao Zedong in 1945 and Deng Xiaoping in 1981.

The new resolution dealt more with the future than the past. It essentially reaffirmed the official view on history, saying that the “basic points and conclusions” of past resolutions “remain valid to this day.”

It repeated the conclusion reached in 1981 on Mao’s errors noting that “mistakes were made” and that “Mao Zedong’s theoretical and practical errors concerning class struggle in a socialist society became increasingly serious” leading to the disasters of the Cultural Revolution.

Criticism of predecessors

Much of the new resolution focuses on emphasising Mr. Xi’s leadership and calling for the party to support his “core” status. It only briefly mentioned Mr. Xi’s predecessors Jiang Zemin and Hu Jintao, and implicitly critcised some aspects of their leadership including on military matters.

“For a period of time, the party’s leadership over the military was obviously lacking,” it noted. “If this problem had not been completely solved, it would not only have diminished the military’s combat capacity, but also undermined the key political principle that the party commands the gun.”

The document said Mr. Xi’s leadership had tightened supervision on the military including boosting “troop training and battle preparedness”, and it repeated China’s stated goals of completing the modernisation of its armed forces by 2035 and building a “world class” military by 2050, which observers see as meaning on par with the U.S.

‘Working vigorously’

“To build strong people’s armed forces, it is of paramount importance to uphold the fundamental principle and system of absolute party leadership over the military, to ensure that supreme leadership and command authority rest with the party Central Committee and the Central Military Commission (CMC), and to fully enforce the system of the CMC chairman assuming overall responsibility,” the resolution said, adding that “setting their sights on this problem, the Central Committee and the CMC have worked vigorously to govern the military with strict discipline in every respect.”

#### The commercial space sector is one of the PLAs central goals – the plan is a 180.

Bartholomew & Cleveland 19 – Carolyn and Robin, 4/25/19, Chairmen and Vice Chairmen. Section is written from Michael A. McDevitt, US Congressperson, [“HEARING ON CHINA IN SPACE: A STRATEGIC COMPETITION?,” <https://www.uscc.gov/sites/default/files/transcripts/April%2025%2C%202019%20Hearing%20Transcript%20%282%29.pdf>] Justin

As the Chairman said, China is determined to become a leading space power, which requires continuing to boost its innovation capabilities, both in its civilian and military sectors. The People’s Liberation Army is closely involved in most if not every aspect of China’s space program, from helping formulate and execute national space goals to overseeing China’s human spaceflight program. Coverage of China’s space program must treat seriously the implications of the reality that in many cases the boundaries between the military and civil silos of China’s program are thin, if they exist at all.

Our second panel today will address the application of what China calls its “military-civil fusion” strategy to its space sector. Military-civil fusion, a strategic concept designed to harness civilian sector innovation to power China’s military and technological modernization with the goal of leapfrogging the United States and becoming a technological powerhouse. Space has been designated as an especially important sector for military-civil fusion, and the impacts of this campaign on China’s burgeoning commercial space sector—itself a recipient of generous government support and protection—will be crucial as Chinese companies increasingly seek to compete in the international marketplace. Military-civil fusion is especially worthy of attention due to its continued reliance on technology transfer, by hook or by crook, to fuel China’s industrial and military growth.

Our third and final panel today will examine China’s military space and counterspace activities. Since its direct-ascent kinetic antisatellite test in 2007, which was responsible for a large amount of all space debris currently in Earth’s orbit, China has continued to invest in a variety of offensive antisatellite capabilities. Indeed, China’s counterspace arsenal contains many options: earlier this month, Acting Secretary of Defense Patrick Shanahan said China “has exercised and continues to develop” jamming capabilities; is deploying directed-energy counterspace weapons; has deployed an operational ground-based antisatellite missile system; and is prepared to use cyberattacks against U.S. space systems.

#### Mining tech’s k2 space expansionism – all 1ac ev would agree

Deudney 20, Daniel. Dark skies: Space expansionism, planetary geopolitics, and the ends of humanity. Oxford University Press, USA, 2020.

Four technologies are so important for all ambitious space expansionist schemes that they can be considered building blocks: cheaper access to orbit, asteroid orbital alteration, mining and processing space materials in space, and thermonuclear fusion (see Table 4.1). If any one of these possible-in-principle technologies remains impractical to develop, major parts of the expansionist program will be technologically infeasible.

Table

Description automatically generated

Propulsion technology to get to space, and around in space, is the most basic technology for space expansion. !e use of rockets to propel objects is now routine, but costs remain high, around ten thousand dollars per pound. Lowering costs by several orders of magnitude is widely seen as vital to more ambitious space activities.36 Current rockets are essentially lineal descendants of the "rst rockets, because used only once, and propelled by burning liquid chemicals, with the combination of cryogenically cooled liquid hydrogen and oxygen being the most e#cient. As many note, commercial aviation would also be prohibitively expensive if airplanes were not reused repeatedly. But this comparison, while capturing a basic di$erence between contemporary aeronautics and astronautics, fails to acknowledge that space launchers must accelerate to velocities some thirty-four times faster than airliners and withstand extreme reentry temperatures. Much e$ort has gone to developing reusable spaceships, but the results have been disappointing. !e most ambitious e$ort, the American space shu%le program, &ew 133 successful &ights between 1981 and 2011, but design &aws caused the destruction of two of the "ve orbiters. It was projected to reduce orbital access costs by an order of magnitude but was never able to achieve any cost reductions because of the extensive maintenance required to ready the shu%les for &ight. Recent e$orts by Space X and other corporations to develop reusable rockets have rekindled hopes for signi"cant cost reductions, but it remains uncertain how many &ights, with what levels of reliability, and with what refurbishment costs these new systems can provide. Achieving multiple-ordersof-magnitude cost reductions probably depends upon developing substantially lighter and stronger materials.37 A truly wild-card transport possibility, the “space elevator,” could, if feasible, probably greatly lower costs, thus enabling many large-scale space activities.38 !e space elevator is simple in its basic outline, a cable stretching roughly sixtytwo thousand miles between the Earth’s surface and a large orbiting counterweight. Once built, substantial payloads could be hoisted up the cable, like elevators in skyscrapers, at costs of pennies per pound. A fundamental barrier to construction is that the cable must be nearly two-hundred times as strong as steel. Amazingly, researchers have discovered forms of carbon possessing such extraordinary strengths, but it remains unknown whether strands of this material can be expanded to lengths of thousands of miles. A space elevator would also have to be con"gured to withstand lightning strikes and severe storms and would catastrophically fail if the cable broke anywhere along its enormous length. However, should such wonders be possible, they might be constructed throughout the solar system. For propelling objects through space on any signi"cant scale, chemical rockets are inadequate, but a wide array of technological alternatives promise vastly greater e)ciencies: ion drives, solar sails, lasers, and even nuclear explosives. For long-duration robotic space probes, nuclear energy is already widely used, and preliminary tests of other novel propulsion technologies have been conducted. Fusion reactors and propulsion are also extremely a+ractive in principle. Development of these alternatives is likely to remain rudimentary until demand for their services expands considerably, but it is reasonable to anticipate that one or several of these dark horse candidates for solar system transportation at reasonable costs will eventually be available. ,e second building-block technology, altering asteroid orbits, is vital for preventing collisions with Earth and acquiring materials for building large-scale infrastructures. ,is has been o-en studied but never a+empted, re.ecting low priorities, not intrinsic di)culty. ,ere is wide agreement that altering asteroid orbits faces no really fundamental technological feasibility problems. ,e /rst study, by a group of MIT engineering students in 1968, analyzed the use of hydrogen bombs launched by multiple Saturn V Apollo Program rockets to alter the orbital path of Icarus, a twenty-two-mile-long NEO.39 ,e energy required for de.ection varies with their mass and the point in their orbits when energy is applied, with the easiest at the apogee, the point when they are furthest from the object they are orbiting. De.ection technology has received steadily more a+ention from researchers as the history of asteroidal collisions has come to light. ,e assumption that nuclear explosions are most suitable has waned with the realization that their brute force could fragment a body. Researchers have proposed a variety of nonnuclear techniques, all of which work slowly, increasing the importance of extended warning times.40 One idea, the “gravity tractor,” envisions positioning a spacecra- near the asteroid and then burning its engines slowly over an extended period of time, which would slowly pull both the asteroid and the spacecra- in a desired direction. Many asteroids are wildly spinning and tumbling and would need to be stabilized before gradual de.ection techniques could be used. While many techniques appear viable in principle, actually a+empting them could encounter unexpected problems and require lengthy trials and errors.

Third, technologies to process materials from the moon and asteroids into structures are vital for space expansion. Initial explorations have revealed a wide array of metals and resources, albeit in very di0erent forms and concentrations than in the terrestrial lithosphere.41 Unlike ores found on Earth, the metals in metallic asteroids are not combined in various oxide and salt compounds, making their conversion into useful objects signi/cantly easier. ,e organic materials in carbonaceous asteroids, and the water, carbon dioxide, methane, and ammonia in comets, could provide the raw materials necessary to support life.42 While copious quantities of raw materials are available, no space material has yet been processed in space. Terrestrial industrial processes for mining and fabricating materials are mature technologies, providing the basis for processing in space. But di!erences in the raw materials themselves and the need to operate in a vacuum and in nearly weightless conditions are likely to limit the direct transfer of established terrestrial material processes. Learning to do in space what is routinely done on Earth will require investment in very basic material-processing technologies, requiring unknown amounts of e!ort, time, and money to accomplish. But because there are no winds or rain in the vacuum of space, structures might be made of much lighter and thinner materials, such as gossamer-thin re"ective #lms that would quickly disintegrate in a turbulent atmosphere. And because objects are weightless they can be vastly larger than on Earth, perhaps many miles in size. But how such materials will weather harsh radiation and periodic solar storms and how long they will last are now unknowable but pivotal to their economic prospects

#### That triggers backlash – they don’t support restrictions on the space sector and will do everything to convince leaders not to do the plan.

Cheng 14 [Dean Cheng, Senior Research Fellow in the Asia Studies Center at the Heritage Foundation, Former Senior Analyst at the China Studies Division of the Center for Naval Analyses, Former Senior Analyst with Science Applications International Corporation, “Prospects for U.S.-China Space Cooperation”, Testimony before the Committee on Commerce, Science, and Transportation, United States Senate, 4/9/2014, https://www.heritage.org/testimony/prospects-us-china-space-cooperation]

At the same time, space is now a sector that enjoys significant political support within the Chinese political system. Based on their writings, the PLA is clearly intent upon developing the ability to establish “space dominance,” in order to fight and win “local wars under informationized conditions.”[8] The two SOEs are seen as key parts of the larger military-industrial complex, providing the opportunities to expose a large workforce to such areas as systems engineering and systems integration. It is no accident that China’s commercial airliner development effort tapped the top leadership of China’s aerospace corporations for managerial and design talent.[9] From a bureaucratic perspective, this is a powerful lobby, intent on preserving its interests. China’s space efforts should therefore be seen as political, as much as military or economic, statements, directed at both domestic and foreign audiences. Insofar as the PRC has scored major achievements in space, these reflect positively on both China’s growing power and respect (internationally) and the CCP’s legitimacy (internally). Efforts at inducing Chinese cooperation in space, then, are likely to be viewed in terms of whether they promote one or both objectives. As China has progressed to the point of being the world’s second-largest economy (in gross domestic product terms), it becomes less clear as to why China would necessarily want to cooperate with other countries on anything other than its own terms. Prospects for Cooperation Within this context, then, the prospects for meaningful cooperation with the PRC in the area of space would seem to be extremely limited. China’s past experience of major high-technology cooperative ventures (Sino–Soviet cooperation in the 1950s, U.S.–China cooperation in the 1980s until Tiananmen, and Sino–European space cooperation on the Galileo satellite program) is an unhappy one, at best. The failure of the joint Russian–Chinese Phobos–Grunt mission is likely seen in Beijing as further evidence that a “go-it-alone” approach is preferable. Nor is it clear that, bureaucratically, there is significant interest from key players such as the PLA or the military industrial complex in expanding cooperation.[10] Moreover, as long as China’s economy continues to expand, and the top political leadership values space efforts, there is little prospect of a reduction in space expenditures—making international cooperation far less urgent for the PRC than most other spacefaring states. [FOOTNOTE] [10]It is worth noting here that the Chinese Ministry of Foreign Affairs is not a part of the CCP Politburo, a key power center in China. Thus, the voice of the Ministry of Foreign Affairs is muted, at best, in any internal debate on policy. [END FOOTNOTE] If there is likely to be limited enthusiasm for cooperation in Chinese circles, there should also be skepticism in American ones. China’s space program is arguably one of the most opaque in the world. Even such basic data as China’s annual space expenditures is lacking—with little prospect of Beijing being forthcoming. As important, China’s decision-making processes are little understood, especially in the context of space. Seven years after the Chinese anti-satellite (ASAT) test, exactly which organizations were party to that decision, and why it was undertaken, remains unclear. Consequently, any effort at cooperation would raise questions about the identity of the partners and ultimate beneficiaries—with a real likelihood that the PLA would be one of them.

#### An unhinged PLA triggers Himalayan war – goes global

Chellaney 17 [Dr. Brahma Chellaney, Professor of Strategic Studies at the Center for Policy Research and Fellow at the Robert Bosch Academy, PhD in International Studies from Jawaharlal Nehru University, “Why the Chinese Military’s Rising Clout Troubles Xi Jinping”, The National, 9/9/2017, https://www.thenational.ae/opinion/why-the-chinese-military-s-rising-clout-troubles-xi-jinping-1.626815?videoId=5754807360001]

China’s president Xi Jinping has stepped up his domestic political moves in the run-up to the critical 19th national congress of the Chinese Communist Party next month, but he is still struggling to keep the People’s Liberation Army (PLA) in line. China’s political system makes it hard to get a clear picture, yet Mr Xi’s actions underscore the troublesome civil-military relations in the country. Take the recent standoff with India that raised the spectre of a Himalayan war, with China threatening reprisals if New Delhi did not unconditionally withdraw its forces from a small Bhutanese plateau, which Beijing claims is Chinese territory. After 10 weeks, the face-off on the Doklam Plateau ended with both sides pulling back troops and equipment from the site on the same day, signalling that Beijing, not New Delhi, had blinked. The mutual-withdrawal deal was struck just after Mr Xi replaced the chief of the PLA’s joint staff department. This key position, equivalent to the chairman of the US joint chiefs of staff, was created only last year as part of Mr Xi’s military reforms to turn the PLA into a force “able to fight and win wars”. The Doklam pullback suggests that the removed chief, Gen Fang Fenghui, who has since been detained for alleged corruption, was an obstacle to clinching a deal with India. To be sure, this was not the first time that the PLA’s belligerent actions in the Himalayas imposed diplomatic costs on China. A classic case happened when Mr Xi reached India on a state visit in September 2014. He arrived on Indian prime minister Narendra Modi’s birthday with a strange gift for his host, a predawn Chinese military encroachment deep into India’s northern region of Ladakh. The encroachment, the worst in many years in terms of the number of intruding troops, overshadowed Mr Xi’s visit. It appeared bizarre that the military of an important power would seek to mar the visit of its own head of state to a key neighbouring country. Yet Chinese premier Li Keqiang’s earlier visit to New Delhi in 2013 was similarly preceded by a PLA incursion into another part of Ladakh that lasted three weeks. Such provocations might suggest that they are intentional, with the Chinese government in the know, thus reflecting a preference for blending soft and hard tactics. But it is also possible that these actions underscore the continuing “disconnect between the military and the civilian leadership” in China that then US defence secretary Robert Gates warned about in 2011. During his 2014 India trip, Mr Xi appeared embarrassed by the accompanying PLA encroachment and assured Mr Modi that he would sort it out upon his return. Soon after he returned, the Chinese defence ministry quoted Mr Xi as telling a closed-door meeting with PLA commanders that “all PLA forces should follow the president’s instructions” and that the military must display “absolute loyalty and firm faith in the party”. Recently Xi conveyed that same message yet again when he addressed a parade marking the 90th anniversary of the PLA’s creation on August 1, 1927. Donning military fatigues, Mr Xi exhorted members of his 2.3-million-strong armed forces to “unswervingly follow the absolute leadership of the party.” Had civilian control of the PLA been working well, would Mr Xi repeatedly be demanding “absolute loyalty” from the military or asking it to “follow his instructions”? China does not have a national army; rather the party has an army. So the PLA has traditionally sworn fealty to the party, not the nation. Under Mr Xi’s two immediate predecessors, Hu Jintao and Jiang Zemin, the PLA gradually became stronger at the expense of the party. The military’s rising clout has troubled Mr Xi because it hampers his larger ambition. As part of his effort to reassert party control over the military, Mr Xi has used his anti-corruption campaign to ensnare a number of top PLA officers. He has also cut the size of the ground force and established a new command-and-control structure. But just as a dog’s tail cannot be straightened, asserting full civil control over a politically ascendant PLA is proving unachievable. After all, the party depends on the PLA to ensure domestic order and sustain its own political monopoly. The regime’s legitimacy increasingly relies on an appeal to nationalism. But the PLA, with its soaring budgets and expanding role to safeguard China’s overseas interests, sees itself as the ultimate arbiter of nationalism. To make matters worse, Mr Xi has made many enemies at home in his effort to concentrate power in himself, including through corruption purges. It is not known whether the PLA’s upper echelon respects him to the extent to be fully guided by his instructions. In the past decade, the PLA’s increasing clout has led China to stake out a more muscular role. This includes resurrecting territorial and maritime disputes, asserting new sovereignty claims, and using construction activity to change the status quo. China’s cut-throat internal politics and troubled civil-military relations clearly have a bearing on its external policy. The risks of China’s rise as a praetorian state are real and carry major implications for international security.

#### Extinction.

Caldicott 17 – Helen, 2017, Founder of Physicians for Social Responsibility [“The new nuclear danger: George W. Bush's military-industrial complex,” The New Press]//Elmer

The use of Pakistani nuclear weapons could trigger a chain reac­tion. **Nuclear-armed India, an ancient enemy, could respond** in kind. China, India's hated foe, could react if India used her nuclear weapons, triggering a nuclear [war] ~~holocaust~~ on the subcontinent. If any of either **Russia** or **America**'s 2,250 strategic weapons on hair-trigger alert were launched either **accidentally** or **purposefully** in response, **nuclear winter** would ensue, meaning the **end of most life on earth**.

## 2

#### Counterplan text: The Committee on the Peaceful use of Outer Space ought to establish an application system for property rights on celestial bodies conditioned upon open disclosure of data and applications. Private entities will only be granted one property grant per celestial body.

#### CP solves the Case – 1] Solves multilat because it eliminates ambiguity over property rights regime and 2] Solves Advantage 2 because the Committee can stop rogue states and terrorist groups from illegally using mining for Asteroid Terrorism which their 1AC card concedes solves. 3] Solves resources advantage because resource conflict relies on unregulated space that fosters harmful competition

#### Mining regulations ensure Mining is safe.

**Steffen 21** [Olaf Steffen, Olaf is a scientist at the Institute of Composite Structures and Adaptive Sytems at the German Aerospace Center. 12-2-2021, "Explore to Exploit: A Data-Centred Approach to Space Mining Regulation," Institute of Composite Structures and Adaptive Systems, German Aerospace Center, [https://www.sciencedirect.com/science/article/pii/S0265964621000515 accessed 12/12/21](https://www.sciencedirect.com/science/article/pii/S0265964621000515%20accessed%2012/12/21)] Adam

4. The data-centred approach to space mining regulation 4.1. Core description of the regulatory regime and mining rights acquisition process The data gathered in the exploration of a [celestial body](https://www.sciencedirect.com/topics/social-sciences/astronomical-systems) is not only of value for space mining companies for informing them whether, where and how to exploit resources from the body in question, but also for science. The irretrievability of information relating to the solar system contained in the body that will be lost during resource exploitation carries a value for humanity and future generations and can thus be assigned the characteristic of a common heritage for all mankind as invoked in the Moon Agreement. This characteristic makes exploration data an exceptional and unique candidate for use in a mechanism for acquiring mining rights because its preservation is of public interest and its disclosure in exchange for exclusive mining rights does not place any additional burden on the mining company. The following principles would form the cornerstones of the proposed regulatory regime and rights acquisition mechanism based on exploration data: Without preconditions, no entity has a right to mine the resources of a celestial body. An international regulatory body administers the existing rights of companies for mining a specific celestial body. Mining rights to such bodies can be applied for from this international regulatory body, with applications made public. The application expires after a pre-set period. Mining rights are granted on the provision and disclosure of exploration data on the celestial body within the pre-set period, proposedly gathered in situ, characterising this body and its resources in a pre-defined manner. The explorer's mining right to the resources of the celestial body is published by the regulatory body in a mining rights grant. The data concerning the celestial body are made public as part of the rights grant within the domain of all participating members of the regulatory regime. The exclusive mining rights to any specific body are tradeable. The scope of the regulatory body with respect to the granting of mining rights is not revenue-oriented. The international regulatory body would thus act as a curator of a rights register and an attached database of exploration data. The concept is superficially comparable to patent law, where exclusive rights are granted following the disclosure of an invention to incentivise the efforts made in the development process. In the following section, the characteristics of such a regulatory regime are further discussed with respect to the formation of [monopolies](https://www.sciencedirect.com/topics/social-sciences/monopolies), market dynamics, conflict avoidance, inclusivity towards less developed countries and the viability of implementation. 4.2. Discussion and means of implementation The proposed regulatory mechanism has advantages both from a business/investor and society perspective. First, it prevents already highly capitalised companies from acquiring exploitation rights in bulk to deny competitors those objects that are easiest to exploit or most valuable, which would otherwise be possible in any kind of pay-for-right mechanism and could result in preventing market access to smaller, emerging companies. Thus, early monopoly formation can be avoided. The use of data disclosure for the granting of mining rights ensures the scientific community has access to this invaluable source of information. In this way, space mining prospecting missions can lead to a boost in research on small celestial bodies at a speed unmatchable by pure government/agency funded science probes. This usefulness to the scientific community could lead to sustained partnerships between prospecting companies and scientific institutions and could even provide a source of funding for the companies through R&D grants and public-private partnerships. The results of the exploration efforts contribute to research on the formation of planets and the history of the solar system and provide valuable insight for space defence against asteroids. The transition of exploration from a tailored mission profile with a purpose-built spacecraft to a standard task in space flight would also lead to a cost reduction of the respective exploration spacecraft through [economies of scale](https://www.sciencedirect.com/topics/social-sciences/economies-of-scale). This describes the very benefits Elvis [[24](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib24)] and Crawford [[25](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib25)] imagined as possible effects of a space economy. Thus, there is an immediate return for society from the exploitation rights grant. It also reconciles the adverse interests of space development and [space science](https://www.sciencedirect.com/topics/social-sciences/space-sciences) as laid out by Schwartz [[26](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib26)]. It ensures that, by exploitation, information contained in celestial bodies is not lost for future generations.The application period should not be set in a manner that creates a situation that can be abused through the potential for stockpiling inventory rights. Rather, it is intended to prevent conflict in the phase before exploration data gathered by a mission, as a prerequisite to the mining rights grant, is available. In other words, only one exploration effort at a time can be permitted for a specific body. The time frame between the application and the granting of mining rights (meaning: availability of the required exploration data set) should be tight and should only consider necessary exploration time on site, transit time and possibly a reasonable launch preparation and data processing markup. These contributors to the application period make it clear that the time frame could be dynamic and individualistic, depending on the exploration target (transit time and duration of exploration) and the technology of the exploration probe (transit time). After the expiration of the application period, applications for the exploration target would again be permissible. To prevent the previously mentioned stockpiling of inventory rights, credible proof of an imminent exploration intention would need to be part of the application process, for example, a fixed launch contract or the advanced build status of the exploration probe. Such a mechanism would not contradict the statement in the OST that outer space shall be free for both exploration and scientific investigation. Applications would not apply to purely scientific exploration. An application would only be necessary as a prerequisite for mining. Even resource prospecting could take place without an application (for whatever reason), with a subsequent application comprising in situ data already gathered. For such cases, the application process would need to provide a short period for objections to enable the secretive explorer to make their efforts public. The publication of the application for the mining rights, which is nothing more than a statement of intention to explore, thus provides a strong measure for avoiding conflict. The transparency of where exploration spacecraft are located and, at a later stage, where mining activities take place, provides additional benefits for the sustainable use of space, trust building and deterrence against malign misuse of mining technology. Involuntary spacecraft collisions of competitors in deep space are prevented by the reduction of exploration efforts at the same destination through the application for mining rights by one applicant at a time. As pointed out by Newman and Williamson [[20](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib20)], this is relevant because space debris does not de-orbit in deep space as in the case of LEO. Deep space may be vast, but the velocities involved mean that small debris particles are no less dangerous. Considering NEO mining with fleets of small spacecraft, malfunctions and/or destructive events could create debris clouds crossing Earth's orbit around the sun on a regular basis, presenting another danger to satellites in Earth's own orbit. Thus, by effectively preventing the collision of two spacecraft, one source of debris creation can be mitigated through this regulation mechanism. With respect to Deudney's [[11](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib11)] scepticism of asteroid mining and the dual-use character of technology to manipulate orbits of celestial bodies, it has to be stated that this potential is truly inherent to asteroid mining. An asteroid redirect mission for scientific purposes was pursued by NASA [[49](https://www.sciencedirect.com/science/article/pii/S0265964621000515" \l "bib49)] before reorientation towards a manned lunar mission. In one way or another, each type of asteroid mining will require the delivery of the targeted resource to a destination via a comparable technology as formerly envisioned by NASA, be it as a raw material or a useable resource processed in situ, even if this is not necessarily done through redirecting the whole asteroid and placing it in a lunar orbit. However, to be misused as a weapon, space mined resources would have to surpass a certain mass threshold to survive atmospheric entry at the target. This seems unfeasible for currently discussed mining concepts using small-scale spacecraft as described in this article. Redirecting larger masses or whole asteroids would require far more powerful mining vessels or small amounts of thrust over long periods of time. The continuous, (for a mining activity) untypical change in the orbit of an asteroid would make a redirect attempt with hostile intent easily identifiable, effectively deterring such an activity in the first place by ensuring the identification of the aggressor long before the projectile hits its target. The proposed database would provide a catalogue of asteroids with exploration and mining activities in place that should be tracked more closely because of their interaction with spacecraft. This would, in fact, be necessary per se as a precaution to avoid catastrophic mishaps, such as the accidental change of a NEO's orbit to intercept Earth by changing its mass through mining.

#### Condo advantage counterplans are good – key to test the intrinsicness of aff impacts – winning a straight turn doesn’t prove the aff is a good idea or better than the squo which is the aff’s burden, and no policymaker would implement a proposal just because it’s not the worst idea.

## Case

### General

#### Extra-T’s a voting issue – the plan doesn’t regard appropriation as unjust, and just bans it – no basis from the resolution justifies infinite affs which explodes predictable limits and can fiat perfect solvency

#### Russia cheats – gives an asymmetric advantage

Lambakis 17 [Dr. Steven Lambakis is a national security and international affairs analyst specializing in space power and policy studies. Dr. Lambakis serves as the Editor-in-Chief of Comparative Strategy, a leading international journal of global affairs and strategic studies whose readership includes key policymakers, academics, and other leaders. Dr. Lambakis was educated in the fields of international politics, with special emphasis on arms control and intelligence issues, American government, and U.S. foreign policy at Northern Illinois University in DeKalb, Illinois (B.A., 1982) and the Catholic University of America in Washington D.C. (M.A., 1984, and Ph.D., 1990). Foreign Space Capabilities: Implications for U.S. National Security. September 2017. www.nipp.org/wp-content/uploads/2017/09/Foreign-Space-Capabilities-pub-2017.pdf]

While Russia is making strong technical strides toward having weapons capable of damaging or destroying U.S. satellites, it is using its foreign policy to try to hobble potential U.S. space weapons. For example, Russia (along with China) has advocated for a treaty preventing the placement of weapons in outer space and the threat or use of force against space-based assets. Russia is fully aware that there are no known technologies or capabilities to verify compliance with such a treaty. The purpose in pursuing such arms control agreements is to hobble U.S. weapons and technology development, because of the domestic political opposition such rhetoric might generate and because the United States will comply with any arms control agreement that it signs. The Russians do not have the same constitutional and political constraints in place as the United States to restrain its development of ASATs. Moreover, the Russians are accustomed to violating arms control agreements that it they have signed. Writes defense analyst Mark Schneider: “There is no reason to expect Russia to break a habit of ignoring its arms control and treaty obligations. By doing this, it has gained military advantages for decades.”119

### Multilat

#### 1AC Foster says new international framework is needed, but all the plan does is revise the OST

**Space cooperation doesn’t lead to broader relations.**

**Sterner 15** (Eric Sterner is a fellow at the George C. Marshall Institute. He held senior staff positions for the U.S. House Science and Armed Services committees and served in DoD and as NASA’s associate deputy administrator for policy and planning, “Talk and Cooperation in Space” 8/6/2015 <https://spacenews.com/op-ed-china-talk-and-cooperation-in-space/>)

How might cooperation with China benefit the United States? Some hold that cooperation in space helps promote cooperation on Earth. Writing in SpaceNews in 2013, Michael Krepon argued “The more they cooperate in space, the less likely it is that their competition on Earth will result in military confrontation. The reverse is also true.” That sentiment is widespread and flows from the nobility of exploration. **If only it were so.** Unfortunately, a country’s space behavior appears to have little affect on its terrestrial actions. Russia’s multidecadal human spaceflight partnership with the United States did not prevent it from invading and destabilizing Ukraine when it moved toward a closer relationship with the European Union, many of whose members are Russian partners in the International Space Station. Space cooperation **has not, and will not**, prevent the continued worsening of the security environment in Europe, which flows from Russian behavior on Earth, not in space. **Space cooperation with China is similarly unlikely to moderate its behavior**. Tensions in Asia derive from China’s insistence on pressing unlawful territorial claims in the Pacific, most recently by transforming disputed coral reefs into would-be military bases. Ironically, civilian space technology has proved critical in documenting these aggressive moves. To further demonstrate the civil space cooperation does not promote cooperation on Earth, we need look no further than recent history. The NASA administrator’s visit to China in the fall of 2014 nearly coincided with China’s hacking of NOAA, with whom Beijing has a “partnership” in studying climate change. Military confrontation flows from the interaction of hard power in pursuit of competing national interests. Space cooperation falls into the realm of soft power. It has value in strengthening relationships among like-minded states with similar interests. China’s aggressiveness toward its neighbors, its human rights record and its cyberattacks on the United States strongly demonstrate that it and the United States are **not of like minds**. This is not the result of insufficient space cooperation, but of divergent national interests. The United States is a status quo power; China is not.

### Asteroids

#### Asteroids are tracked and we can deflect them back

Martin **Rees 18**. Astronomer Royal, founded the Centre for the Study of Existential Risk, Fellow of Trinity College and Emeritus Professor of Cosmology and Astrophysics at the University of Cambridge. 10/16/2018. On the Future: Prospects for Humanity. Princeton University Press.

You may guess that, being an astronomer, anxiety about asteroid collisions keeps me awake at night. Not so. Indeed, this is one of the few threats that we can quantify— and be confident is unlikely. Every ten million years or so, a body a few kilometres across will hit the Earth, causing global catastrophe— so there are a few chances in a million that such an impact occurs within a human lifetime. There are larger numbers of smaller asteroids that could cause regional or local devastation. The 1908 Tunguska event, which flattened hundreds of square kilometres of (fortunately unpopulated) forests in Siberia, released energy equivalent to several hundred Hiroshima bombs. Can we be forewarned of these crash landings? The answer is yes. Plans are afoot to create a data set of the one million potential Earth- crossing asteroids larger than 50 metres and track their orbits precisely enough to identify those that might come dangerously close. With the forewarning of an impact, the most vulnerable areas could be evacuated. Even better news is that we could feasibly develop spacecraft that could protect us. A ‘nudge’, imparted in space several years before the threatened impact, would only need to change an asteroid’s velocity by a few centimetres per second to deflect it from a collision course with the Earth.

#### No big asteroids near Earth to deflect and we closely monitor them

Robert **Walker 16**. Software Developer of Tune Smithy, Wolfson College, Oxford. 12-14-2016. "Why Resilient Humans Would Survive Giant Asteroid Impact." Science 2.0. https://www.science20.com/robert\_inventor/we\_wont\_go\_extinct\_after\_a\_major\_asteroid\_impact\_even\_96\_of\_species\_extinct\_0\_chance\_of\_humans\_extinct-187383

This is something you hear said so often - that we risk being hit by an asteroid that could make humans extinct. But do we really? This is the article I’m commenting on, a recently breaking news story: Earth woefully unprepared for surprise comet or asteroid, Nasa scientist warns. Some are already worrying that it means that we are all due to die in the near future from an asteroid impact. Well, no, it doesn't mean that. So, what is the truth behind it? The source of all this is a comment by Dr Joseph Nuth who warns: “But on the other hand they are the extinction-level events, things like dinosaur killers, they’re 50 to 60 million years apart, essentially. You could say, of course, we’re due, but it’s a random course at that point.” Photograph of comet Siding Spring by Hubble - right hand image is more processed. This comet did a close flyby of Mars and at one point was predicted to have a tiny chance of hitting Mars. In the end it missed Mars by more than a quarter of the distance from Earth to the Moon If you read the rest of the article, it’s a worthy goal, to prepare us for asteroid impacts of all sizes from the small Chelyabinsk one up to really large 10 km ones. There are a number of things potentially confusing about this statement however, if you read it as a non scientist. Although there is a risk of “mass extinction” if a large asteroid hit Earth, “mass extinction” there doesn’t mean “extinction of humans”, we are such a resilient species that we would certainly survive a giant asteroid impact. We are not “due” an extinction at all. Next giant impact is most likely to happen many millions of years into the future. As we'll see, there is almost zero chance of a giant impact in the next century. There is however much we can do to protect ourselves from smaller asteroids. As a result of extensive asteroid surveys over the last couple of decades: We can be pretty sure (as in perhaps 99.999999% sure) that there isn’t an extinction level asteroid headed our way in the next century. We know the orbits of all the Near Earth Asteroids that could do this and none will hit Earth over that timescale. That leaves comets, and the chance of that is something like 1 in 100 million per century, as a very rough guess (since 99% of the impacts are thought to be from asteroids). This risk has been pretty much retired due to the automated asteroid searches by the likes of Pan STARRS. But the chance of a smaller asteroid impact is still high enough to make it worth working on it, especially since this is the one natural hazard we can not only predict to the minute, decades in advance, with enough information but also prevent also, given a long enough timeline. We are already close to completing the survey of 1 km asteroids (90% done). With a bit more funding we could also find most of the asteroids down to 45 meters in diameter. As a result of new developments in the science of asteroid detection, this could be done for a cost of only $50 million to protect the entire Earth. We would then be able to deflect asteroids decades before they are due to hit, which is a far easier task than a last minute deflection. First when he said "You could say, of course, we’re due, but it’s a random course at that point.”" - that is a scientist speaking as a scientist. But of course people sharing this on social media, retweeting, writing new stories about it, pick up the “we are due” and omit the scientific qualification “but it’s a random course at that point”. To say that we are “due” a mass extinction is a bit like saying that after you throw nine heads, you are due to throw a tail. Not true. The chance that the next coin toss is a tail is always going to be 50/50 for a fair coin no matter how many heads you throw. It's the same with extinctions. So long as it is a random process, then an extinction that happens every 60 million years could happen tomorrow or it could be 60 million years or 120 million years before it happens. On average we would still expect to wait 60 million years for the next such mass extinction even if the last one happened hundreds of millions of years ago. It’s just as for the coin toss. Same for an extinction event of a size that happens every 100 million years. If you look at the diagram the big five are irregularly spaced. The last one happened 66 million years ago. But they are irregularly spaced so we can't conclude either that we need to wait 44 million years for the next big extinction either. Some scientists have tried to discern a periodicity in the extinctions of perhaps 26 to 30 million years. If they are right then we are due the next extinction perhaps 15 million years or so from now. But that is very controversial and if true, it wouldn’t cover all mass extinctions. At any rate that's so far into the future it makes no difference to us now, if they are right or wrong. We could get a mass extinction in the next few millions of years. But it is nearly impossibly unlikely in the next century.

### Debris

#### Collision risk is tiny

Wein 9 [Lawrence M. Wein, Professor & Senior Fellow at Stanford’s Center for International Security and Cooperation Jeffrey S. Skoll Professor of Management Science at Stanford University and Senior Fellow at Stanford’s Center for International Security and Cooperation, former DEC Leaders for Manufacturing Professor of Management Science at MIT, and Andrew M. Bradley, PhD-Institute for Computational and Mathematical Engineering at Stanford University, Space debris: Assessing risk and responsibility, Advances in Space Research 43 (2009) 1372–1390]

More importantly, while our numerical results mimic earlier results (Liou and Johnson, 2005; Walker and Martin, 2004) that stressed the importance of postmission deorbiting, we do not necessarily agree with the claim that the only way to prevent future problems is to remove existing large intacts from space (Liou and Johnson, 2006, 2008). The divergence between our views and those in Liou and Johnson (2006, 2008) is perhaps due to the different performance metrics used. The root causes for alarm in Liou and Johnson (2006, 2008) appear to be the growth rate of fragments and the small increase in the rate of catastrophic collisions over the next 200 years (Liou and Johnson, 2008, Fig. 2). However, the great majority of catastrophic collisions in the SOI do not involve operational spacecraft, and are hazardous only in the sense that the fragments generated from such a collision could subsequently damage or destroy operational spacecraft. Therefore, we introduced the notion of the lifetime risk of an operational spacecraft as the primary performance metric. Our model predicts that the lifetime risk is <5x10^-4 [less than .0005%] over the next two centuries, and always stays <10^-3 [less than .001%] than if there is very high (>98%) spacecraft deorbiting compliance. These risks appear to be low relative to the immense cost and considerable technological uncertainty involved in removing large objects from space, are dwarfed by the ~20% historical mission-impacting (but not necessarily mission-ending) failure rate of spacecraft (Frost and Sullivan, 2004), and could be overestimated if improved traffic management techniques lower future collision risks (Johnson, 2004). Hence, the need to bring large objects down from space does not appear to be as clear cut as suggested in Liou and Johnson (2006, 2008). Nonetheless, our model does not incorporate the possibility of intentional catastrophic collisions (ASAT tests, space wars) that could conceivably occur in the future. In addition, Fig. 5 considers only catastrophic collisions, whereas noncatastrophic intact-fragment collisions could easily disable an operational spacecraft. If the operational lifetime risk is modified to include noncatastrophic collisions with fragments >= 10cm, then the sustainable risk rises by ~50%: it increases from 2.19x10^-2 [.0219%] to 3.09x10^-2 in the base case, and increases from 4.91x10^-4 [.000491%] to 7.94x10^-4 in the full compliance case. Moreover, if fragments >= 1 cm (rather than >= 10 cm) are harmful to spacecraft (Johnson, 2004), then we (as well as other researchers) could be underestimating the risk.

#### Long timeframe and squo solves

--Long timeframe – Kessler initially said debris would kill us by 2000 and recanted – now says a century

--tracking now helps avoid collisions – can see objects as small as a softball

--japan has a magnetic net, Australia a laser to remediate

--sufficiency – need to just remove 5 pieces a year to solve and we’re on cusp – solving it 100 yyrs early

Kurt 15 [Joseph Kurt, JD- William & Mary School of Law, BA-Marquette University, NOTE: TRIUMPH OF THE SPACE COMMONS: ADDRESSING THE IMPENDING SPACE DEBRIS CRISIS WITHOUT AN INTERNATIONAL TREATY, 40 Wm. & Mary Envtl. L. & Pol'y Rev. 305 (2015)]

A. Practical Considerations: Feasible Solutions to the Space Debris Problem Are on Their Way

One key question in assessing whether an international treaty is a requisite for solving the space debris problem is just how difficult it will be to fashion a remedy. The more complex and costly are feasible solutions, the more likely it is that a comprehensive regime is necessary to bind the various actors together. 93Link to the text of the note

A good place to begin is to determine just how imminent is the onset of the cascade of exponentially more frequent debris-creating collisions, known as the Kessler Syndrome. 94Link to the text of the note To be certain, no one can be sure--this phenomenon being subject to highly complex probabilities. 95Link to the text of the note Indeed, experts' estimates of when such a cascade will become irreversible vary [\*316] widely. 96Link to the text of the note The National Research Council produced a report in 2011 that suggested that "space might be just 10 or 20 years away from severe problems." 97Link to the text of the note In fact, the cascading effect has already begun, albeit at a modest pace. 98Link to the text of the note However, Donald Kessler, who first described the eponymous effect in 1978, has significantly recalibrated his own outlook over the years. 99Link to the text of the note Originally, Kessler predicted that catastrophe would result by the year 2000. 100Link to the text of the note That date long passed, Kessler now speaks of a century-long process that "we have time to deal with." 101Link to the text of the note

Nevertheless, few would disagree with Cristophe Bonnal of the Centre National d'Études Spatiales ("CNES"), the French space agency, who says that it is "not yet clear" how much time we have to act. 102Link to the text of the note None of this is to say that interested parties should not act with great dispatch to address the space debris problem. Even if catastrophe is not on the immediate horizon--as some have suggested--Heiner Klinkrad, the European Space Agency's leading authority on space debris points out that "[t]he longer you wait, the more difficult and far more expensive" any solution will be. 103Link to the text of the note

The additional slack in plausible timelines is cause for optimism when one considers the progress being made towards remediating the problem of space debris. Such remediation entails a three-pronged approach: preventive measures to reduce the creation of new debris, 104Link to the text of the note space debris tracking technologies, 105Link to the text of the note and active debris removal ("ADR"). 106Link to the text of the note

In an effort to address the first prong, the United Nations General Assembly in 2007 endorsed the COPUOS Space Debris Mitigation Guidelines. 107Link to the text of the note The recommended measures include design changes which would [\*317] avoid the previously common practice of releasing debris during standard operations, refraining from intentional destruction of space objects, and limiting the risk of collisions through avoidance maneuvers and delaying launch times. 108Link to the text of the note As the COPUOS document points out, many of these practices had already been adopted by spacefaring nations. 109Link to the text of the note

Compliance with the COPUOS Mitigation Guidelines is voluntary and has not been universal; 110Link to the text of the note however, many nations do take steps beyond those called for in the Mitigation Guidelines, recognizing the importance of redressing the issue. 111Link to the text of the note That said, even if no nation ever again launched a single object into outer space, the operation of the Kessler Syndrome would ensure that, over time, continuing collisions amongst already present objects would result in Earth's orbit being rendered unusable. 112Link to the text of the note

Improvements in space debris tracking technology are another partial solution that promises to help actors avoid collisions by identifying orbital debris in the path of satellites or spacecraft. 113Link to the text of the note There are limits on the effectiveness of such tracking, however, including the inability of some optical systems to track objects at night. 114Link to the text of the note Moreover, commonly employed systems cannot continually track objects smaller than thirty centimeters in diameter. 115Link to the text of the note New systems are being developed, however, that will use lasers that can track the location of objects as small as a softball--sometimes to within one meter. 116Link to the text of the note Such technology is still at the planning stage for NASA, 117Link to the text of the note but Lockheed Martin is teaming up with an Australian-based company on a laser-tracking project already in the works. 118Link to the text of the note Another promising development comes from scientists at the Massachusetts Institute of Technology, who are working on soccer-ball-sized robots [\*318] designed to travel alongside the ISS, investigating potentially harmful space debris along the way. 119Link to the text of the note

But while tracking space debris can help avoid specific accidents, and thus slow the machinations of the Kessler Syndrome, only ADR can stabilize the space environment. 120Link to the text of the note

Fortunately, the targets for ADR that scientists believe will allow us to forestall an irreversible cascade of collisions are relatively modest. 121Link to the text of the note The most common estimate is that removing five to ten large pieces of debris per year is enough to keep the Kessler Syndrome at bay. 122Link to the text of the note And even more encouraging is that a broad array of national and private actors are exploring a plethora of ADR methods. 123Link to the text of the note For example, the Japanese hope to deploy, by 2019, a magnetic net that will draw pieces of space debris down to the Earth's atmosphere, where they will burn up. 124Link to the text of the note Such use of the atmosphere to incinerate debris is a common element of many ADR strategies, whether they employ nets, harpoons, tentacles, or ion thrusters to impact the debris. 125Link to the text of the note Meanwhile, a German Space Agency program is developing the means to robotically capture satellites. 126Link to the text of the note Other solutions include using enormous puffs of air, static electricity, or lasers to throw objects out of orbit. 127Link to the text of the note

Obviously, such projects carry a hefty price tag, but funding is coming in from a variety of sources. 128Link to the text of the note A laser-based project being developed by Australian National University, for example, received $ 20 million from the Australian government and an additional $ 130 million from NASA and other international public and private actors. 129Link to the text of the note But even these sums [\*319] are dwarfed by the $ 2 billion that Russia's leading space corporation, Energia, is investing in a nuclear-powered pod that it hopes to deploy by 2023. 130Link to the text of the note This pod will fly around space for fifteen years, knocking debris out of the atmosphere using an ion drive. 131Link to the text of the note

That substantial investments in ADR technologies have seemingly put us on the cusp of possessing the technology to stabilize the space environment significantly undermines claims that incentives to solve the orbital debris problem are lacking because of its nature as a "tragedy of the commons". 132Link to the text of the note Successful implementation of a solution is still years away--and can't be presumed. But taken together with the fact that we likely have a decades-long window to redress the problem, 133Link to the text of the note Col. Joseph Imburgia's 2011 warning that "a binding international agreement is needed to provide stability and order . . . and to preserve mankind's access to and through space" looks less and less prescient. 134Link to the text of the note

#### No space war – systems would avoid debris and know if it is debris

Johnson-Freese and Hitchens 16 [Dr. Joan Johnson-Freese is a member of the Breaking Defense Board of Contributors, a Professor of National Security Affairs at the Naval War College and author of Space Warfare in the 21st Century: Arming the Heavens. Views expressed are those of the author alone. Theresa Hitchens is a Senior Research Scholar at the Center for International and Security Studies at Maryland (CISSM), and the former Director of the United Nations Institute for Disarmament Research (UNIDIR) in Geneva, Switzerland. Stop The Fearmongering Over War In Space: The Sky’s Not Falling, Part 1. December 27, 2016. https://breakingdefense.com/2016/12/stop-the-fearmongering-over-war-in-space-the-skys-not-falling-part-1/]

In the last two years, we’ve seen rising hysteria over a future war in space. Fanning the flames are not only dire assessments from the US military, but also breathless coverage from a cooperative and credulous press. This reporting doesn’t only muddy public debate over whether we really need expensive systems. It could also become a self-fulfilling prophecy. The irony is that nothing makes the currently slim possibility of war in space more likely than fearmongering over the threat of war in space.

Two television programs in the past two years show how egregious this fearmongering can get. In April 2015, the CBS show 60 Minutes ran a segment called “The Battle Above.” In an interview with General John Hyten, the then-chief of U.S. Air Force Space Command, it came across loud and clear that the United States was being forced to prepare for a battle in space — specifically against China — that it really didn’t want.

It was explained by Hyten and other guests that China is building a considerable amount of hardware and accumulating significant know-how regarding space, all threatening to space assets Americans depend on every day. If viewers weren’t frightened after watching the segment, it wasn’t for lack of trying on the part of CBS.

Using terms like “offensive counterspace” as a 1984 NewSpeak euphemism for “weapons,” it was made clear that the United States had no choice but to spend billions of dollars on offensive counterspace technology to not just thwart the Chinese threat, but control and dominate space. While it didn’t actually distort facts — just omit facts about current U.S. space capabilities — the segment was basically a cost-free commercial for the military-industrial complex.

In retrospect though, “The Battle Above” was pretty good compared to CNN’s recent special, War in Space: The Next Battlefield. The latter might as well have been called Sharknado in Space – because the only far-out weapons technology our potential adversaries don’t have, according to the broadcast, seems to be “sharks with frickin’ laser beams attached to their heads!”

First, CNN needs to hire some fact checkers. Saying “unlike its adversaries, the U.S. has not yet weaponized space” is deeply misleading, like saying “unlike his political opponents, President-Elect Donald Trump has not sprouted wings and flown away”: A few (admittedly alarming) weapons tests aside, no country in the world has yet weaponized space. Contrary to CNN, stock market transactions are not timed nor synchronized through GPS, but a closed system. Cruise missiles can find their targets even without GPS, because they have both GPS and precision inertial measurement units onboard, and IMUs don’t rely on satellite data. Oh, and the British rock group Pink Floyd holds the only claim to the Dark Side of the Moon: There is a “far side” of the Moon — the side always turned away from the Earth — but not a “dark side” — which would be a side always turned away from the Sun.

More nefariously, the segment sensationalized nuggets of truth within a barrage of half-truths, backed by a heavy bass, dramatic soundtrack (and gravelly-voiced reporter Jim Sciutto) and accompanied by sexy and scary visuals.

Make no mistake there are dangers in space, and the United States has the most to lose if space assets are lost. The question is how best to protect them. Here are a few facts CNN omitted.

The Reality

The U.S. has all of the technologies described on the CNN segment and deemed potentially offensive: maneuverable satellites, nano-satellites, lasers, jamming capabilities, robotic arms, ballistic missiles that can be used as anti-satellite weapons, etc. In fact, the United States is more technologically advanced than other countries in both military and commercial space.

That technological superiority scares other countries; just as the U.S. military space community is scared of other countries obtaining those technologies in the future. The U.S. military space budget is more than 10 times greater than that of all the countries in the world combined. That also causes other countries concern.

More unsettling still, the United States has long been leery of treaty-based efforts to constrain a potential arms race in outer space, as supported by nearly every other country in the world for decades. Indeed, under the administration of George W. Bush, the U.S. talking points centered on the mantra “there is no arms race in outer space,” so there is no need for diplomat instruments to constrain one. Now, a decade later, the U.S. military – backed by the Intelligence Community which operates the nation’s spy satellites – seems to be shouting to the rooftops that the United States is in danger of losing the space arms race already begun by its potential adversaries. The underlying assumption — a convenient one for advocates of more military spending — is that now there is nothing that diplomacy can do.

However, it must be remembered that most space-related technologies – with the exception of ballistic missiles and dedicated jammers – have both military and civil/commercial uses; both benign — indeed, helpful — and nefarious uses. For example, giving satellites the ability to maneuver on orbit can allow useful inspections of ailing satellites and possibly even repairs.

Further, the United States is not unable to protect its satellites, as repeated during the CNN broadcast by various interviewees and the host. Many U.S. government-owned satellites, including precious spy satellites, have capabilities to maneuver. Many are hardened against electro-magnetic pulse, sport “shutters” to protect optical “eyes” from solar flares and lasers, and use radio frequency hopping to resist jamming.

Offensive weapons, deployed on the ground to attack satellites, or in space, are not a silver bullet. To the contrary, U.S. deployment of such weapons may actually be detrimental to U.S. and international security in space (as we argued in a recent Atlantic Council publication, Towards a New National Security Space Strategy). Further, there are benefits to efforts started by the Obama Administration to find diplomatic tools to restrain and constrain dangerous military activities in space.

These diplomatic efforts, however, would be undercut by a full-out U.S. pursuit of “space dominance.” This includes dialogue with China, the lack of which Gen. William Shelton, retired commander of Air Force Space Command, lamented in the CNN report.

Given CNN’s “cast,” the spin was not surprising. Starting with Ghost Fleet author Peter Singer set the sensationalist tone, which never altered. The apocalyptic opening, inspired by Ghost Fleet, posited a scenario where all U.S. satellites are taken off-line in nearly one fell swoop. Unless we are talking about an alien invasion, that scenario is nigh on impossible. No potential adversary has such capabilities, nor will they ever likely do so. There is just too much redundancy in the system.

### Resource Adv

#### Framing issue is that they have read ev that says REM shortages now, but they’ve read zero ev that the aff alleviates those shortages – any risk of solvency on mining good is sufficient to internal link turn the advantage.

#### Abundance of REMs in outer space means they won

#### All 1ac impact ev is about either resource shortages causing wars, but all their link ev is about how there is an abundance of REMs in space now – their best ev on this question is about a mining act that passed in 2015 with zero consequences

#### Commercial mining solves extinction from scarcity, climate, terror, war, and disease.

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

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

#### Outweighs 1AC Khan – their ev assumes we use inefficient tech from the industrial revolution and doesn’t account for regulations in the counterplan.

#### Resource scarcity coming now and causes extinction—asteroid mining is the only way to solve

Crombrugghe 18 – Guerric, Business Development Manager Brussels, Brussels Capital Region, “Asteroid mining as a necessary answer to mineral scarcity”, LinkedIn, 1/11/2018, <https://www.linkedin.com/pulse/asteroid-mining-necessary-answer-mineral-scarcity-de-crombrugghe>

We need minerals, and we always will. Yet, our reserves are finite and a 100% end-of-life recycling rate is impossible to achieve. Eventually, new entrants will therefore be required to sustain our system. While the business case for asteroid mining can obviously not be closed with current technologies, it will someday become a necessity. We may as well start preparing ourselves. Scarcity of resources, the challenge of the 21st century According to the World Bank, in 2016 humanity's growth rate was of 1.18% in terms of population, and 2.50% in terms of GDP. Both of these, in turn, drive our staggering resource consumption: there are more of us, and each of us needs more. On the other, the Earth is a closed system, and resources are only available in a finite amount. We all know by now that there is only this much oil & gas, but the same can actually be said for water, arable land, minerals, etc. These two simple observations have sparkled the debate around the scarcity of resources. Even with the best intentions, mathematics teaches us that it is impossible to indefinitely extract resources from a given finite supply [1]. The problem arising in the short-term is the exhaustion of the existing supply. That limit is actually coming in fast. In a paper published in 2007, Stephen Kessler demonstrates that the global mineral reserves are only sufficient for the next 50 years. The figure on the right shows the ratio of known global reserve to global annual consumption, given a rough indication of adequacy in years. It dates from an earlier paper, published in 1994. Since then, the development of environmental-friendly technologies (e.g. batteries, electric engines, etc.) has drastically increased the consumption rate of high-tech metals such as cobalt, platinum, rare earths, or titanium. On the other hand, exploration programs have allowed to discover new deposits, notably of gold and diamond. We will certainly be able to continue to increase - or at least sustain - our reserves, but only temporarily. Recycling and other temporary fixes An obvious solution is recycling, i.e. rejuvenating our stocks. A popular concept to illustrate this idea is that of urban mining: retrieving the ores present in smartphones and other electronic devices. It may prove to be not only more environmental-friendly, be also safer and more cost-effective. Nevertheless, every solution based on recycling is, again, nothing more than a temporary fix, buying us a finite amount of time. The United Nations Environment Programme studied in a report the current recycling rate of 60 metals. More than half of them have an end-of-life recycling rate below 1%, and less than one-third are above 50%. Nickel, for example, is relatively easy to retrieve, with and end-of-life recycling rate of up to 63% under the best conditions. At that rate, less than 1% of the initial stock is available after only 10 cycle. Even with a staggering 99% efficiency, the same 1% limit is achieved in less than 460 cycles. Not bad, of course, but still not enough. Should our hunger for resources continue, and even with the most optimised recycling techniques, a second problem will arise in the longer term: the amount of resources needed at a given time will simply exceed the total available stock. Unless we manage to find growth vectors that do not require raw materials, that tipping point is an impassable limit. Its proximity obviously depends on our consumption rate. Asteroid mining? No matter which way we look at it, we will thus be short on resources, either through sheer exhaustion (i.e. transformation in an unrecoverable form) or because the demand will exceed the total reserves. We can - and should - talk about recycling, dematerialisation, and other more ethically questionable solutions such as bio-engineering. Nonetheless, no matter how good they are, these are only temporary fixes. If we don't radically change our lifestyle, we will sooner or later have to address the elephant in the room: the Earth is a closed system, we need new entrants. How can space help? Short answer: all these minerals can be found in space. Some are difficult to obtain, others are even more difficult, none are straightforward. The most accessible destination is near-Earth asteroids, a reservoir of over 17,000 known - and counting - giant rocks that regularly cross the orbit of our planet. They are commonly classified in three main families. The most interesting one, for our case, is that of the S-type asteroids. These are metallic bodies, containing first and foremost nickel, iron and cobalt, but also gold, ores from the platinum group. But the list doesn't stop there, many other minerals can be found in smaller amounts: iridium, silver, osmium, palladium, rhenium, rhodium, ruthenium, manganese, molybdenum, aluminium, titanium, etc. How do we get there? Let's take an example: Ryugu, formerly known as 1999 JU3. It's a C-type asteroid measured to be approximately one kilometre in size [2]. In addition to nickel, iron and cobalt, it also contains a fair share of water, nitrogen, hydrogen, and ammonia. Its total value is estimated to be approximately 80 billion USD. Fantastic! But how do we get there and, most importantly, how much does it cost? Well, we may have the start of an answer to these questions. Reaching Ryugu is a technological challenge, but it is feasible. In December 2014, the Japanese space agency has launched a spacecraft, Hayabusa2, heading to the asteroid. Its mission includes the collection of a small sample which will be sent back to the Earth, with a landing planned for December 2020. The target for the sample size is at least 100 µg. The total cost of the mission was projected to be around 200 million USD. That's 2 trillion USD per gram. Let's be optimistic and assume that the sample retrieved is pure gold. At today's rate, it is worth 42.5 USD per gram. That's a difference of over 10 orders of magnitude. Some may argue that Hayabusa2 has many other objectives that retrieving a sample. The mission does indeed include multiple landers, thorough scientific investigations, etc. There is actually another asteroid sample return mission underway, which we could you as a second point of comparison: OSIRIS-Rex, from NASA. It's heading for Bennu, also a C-type asteroid, which it will reach in August 2018. Total cost of the mission: 980 million USD. Target sample size: at least 60 g. We achieve thus roughly speaking 16 million USD per gram. Better, but still 6 orders of magnitude off compared to pure gold. It's pretty much as good as it gets with existing state-of-the-art technologies. Not much of a business case. Should we forget about it? Referring back to our earlier conclusion on resource scarcity, we had two options. Either we drastically reduce our resource consumption, to such a degree that reserves can last for longer than humanity itself, or we extend our closed system, the Earth, to nearby asteroids. In the current state of affairs, I am honestly not sure which course of action is the easiest. As they get increasingly rare, the cost of minerals will go up. On the other hand, as explained in a previous article, we can expect the cost of space activities to go steadily down. Step by step, these 6 orders of magnitude will slowly get munched away from both ends, until eventually asteroid mining becomes a viable operation. In other words: it will only become financially interesting once minerals become a thousand times more expensive and space activities a thousand times cheaper. As a point of reference, the introduction of reusable rockets by SpaceX, widely considered as one of the few truly disruptive changes in the aerospace sector in the last few decades, has "only" brought a cost reduction of 30%. While it's clearly amazing, we still need at least 220 innovations of the same calibre [3] before we can make it work (again: assuming the price of minerals simultaneously goes up by a factor of a thousand). It's therefore quite likely that space mining will not take place within our lifetime [4]. How can we accelerate the process? Firstly, we can only celebrate and support the numerous private initiatives which contribute to make that reality happen, either indirectly (e.g. launchers, space systems, etc.) or directly (e.g. in-space manufacturing, lunar exploration, etc.). Shout out to all the folks who manage to keep the flame of space exploration burning while generating profit for their investors. Secondly, space agencies and other institutional actors should continue to act as promoters of pioneering mission such as Hayabusa2, OSIRIS-REx, or DART. We can only regret that the Asteroid Redirect Mission from NASA and the Asteroid Impact Mission from ESA were not funded. From my perspective, these should actually be amongst the top priorities of our space exploration agenda. Not only are they instrumental to our understanding of the solar system, but they are also essential if we want to avoid the same fate as the dinosaurs. It's a question of survival. As a bonus, they also pave the way towards cost-efficient asteroid mining. In the meantime, we might want to consume existing resources a bit more efficiently.

#### Resource conflicts on Earth, not space escalate – that was 1AC ev

#### Mining solves Water Shortages

Kean 15 Sam Kean December 2015 "The End of Thirst" <https://www.theatlantic.com/magazine/archive/2015/12/the-end-of-thirst/413176/> (writer based in Washington DC for the Atlantic)//Elmer

Imagine turning on your tap and seeing no water come out. Or looking down into your village’s only well and finding it dust-dry. Much of the developing world could soon face such a scenario. According to the United Nations, 1.2 billion people already suffer from severe water shortages, and that number is expected to increase to 1.8 billion over the next decade, in part because of climate change. Developed countries probably won’t be immune. California and other states in the western U.S. are already experiencing extreme drought, and climate experts warn of even worse to come—multi-decade megadroughts. Mass migrations and wars over freshwater loom as real possibilities. Staving off disaster will require conservation, especially in agriculture, which consumes more than two-thirds of all the water humans use. Basic infrastructure maintenance would also go a long way: Some developing countries lose more than half their water through leaky pipes. But conservation and maintenance won’t solve all our water woes, especially as the planet warms and people continue to pack into cities. As a result, governments around the world are investing in new water-recycling and water-harvesting technologies. Here’s what the future of water might look like. 1. Drinking From the Sea … One obvious solution would be to drink ocean water. Converting seawater into freshwater by stripping out the salt—a process called desalination—offers several advantages. Roughly half the world’s population lives within 65 miles of an ocean, and saltwater accounts for about 97 percent of all water on Earth. Still, desalination presents obstacles. Older plants that boil seawater and collect the vapors, as many of those in the Middle East do, use ungodly amounts of energy. Newer plants that use reverse osmosis—whereby seawater is forced through membranes at high pressure—are more efficient, but still expensive and energy-intensive. The process also produces a briny waste that can harm marine life if not disposed of properly. We can nevertheless expect to see more desalination plants soon—thanks in part to Israel, which all but eliminated its chronic water shortages in the past decade by building four large reverse-osmosis plants, inspiring other countries to follow suit. A $1 billion plant operated by an Israeli company is about to open north of San Diego; it will be the largest in the Western Hemisphere, providing up to 50 million gallons of water a day to Californians. 2. … Or From the Toilet Instead of desalination, some experts favor recycling wastewater—cleaning the water from showers, washing machines, and, yes, toilets—for human consumption. Most water-recycling plants clean water in two basic ways. First, they force it through filters, some of which have holes hundreds of times narrower than a strand of human hair. These filters remove waste particles, organic chemicals, bacteria, viruses, and other dreck. Second, chemicals like hydrogen peroxide or ozone and pulses of ultraviolet light destroy any pathogens that have slipped through. Water recycling is a proven technology: California recycles hundreds of millions of gallons each day for irrigation and other uses. So what’s stopping recycled wastewater from going directly to our taps? Human psychology. The very idea of drinking it disgusts many people. They view such water as irredeemably dirty, little better than toilet water. In reality, recycled water is some of the cleanest drinking water around—as good as or better than the best bottled water. (Breweries in Oregon and California have plans to make beer with recycled water for this very reason—it’s so clean that it’s tasteless, a blank slate.) More to the point, recycled water is far purer than most tap water. By the time the water in the Mississippi reaches New Orleans, for instance, every drop has been used by cities along the river multiple times, and the treatment it gets before going through the taps is nowhere near as extensive as what a water-recycling plant provides. Singapore and Namibia have recycled water for years with no adverse health effects, and nasa began recycling water on the International Space Station in 2008. (The Russian cosmonauts there don’t recycle their pee, but they give the Americans bags of it to recycle and then drink.) In the United States, a few parched towns in Texas and New Mexico drink recycled wastewater already, and last year the city of San Diego—which gets most of its water from rivers that are running dry—approved a $3 billion recycling plant that would provide one-third of its tap water, 83 million gallons a day, by 2035. San Diego had rejected essentially the same plan in 1998, but this time the city decided it had no other choice. 3. Microbe Power Rather than filtering out organic waste, water-recycling plants might one day be able to break it down with microbes, a process that could bring an ancillary benefit: electric power. As they digest the gunk in wastewater, certain species of bacteria, called electricigens, can liberate electrons, the stuff of electricity. Producing electrons is actually common in nature—much of photosynthesis involves shuttling them around. Unlike plants, though, electricigens don’t store electrons internally. They use microscopic appendages that look like hairs to deposit the electrons onto external surfaces, usually minerals. In experimental fuel cells, scientists have replaced the minerals with wires and harvested electrons. Someday the bacteria might even generate enough power to run a water-recycling plant, making it self-sufficient. 4. Keeping It Simple Some up-and-coming water technologies are startlingly straightforward. People on arid plateaus, for instance, can string a fine plastic mesh between two posts and use it to capture water from fog that rolls through, collecting the drops in storage tanks. Existing systems in one small Guatemalan village can collect 6,300 liters a day, and more during the wet season. Scientists think that updating the mesh with new materials and tighter weaves could dramatically improve yields. People could even channel the water into hydroponic gardens to grow food. Imagine famously foggy San Francisco with a farm on every rooftop. Oil films present another low-tech opportunity. Reservoirs lose appalling amounts of water to evaporation: By some estimates, more water escapes into the air than is used by humans. But covering the surface with an extremely thin layer—even just one molecule thick—of nontoxic chemicals derived from coconut or palm oil can cut evaporative losses. Wind tends to break up layers of oil, re-exposing the water to the elements. But drones or blimps equipped with sensors could someday monitor reservoirs and signal where oil needed to be re-applied. In one recent test, spreading oil over a lake in Texas (via boats) appears to have cut evaporation by about 15 percent. 5. Making It Rain Of course, for every modest proposal to save water, there’s an audacious one floating around. Take weather modification. Advocates of the idea hope to significantly boost precipitation using a process called “cloud seeding”: spraying clouds with a chemical like silver iodide, which acts as a nucleus around which water droplets collect. The droplets then fall to Earth as rain or snow. That’s the theory, at least. The first large-scale experiments, in the 1940s, generated a lot of excitement. More recently, weather modification has been dogged by accusations of hype and questions about its reliability. A six-year program in Wyoming claimed to have squeezed 5 to 15 percent more precipitation out of the clouds it seeded. Unfortunately, conditions were suitable for seeding only 30 percent of the time, so the total increase in precipitation was closer to 3 percent. That’s not nothing, especially during droughts. But weather modification may be the flying car of water technology—a tantalizing idea that’s forever on the horizon. 6. The Moon Shot If Earth does run dry, we might be able to save ourselves by mining water from asteroids and comets. Scientists have landed probes on these space rocks to study them. Future landers could mine them in deep space or possibly even drag them back toward Earth. Though the idea sounds far-fetched, space-mining companies already exist, and one of them, Planetary Resources, expects to start harvesting resources from asteroids in about a decade. According to Planetary Resources, a single 1,600-foot-wide asteroid could yield more platinum than has ever been mined in human history. But water could prove to be the real prize for space-mining companies. Some astronomers believe that the asteroid Ceres, which sits between Jupiter and Mars, may contain more freshwater (as ice) than all of Earth does. In addition to quenching people’s thirst, this water could be turned into fuel for interplanetary spaceships. In that case, an ample supply of water would be the key to a happy future not just down here on the ground, but up among the stars as well.

#### Sino-India Conflict – goes Nuclear

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China, India, and the Brahmaputra River

The potential for interstate conflict—even nuclear conflict—over shared water supplies arises in the case of another major river at risk from climate change: The Brahmaputra, which originates in China and traverses much of northeastern India before merging with the Ganges in Bangladesh and emptying into the Bay of Bengal. The fifth-largest river in the world by volume of water flow, the Brahmaputra starts on the northern slopes of the Himalayas and flows easterly across the southern Tibetan plateau (where it is known as the Yarlung Tsangpo) before making a nearly 180-degree turn and crossing into the Indian state of Arunachal Pradesh; from there, it flows in a southwesterly direction towards its confluence with the Ganges and thence its exit into the Bay of Bengal. For the Chinese, the Brahmaputra is an important engine of hydroelectric power; they have already installed one dam on the river, at Zangmu, and have announced plans for at least three more. For the Indians, it is a valuable source of irrigation water, especially in agriculture-dependent regions of the northeast. Leaders of both countries are fully aware of their counterparts’ interests and concerns over the river but have made little effort to reach a mutual understanding—let alone any formal agreements—regarding its future development.31

Several factors make the future status of the Brahmaputra a matter of deep concern to security analysts. To begin with, the river enters India through the state of Arunachal Pradesh, an area of northeastern India abutting Tibet that is claimed by both countries. Beijing insists that this region was once part of the kingdom of Tibet, and so belongs to China; New Delhi claims it is a legitimate part of India under a 1914 treaty between Tibet and Great Britain. The two sides fought a war here in 1962, with India suffering significant battlefield setbacks but China agreeing to restore the status quo ante. The countries have not been able to resolve the ownership dispute in subsequent years, despite intermittent negotiations, and both continue to maintain substantial military forces in the region. To this day, discord over Arunachal Pradesh remains a continuing source of friction in Sino-Indian relations and a potential spark for violent conflict.32

Another potential source of friction between China and India arises from Chinese plans (or rumors of such plans) to divert water from the upper Brahmaputra and funnel it via a series of tunnels and canals to northeastern China, where existing supplies are hugely inadequate.33 While dismissed by many Chinese experts as overly ambitious and costly, the notion of diverting water from the Brahmaputra has generated considerable anxiety in India, where experts fear that the resulting decline in water flow into the Indian section of the river would threaten agricultural productivity. Given the centrality of farming in the Indian economy and political system, any Chinese move to proceed with such a diversion project could lead to increased tension between the two countries. 34

Few analysts believe that a Sino-Indian conflict over the Brahmaputra is likely in the years immediately ahead. Both countries have strong motives for maintaining friendly—if not necessarily, warm—relations between them, and water issues have not yet dominated the bilateral agenda. This, however, is where global warming enters the picture. The Brahmaputra, like the Indus, draws much of its flow during dry seasons from the melting of Himalayan glaciers—and these, as has already been noted, are melting as a result of climate change, and could eventually disappear. For both China and India, the melting of the Himalayan glaciers will have momentous consequences. Given the Brahmaputra’s critical importance to agriculture and economic activity in both countries, any significant long-term decline in its flow would be highly disruptive, causing widespread hardship and social unrest.35

Under these more stressful conditions, the Chinese leadership, desperate to provide additional supply to China’s water-starved northeast, might be more inclined to proceed with water diversion projects on the Brahmaputra and other shared river systems.36 Coming at a time of equivalent water scarcity in India, such an effort is almost certain to trigger a harsh Indian response. “The most salient climate-related point of conflict [between China and India] could be China’s move to divert the upstream waters of rivers originating in the Himalayan watershed,” the NIC warned in a special report on climate change and India. “If China was determined to move forward with such a scheme, it could become a major element in pushing China and India towards an adversarial rather than simply a competitive relationship. Border clashes related to control of the rivers are not out of the question.”37

Any conflict between China and India over the waters of the Brahmaputra, should one occur, is most likely to remain a localized affair, without provoking a full-scale mobilization of forces on both sides. During the 1962 war over Arunachal Pradesh, Chinese army troops engaged their Indian counterparts in disputed areas along the border, but neither side escalated to large-scale combat. However, once fighting breaks out, it is impossible to predict the succeeding chain of events, and any outcome is conceivable. A minor skirmish along the Indo-Chinese border might not be a cause for alarm in the United States, but a larger war between those two countries undoubtedly would be. Both are armed with nuclear weapons, and Washington views India as a strategic counterweight to China.38 A crushing defeat of India would be viewed as a potential threat to American national interests and might conceivably precipitate U.S. military intervention. Where that might lead is anyone’s guess, but the mere possibility of such combat has made this scenario a matter of deep concern for security analysts in Washington.39