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### 1

#### CP: The appropriation of outer space by private entities is unjust, except for the appropriation of outer space by Origin Space using the Yangwang 1 satellite for nighttime light data collection. Origin Space ought to immediately publicly release said data.

#### It competes.

Jones 21 “Chinese commercial satellite has been spotting meteors and aurora” Andrew Jones [freelance space journalist with a focus on reporting on China's rapidly growing space sector. He began writing for Space.com in 2019 and writes for SpaceNews, IEEE Spectrum, National Geographic, Sky & Telescope, New Scientist and others.] September 28, 2021 <https://www.space.com/chinese-satellite-watching-meteors-aurora> SM

Chinese commercial satellite has been spotting meteors and aurora

Yangwang 1 is focused on near-Earth asteroids, but the bonus observations are stunning.

A small Chinese commercial satellite has been detecting meteors impacting the atmosphere and even filming the aurora.

The Yangwang 1 ("Look Up 1") satellite, belonging to Beijing-based space resources company Origin Space, launched in June along with three other satellites. With its small optical space telescope, Yangwang 1 has been using visible and ultraviolet observations to detect near-Earth asteroids.

#### We’ll read ev.

Thornburg 18 [(Matthew, associate editor at the Michigan Journal of International Law) “Are the Non-appropriation Principle and the Current Regulatory Regime Governing Geostationary Orbit Equitable for All of Earth’s States?,” November 30, 2018 http://www.mjilonline.org/are-the-non-appropriation-principle-and-the-current-regulatory-regime-governing-geostationary-orbit-equitable-for-all-of-earths-states/] TDI

As the law currently stands, geostationary orbit – a constant orbital position above Earth’s equator – is governed by the OST and is therefore subject to the treaty’s attendant ban on national appropriation. Spaces, or slots, in geostationary orbit[2] are desired because they are exceedingly convenient for communicating with earth. They are highly limited and as a consequence, highly valuable. Moreover, these spaces are allotted on a first-come-first-served basis[3] making them virtually unattainable by less scientifically and economically advanced states[4], or those that are just plain late to the game. The ban on national appropriation is enumerated in the Second Article of the OST, which states: “Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by other means.”[5] The geostationary orbital position is generally agreed upon by experts[6] as part of “outer space” and consequently, forbidden from appropriation. The OST is clear in prohibiting claims of sovereignty, but the subsequent clauses leave much to interpretation when considering what other acts constitute “national appropriation.” In other words, the question surrounding geostationary orbital slots is “whether the continued exclusive occupation by a geostationary satellite of the same physical area is a violation of the ban on national appropriation”[7] by use, occupation, or other means. In his article, Major Legal Issues Arising from the Use of the Geostationary Orbit, Stephen Gorove says that, “it is not clear that a satellite in geostationary orbit would be able to maintain its exact position and occupy the same area over a period of time…” so as to “appropriate” and thus violate Article II of the OST. The analysis should not turn on whether the satellites in geostationary orbit maintain their exact position. Instead, it is the continual use of the orbital slot that should be examined in light of the OST prohibition. The average lifespan of a geostationary satellite is 15-20 years,[8] effectively shutting out any other state’s use of that slot for at least that long. A time frame of this nature seems to be the exact type of “use or occupation” the treaty seeks to foreclose because of the consequent unequal access to the use of space, and the consequent potential to cement the economic interests of certain nations and firms. Compounding this concern is the fact that operators of the geostationary satellites need only refile with the International Telecommunications Union (“ITU”) to “renew” a slot and replace old satellites with new ones.[9] Essentially, such operators keep the orbital slot indefinitely. In light of the OST – a treaty dominated by goals of fair and equitable use and access to space – endless use of these valuable slots should rise to the level of national appropriation by means of use, occupation, or other means.

#### Yangwang-1 is key to nighttime light data – significant advancements over alternatives.

Zhu et al 22 “Assessment of a New Fine-Resolution Nighttime Light Imagery From the Yangwang-1 (“Look up 1”) Satellite” Xiaolin Zhu, Xiaoyue Tan, Minglei Liao, Shuheng Zhao, Yi Nam Xu, and Xintao Liu are with the Department of Land Surveying and GeoInformatics, The Hong Kong Polytechnic University; Tianshu Liu is with the S.T.E.M Academy, Orange Lutheran High School, Meng Su is with the Laboratory for Space Research, The University of Hong Kong. IEEE GEOSCIENCE AND REMOTE SENSING LETTERS, VOL. 19, 2022 6505205 <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9666911&tag=1> SM

The calibrated radiance of Yangwang-1 was used to estimate the population in 27 districts of Hong Kong and Shenzhen by a linear regression model (Fig. 3). The good performance of this model (R2 = 0.94) suggests that radiance data obtained by Yangwang-1 is capable of evaluating socioeconomic parameters.

B. Spatial Properties

Among three satellites, Yangwang-1 has the highest spatial resolution 38 m, which is higher than 130 m of Luojia-1 and dramatically higher than 750 m of VIIRS (Table II). As a result, Yangwang-1 should be more capable of capturing the spatial pattern of artificial lights, such as bright city blocks (e.g., business districts) and road networks. To investigate the spatial properties of NTL images from different satellites, a subregion covering the Hong Kong–Zhuhai–Macau Bridge (HZMB) was selected to demonstrate the NTL spatial patterns (Fig. 4). It is clear that all three satellites can capture the general spatial pattern of NTL, but Yangwang-1 and Luojia-1 NTL images show much more spatial details than VIIRS image. For example, the images from Luojia-1 and Yangwang-1 can clearly capture the HZMB [bright line in the middle of Fig. 4(c) and (d)], and the regular shape of the Hong Kong International Airport [the bright patch on the right side of Fig. 4(c) and (d)], but VIIRS cannot spot the HZMB and the image hardly show the shape of the airport [Fig. 4(b)]. The comparison between Yangwang-1 and Luojia1 in the zoomed area shows that Yangwang-1 [Fig. 4(h)] captures the road network more clearly than Luojia-1 [Fig. 4(g)]. To quantify the image quality in the spatial domain, the dubbed Blind/Referenceless Image Spatial Quality Evaluator (BRISQUE) index [17] was calculated for the three NTL images using a python package (https://pypi.org/project/imagequality/). BRISQUE quantifies losses of “naturalness” in the image due to distortions and a lower value indicates better image quality. To exclude the impact of the saturation problem of Yangwang-1 on the BRISQUE calculation, pixels in all three images with radiance higher than the saturated value were adjusted to the saturated one and max–min normalization was applied to all images. The results show that Yangwang-1 has a BRISQUE value lower than Luojia-1 and VIIRS (27.4 versus 40.3 and 69.7), indicating that Yangwang-1 has spatial quality better than Luojia-1 and VIIRS by 32% and 61%, respectively.

To further quantify the spatial properties, we estimated the spatial response of Luojia-1 and Yangwang-1 using the HZMB as ground reference samples. Spatial response refers to the satellite’s ability to position ground targets accurately and precisely. The HZMB comprises a 22.9-km long bridge and a 6.7-km long subsea tunnel connected by two artificial islands. To provide illumination, the lighting provisions on the HZMB include lights outlining the boundary of the artificial islands, street and traffic sign lights, high mast lights, etc. Since the bridge has a width of 33.1 m, which is smaller than a pixel of all three satellites, it is ideal to test whether the NTL image is sharp enough to delineate the actual location of the bridge. A transect crossing the bridge was used to investigate the spatial response (Fig. 5). It shows that both Luojia-1 and Yangwang-1 have a peak in NTL that corresponds to the bridge, but the peak of Yangwang-1 has a narrower width than Luojia-1, indicating its superiority in detecting tiny light sources. As for VIIRS, the light is nearly invisible due to the coarse spatial resolution [Fig. 4(b)], so the profile of VIIRS is not included in Fig. 5. In addition, the comparison also indicates that Yangwang-1 is more sensitive than Luojia-1 to low lights (e.g., reflected moonlight or weak emissions), since Yangwang-1 recorded more valid radiance on both sides of the bridge than Luojia-1 (Fig. 5). Further comparisons were conducted on selected sites located in the mountainous areas around cities [yellow points in Fig. 1(a)]. As summarized in Table III, Yangwang-1 and VIIRS/DNB have similar radiances with a difference of less than 1 nW·cm−2·sr−1, whereas Luojia-1 did not record these low radiance values.

C. Spectral Properties

Fig. 6(a) shows the spectral responses of the three satellites for the NTL visible band. Spectral response describes the sensitivity of the sensor to optical radiation of different wavelengths. This is important because spectral responses determine which part of the optical radiation spectrum is measured. The spectral responses of Luojia-1 and VIIRS were collected from previous studies [14], [18]. The spectral response of Yangwang-1 was estimated as the product of the quantum efficiency (QE) and lens transmittance data provided by the Yangwang-1 satellite team [19]. Fig. 6(a) suggests that the spectral response of Yangwang-1 is significantly different from Luojia-1 and VIIRS. It shifts more to the shorter wavelengths, which indicates that Yangwang-1 has some strengths in artificial light monitoring. First, the absorption of the atmosphere mainly happens in the band greater than 650 nm, and Yangwang-1 concentrates on a shorter wavelength ranging from 420 nm to approximately 700 nm, so Yangwang-1 will be less influenced by the absorption of the atmosphere. Second, the energy of three main types of artificial lights (fluorescent, high-pressure sodium, and LED) mainly distributes within the spectral response curve of Yangwang-1 except for the narrow peak of high-pressure sodium [Fig. 6(b)]. Therefore, Yangwang-1 is more suitable to be utilized for observing artificial lights, especially for LEDs of which the first peak of energy is out of the spectral responses of Luojia-1 and VIIRS.

IV. DISCUSSIONS AND CONCLUSION

From our assessment, NTL imagery from Yangwang-1 has acceptable quality compared to the state of the art in NTL remote sensing (e.g., VIIRS, Luojia-1) and some aspects are even better. For the radiometric property, Yangwang-1 has a detectable minimum radiance lower than the other two satellites, so it can better capture weak light emissions. For spatial properties, Yangwang-1 images have the highest spatial resolution among the currently available NTL satellites except for some images acquired through aerial photography and commercial satellites. Therefore, Yangwang-1 can help monitor human activities and socioeconomic disturbances at fine scales, such as neighborhood scale. For spectral property, based on the comparison of spectral response curves, Yangwang-1 is more suitable to detect artificial light and less influenced by the absorption of the atmosphere. Considering the capability and improvement of Yangwang-1 in NTL imaging, Yangwang-1 NTL data can be applied to various fields, including urban mapping, road network extraction, light pollution, illegal fishing, fires, disaster detection, and human settlements and associated energy infrastructure mapping at fine scales. The sample data used in this study can be downloaded from <https://github.com/XZhu-lab/Yangwang-1-NTLdata-assessment>.

#### Improved NTL data key to fisheries management.

Exeter et al 21 “Shining Light on Data-Poor Coastal Fisheries” 28 January 2021 Owen M. Exeter [Environment and Sustainability Institute, College for Life and Environmental Sciences, University of Exeter, Environmental Biology, College for Life and Environmental Sciences, University of Exeter], Thaung Htut [3Wildlife Conservation Society], Christopher R. Kerry [Environment and Sustainability Institute, College for Life and Environmental Sciences, University of Exeter], Maung Maung Kyi4 [Rakhine Coastal Region Conservation Association] Me'ira Mizrahi [Wildlife Conservation Society], Rachel A. Turner [Environment and Sustainability Institute, College for Life and Environmental Sciences, University of Exeter], Matthew J. Witt [Environment and Sustainability Institute, College for Life and Environmental Sciences, University of Exeter, Environmental Biology, College for Life and Environmental Sciences, University of Exeter] and Anthony W. J. Bicknell [2Environmental Biology, College for Life and Environmental Sciences, University of Exeter] https://www.frontiersin.org/articles/10.3389/fmars.2020.625766/full SM

Coastal fisheries provide livelihoods and sustenance for millions of people globally but are often poorly documented. Data scarcity, particularly relating to spatio-temporal trends in catch and effort, compounds wider issues of governance capacity. This can hinder the implementation and effectiveness of spatial tools for fisheries management or conservation. This issue is acute in developing and low-income regions with many small-scale inshore fisheries and high marine biodiversity, such as Southeast Asia. As a result, fleets often operate unmonitored with implications for target and non-target species populations and the wider marine ecosystem. Novel and cost-effective approaches to obtain fisheries data are required to monitor these activities and help inform sustainable fishery and marine ecosystem management. One such example is the detection and numeration of fishing vessels that use artificial light to attract catch with nighttime satellite imagery. Here we test the efficiency and application value of nighttime satellite imagery, in combination with landings data and GPS tracked vessels, to estimate the footprint and biomass removal of an inshore purse seine fishery operating within a region of high biodiversity in Myanmar. By quantifying the number of remotely sensed vessel detections per month, adjusted for error by the GPS tracked vessels, we can extrapolate data from fisher logbooks to provide fine-scale spatiotemporal estimates of the fishery's effort, value and biomass removal. Estimates reveal local landings of nearly 9,000 mt worth close to $4 million USD annually. This approach details how remote sensed and in situ collected data can be applied to other fleets using artificial light to attract catch, notably inshore fisheries of Southeast Asia, whilst also providing a much-needed baseline understanding of a data-poor fishery's spatiotemporal activity, biomass removal, catch composition and landing of vulnerable species.

Introduction

Small-scale coastal fishing fleets are known to exert pressure on marine ecosystems. Without effective management even small-scale operations can deplete fish stocks (Wilson et al., 2010), contribute to species declines through bycatch and intentional targeting (Mangel et al., 2010; Alfaro-Shigueto et al., 2011; Aylesworth et al., 2018) and cause the degradation of coastal habitats through high impact fisheries methods (Blaber et al., 2000; Thrush et al., 2002; Fox and Caldwell, 2006; Shester and Micheli, 2011; Chan and Hodgson, 2017). Small-scale fisheries are also intrinsically linked to food security and livelihoods. Twenty-two of an estimated 50 million fishers globally are involved in small-scale operations (Teh and Sumaila, 2013). With annual yields close to 22 million tons (Pauly and Zeller, 2016), these fisheries are estimated to contribute more than half of reported landings in developing regions (World Bank, 2012) yet are often considered poorly documented and neglected by management authorities (Food and Agriculture Organisation, 2015).

To monitor fisheries, larger vessels are often instrumented with global positioning systems (GPS) including vessel monitoring systems (VMS) and automatic identification systems (AIS) (Witt and Godley, 2007; Jennings and Lee, 2012; Kroodsma et al., 2018). This has allowed fisheries scientists to quantify their spatial footprint (Natale et al., 2015; Kroodsma et al., 2018) and assess the effectiveness of spatial management efforts (White et al., 2017; Ferrà et al., 2018). Small-scale coastal fisheries, notably in developing regions, often lack the capacity to equip such systems or are not currently required to carry them (Dunn et al., 2010; Breen et al., 2015; Kroodsma et al., 2018). Despite being globally distributed, spanning a variety of gear types, vessel sizes, target species, spatial profiles and socioeconomic characteristics (Smith and Basurto, 2019), these fleets largely lack data on spatial and temporal trends in activity (Johnson et al., 2017; Selgrath et al., 2018). As small-scale fleets primarily operate in inshore zones (Stewart et al., 2010), the paucity of spatial data on vessel behavior can seriously hinder effective coastal management, impacting both people and wildlife (Ban et al., 2009; Metcalfe et al., 2017; Cardiec et al., 2020).

In the absence of traditional tracking technologies, a variety of alternate methods have been used to quantify small-scale fisheries in time and space. These include self-reporting logbooks (Vincent et al., 2007), sightings (Breen et al., 2015), participant mapping and interviews (Léopold et al., 2014; Selgrath et al., 2018; Gill et al., 2019), mapping known behaviors (Witt et al., 2012) or combinations of these (Turner et al., 2015). These methods are often only a snapshot in time and can host inaccuracies as a result of observer bias (Brown, 2012, 2017). The novel application of remote sensing systems offers a potential source of long-term monitoring data (Chassot et al., 2011). Remote sensing systems provide high resolution data over large spatial scales and long temporal periods (Chassot et al., 2011; Klemas, 2013). One example is the detection of vessels using sensors on weather satellites at night (Croft, 1978) i.e., the Defense Meteorological Satellite Program Operational Linescan System (DMSP OLS). This has been demonstrated to be useful in detecting vessels that use artificial light to lure fish or squid to the surface before netting or hooking (Liu et al., 2015; Cozzolino and Lasta, 2016; Paulino et al., 2017). More recently, the National Oceanic and Atmospheric Administration's (NOAA) Suomi National Polar Partnership satellite primary imager, the Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band, has captured a variety of artificial light sources at the Earth's surface (Elvidge et al., 2015). The subsequent development of algorithms by the Earth Observation Group (EOG) for the automatic detection of fishing vessels from VIIRS imagery provides an open-source repository of global nighttime fishing effort (Elvidge et al., 2015). These data have proven highly effective for the monitoring of fisheries closures (Elvidge et al., 2018), identifying fishing grounds (Geronimo et al., 2018; Hsu et al., 2019), estimating capacity of illegal, unreported and unregulated fisheries (Oozeki et al., 2018) or combining with government landing statistics to predict stock migration routes (Choi et al., 2008). However, VIIRS imagery has yet to be combined with landings data collected in situ to quantify fine-scale spatiotemporal trends of effort, catch and value in data-poor scenarios. Combination in this manner could enable real-time estimation of biomass removal across large spatial scales and inform targeted fisheries and conservation management.

Fishing fleets using artificial light operate throughout the world's oceans and are prominent across Southeast Asia where these practices are known as “light-boat fishing.” Squid species are generally targeted by these fleets, but small forage fish, such as clupeids, are also targeted in coastal waters (Gorospe et al., 2016). Light-boat fisheries, as with other fish aggregation methods, are often considered high impact, associated with landings of immature fish and have high bycatch rates of vulnerable megafauna due to low-selectivity and small net mesh sizes (Solomon and Ahmed, 2016). Myanmar is one of the top ten fish producing countries of the world, with more than three million metric tons of fish providing 43% of the country's consumed protein per year Food and Agriculture Organisation, 2014; Tezzo et al., 2018). Marine fisheries also provide direct livelihoods to ~1.4 million fishers (Department of Fisheries, 2017). Myanmar's small-scale marine fisheries are characterized as multi-gear, multi-species fisheries, with limited access to external markets (Schneider and Thiha, 2014).

Myanmar is also an example of a country lacking capacity to implement effective management and conduct long-term monitoring. This has led to data on marine fisheries being scarce, especially for the inshore fleet (Tezzo et al., 2018). Government statistics reveal decadal (2003–2012) increases of 121% in landings (Pauly and Zeller, 2016) with small pelagic fish stocks estimated to be at 10% of 1979 levels (Krakstad et al., 2014). Few spatial management areas exist to aid stock recovery (Boon et al., 2016) or protect Myanmar's rich biodiversity and species of conservation concern (Birch et al., 2016). Some gear restrictions exist, including the ban of certain trawl gears in inshore waters, however without enforcement illegal fishing continues unabated (Wildlife Conservation Society, 2018). Whilst the Government of Myanmar has taken steps toward monitoring its marine fisheries through the installation of VMS, this is limited to offshore fishing vessels, with no current monitoring of small-scale vessels. As Myanmar enters a new phase of rapid globalization (Orlov, 2012; Prescott et al., 2017), its marine environment is likely to experience increased pressures in the future. Strengthening governance, improving enforcement capacity and designing community-led initiatives will all be required to resolve wider issues of management capacity. Baseline data on fisheries landings and effort is therefore an important first step to improved marine management for the country.

#### Fish Wars escalate – causes global resource wars and escalates existing hotspots.

Spijkers 20, Jessica. Global patterns of international fisheries conflict. Diss. Stockholm Resilience Centre, Stockholm University, 2020. (Postdoctoral Researcher at CSIRO)//Elmer

International conflict over fishery resources is considered to be a growing security concern. Ongoing, high-profile interstate fishery disputes are sparking concerns of future global fish wars (note: for the remainder of this thesis, terms such as fishery conflicts refer to marine fishery conflicts, excluding conflicts over fresh water species). One of those ongoing interstate disputes is the so-called ‘mackerel war’ between Norway, the European Union (EU), Iceland and the Faroe Islands, which erupted in 2007 when the northeast Atlantic mackerel (Scomber scombrus) stock shifted its distribution towards the north-west of the Nordic Seas and their surrounding waters. The conflict has had disruptive social and ecological consequences: it resulted in the overfishing of the mackerel stock, undermined the coastal states’ management plans, and even contributed to Iceland withdrawing its application to become an EU member state (Spijkers & Boonstra 2017). Another prominent example is that of the South China Sea, where fishers often find themselves on the frontlines of international disputes over fishery resources as China, Vietnam, the Philippines, Taiwan, Malaysia and Brunei fail to resolve competing claims over parts of the area (Dupont & Baker 2014). Although these fisheries conflicts are linked to a larger territorial struggle in the region (with China increasingly militarizing what it has determined to be its maritime sphere of influence), the rich fishing grounds are an important, strategic commodity for surrounding states given that fisheries play a vital role in ensuring food security in the region (Dupont & Baker 2014). Some scholars even claim fish is an ‘overlooked destabilizer’ in the region, and that China’s militarization efforts are a power move intended to dominate marine harvest (Baker et al. 2016, Thomspon 2019) Moreover, environmental conditions that might trigger or exacerbate fisheries conflict are likely to become more widespread in the future, further heightening worries about impending security challenges for ocean governance. First, changing ocean conditions are causing shifts in fisheries resources' distribution patterns, 3 affecting potential yields of and revenues generated from exploited marine species (Lam et al. 2016, Sumaila et al. 2011). This redistribution of resources is expected to result in more fishery disputes, as current fisheries management is predicated on the assumption that the geographical distribution of fish populations is largely static (Pinsky et al. 2018, Cheung et al. 2010). However, climate change will lead to a redistribution of resources and a loss of revenue for the global fishing industry (Lam et al. 2016, Sumaila et al. 2011). Such shifts in resources might become a particular menace for countries with a high dependence on fish protein for nutritional security with countries such as Tuvalu and Kiribati likely to experience the largest decreases in their maximum catch potential due to climate change (Blasiak et al. 2017, Lam et al. 2016). Depending on how the impacts of anthropogenic climate change play out in the global ocean, 23-35% of global Exclusive Economic Zones (EEZs) are projected to receive new transboundary fish stocks by the end of the century (Pinsky et al. 2018). In some EEZs in the already troubled maritime region of East Asia, 10 new stocks are projected to enter as a consequence of climatic changes (Pinsky et al. 2018). In summary, the changes fishery systems will undergo due to climate change are likely to cause disruption to fisheries management globally, and are feared to spark conflict. Second, the global decline in catches, largely as a consequence of overfishing, is also considered to be an accelerating driver of conflict. The abundance of available fishery resources has decreased substantially: 33.1% of fish stocks were fished at biologically unsustainable levels in 2015 (in 1974, this was 10%), and 59.9% fished at their maximally sustainable level (FAO 2018). While effort has increased since the 1950s, catches have stagnated and then slowly declined since the late 1980s (Pauly & Zeller 2017, Pauly & Zeller 2016, Watson et al. 2013). Simultaneously, consumption of and demand for fish is steadily increasing, and the average annual increase in global fish consumption (3.2%) outpaced population growth (1.6%) between 1961 and 2016 (the average annual increase in meat consumption, for example was 2.8% during that 4 same period (FAO 2018)). In combination with disputed maritime boundaries, this increased competition may contribute to volatile situations. International fisheries conflicts are considered a threat to maritime security as they can have far-reaching impacts on marine safety, resource sustainability, geopolitical relations and food security. For example, geopolitical stability and marine safety (safety of seafarers and passengers (Bueger 2015)) were compromised during the infamous Cod Wars that occurred between Great Britain and Iceland during the 1950s and 1970s. The two countries were embroiled in a string of confrontations over fishing rights in the North Atlantic, where Iceland wanted to extend its fishing limit, but Great Britain did not recognize their right to do so. The consequences for geopolitical stability and, at certain stages, marine safety (Bueger 2015) were severe: flash points of the conflict included the use of military vessels to patrol the area and defend fishing boats, patrol boats cutting the nets of trawlers, ships ramming trawlers and frigates, and, ultimately, Iceland threatening to leave NATO (Bakaki 2017). An example of compromised resource sustainability due to an international fisheries conflict is the previously discussed northeast Atlantic mackerel dispute. As a result of the conflict, there are no comprehensive management plans for the stock, and the mackerel has become severely overfished. With countries setting unilateral quotas, their combined catch in 2018 was twice that recommended by the International Council for Exploration of the Sea (ICES), and the fisheries had their Marine Stewardship Council (MSC) certifications retracted (Ramsden 2019, Seamon 2018). Lastly, food security has also been jeopardized due to international fisheries conflict, as exemplified by the incidents taking place in the South China Sea. Fishermen from contending countries that operate in the troubled waters, and whose livelihoods depend on the rich fishing grounds, have at times decided to leave their occupation all together, afraid of going out into the waters without any protection (Patience 2013). Moreover, failure to address rising tensions could lead to greater 5 regional instability and severe environmental degradation, further compromising regional food security (Zhang 2016, deLisle 2012).

### Case

### Space War

#### Public private distinction – analytic

#### Territorial claims solve resource disputes – mining – how acquisition of minerals works in sqo

#### Surplus sovles shortage

#### Private mining dampens space tensions–the alternative is military space programs which triggers US-China war

[**Utrata**](https://bostonreview.net/authors/alina-utrata/) **21** (Alina, PhD Candidate in the Department of Politics and International Studies at the University of Cambridge, and a Gates-Cambridge and Marshall scholar. Her research “Silicon Valley and the State” examines technology corporations as competitors to state power. “Lost In Space” <https://bostonreview.net/articles/lost-in-space/> July 14, 2021)DR 22

Company-states were predicated on an understanding of sovereignty as divisible and delegatory, defying what we today consider “public” and “private” power. Compared to company-states at their zenith, even the largest modern-day multinational **corporation**—and certainly SpaceX and Blue Origin—has significantly less authority, with absolutely no military might to speak of. The monarchies that first granted monopoly charters to these voyaging companies, having evolved into modern states, have also consolidated sovereign authority and gained far more power than their antecedents in previous centuries. Today states, not corporations, are perceived to be the truly dangerous actors in space exploration. Particularly in the context of worsening U.S.-China relations, the **militarization of space by states** is often posited as the most likely way that **celestial encounters** may become violent. On this view, if private U.S. companies were to extract commercial resources from asteroids, it would be a much more peaceful prospect than the U.S. Space Force establishing a military base on the moon.

#### No space war – it’s hype and systems are redundant

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.

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

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

There’s been increasing rhetoric...about the militarization of space and the potential for conflicts on Earth to extend into space. That’s driven in part by reports about anti-satellite testing in Russia and China...The report really grew out of our frustration at the level of publicly available information on this topic.

A lot of what you get are public statements from military leadership or politicians, or sometimes news articles talking about something and it’s really hard to get down to details and...sort through what might be real, what might be hype. Our goal was to dig into the open source material and see what we could determine from a factual standpoint was really going on -- what types of capabilities were being developed and how might they be used in a future conflict.

Ultimately we hoped that would lead to a more informed debate about what U.S. strategy should be to address those threats.

What sort of feedback have you gotten so far?

A lot of the feedback has been either informal or private because a lot of the issues we talk about, people in the government research using classified materials. So it’s difficult for them to give detailed feedback.

In general, the feedback we’ve gotten has been pretty positive. People have said they like the fact that this sort of stuff is being put in the public domain and encouraged us to continue.

Were your findings better or worse than the picture public discourse paints?

In general, it’s a little bit better. A lot of political rhetoric and news stories focus on the most extreme examples, so using kinetic weapons to blow up satellites. While there is research and development going on to develop those capabilities, what we found is there’s yet to be any publicly-known example of them being used.

What is being used and what seems to be of the most utility are the non-kinetic things, like jamming and cyber attacks. The good news is we have yet to see the most destructive kinetic attacks that can cause really harmful long-term damage to the space environment, but unfortunately we are seeing non-kinetic attacks being used, and that’s likely to continue.

#### No China space war – the only scenario for conflict is Earthbound – Chinese military plans prove

Cheng 17 [Dean Cheng, Senior Research Fellow, Asian Studies Center, Davis Institute for National Security and Foreign Policy Heritage. The U.S.-Japan Alliance and Deterring Gray Zone Coercion in the Maritime, Cyber, and Space Domains. Chapter 6. Space Deterrence, the U.S.-Japan Alliance, and Asian Security: A U.S. Perspective. Rand Corporation. 2017]

But while there may be clashes in space, the actual source of any Sino-American conflict will remain earthbound, most likely stemming from tensions associated with the situation in the East China Sea, the Taiwan Strait, or the South China Sea. This suggests that U.S. and allied decisionmakers (both in Asia and Europe) should be focusing on deterring aggression in general, rather than concentrating primarily on trying to forestall actions in space. Indeed, there is little evidence that Chinese military planners are contemplating a conflict limited to space. While there may be actions against space systems, Chinese writings suggest that they would either be limited in nature, as part of a signaling and coercive effort, or else would be integrated with broader terrestrial military operations.

#### Commercial mining solves extinction from scarcity, 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.

#### 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 Shortages Exacerbate Conflict

Wingo 13 - Dennis Wingo, Former CTO of the Orbital Recovery Corporation, Founder & CEO of Skycorp Inc, and Greentrail Energy Inc., Co-Founder & CTO of Orbital Recovery Inc. Leader of NASA's the Lunar Orbiter Image Recovery Project (LOIRP), First in history to rescue and operate a spacecraft (ISEE-3) in interplanetary space, and University of Alabama in Huntsville Consortium for Materials Development in Space Researcher At University of Alabama in Huntsville Consortium for Materials Development in Space “Commentary | The Inevitability of Extraterrestrial Mining”, *Space News*, 7/29/2013, https://spacenews.com/36511the-inevitability-of-extraterrestrial-mining/

I am honored to provide the counterpoint to my esteemed colleague Ambassador Roger Harrison’s negative contention concerning the mining of extraterrestrial materials off of planet Earth. Let’s begin with his ending: “The conclusion is inescapable, though liable to be escaped, i.e., that raw materials will never be mined in space and sold profitably within the atmosphere or anywhere else. … Asteroids will continue unvexed in their obits, and the Moon too.” I bring a different quote, from the book “Empire Express,” the story of the intercontinental railroad, from U.S. Army Lt. Zebulon Pike, for whom Pike’s Peak is named: “In various places there were tracts of many leagues, where the wind had thrown up sand in all the fanciful forms of the ocean’s rolling wave, and on which not a spear of vegetable matter existed.” Pike’s visions of sand dunes, pathless wastes and sterile soils were reported, widely read and faithfully believed by geographers. The myth became innocently embellished by subsequent visitors, especially those in the party of Maj. Stephen H. Long, who traversed the whole area in 1820. It was reported to be “an unfit residence for any but a nomad population … forever to remain the unmolested haunt of the native hunter, the bison, and the jackal.” The delicious irony is that Mr. Harrison today lives in the shadow of Pike’s Peak, and the U.S. Air Force Academy where he teaches is in the middle of the confidently prophesied unmolested haunt. When Long’s report was written, the Erie Canal across New York was five years from completion and it was another 31 years before the first railroad was completed across the state. Mr. Harrison’s technical objections are for the most part valid today for his scenario, just as objections to a railroad across the North American continent were valid in the 1820s. However, technology is being developed today that will enable extraterrestrial mining, manufacturing and development just as technology was developed that would enable the creation of the national railroad. Mr. Harrison says it is an illusion that we are running out of resources. He is correct. That is not our claim. The claim is that extraction costs of economically viable terrestrial resources are rising dramatically and may soon exceed the cost of extraction from much more plentiful extraterrestrial sources. Today rapidly advancing costs and diminishing returns are rapidly redefining mining due to diminishing ore grades. This fact is developed in a 2012 distinguished lecture by Dan Wood before the Society of Environmental Geologists, “Crucial Challenges to Discovery and Mining — Tomorrow’s Deeper Ore Bodies.” This is a vitally important issue to solve as resource conflict has been the impetus for most wars in human history. We live in a global civilization of over 7 billion people, which will expand to over 9 billion before plateauing in mid-century. While American politicians are not paying attention to what this means, the rest of the world is noticing. Gross domestic product (GDP) growth and increasing global resource demand are addressed in “Iron Ore Outlook 2050,” a report commissioned for the Indian government. The GDP of the major powers (the United States, Europe, China, India and Japan) is forecast to rise from $48 trillion in 2010 to $149 trillion by 2050. The report’s substance is that with this massive increase in global GDP, an intensifying scramble for metal resources is inevitable. If the trend of resource consumption demand increase continues unabated, there are three likely potential outcomes. The first is collapse, forecast by the “Limits to Growth” school of thought. The second and more likely scenario is fierce national economic competition leading to wars over diminishing resources. The third, and most desirable, is to increase the global resource base by the economic and industrial development of the inner solar system. Mr. Harrison uses cost as the primary reason that extraterrestrial mining will never happen by focusing on a straw man argument related to mining asteroids in orbits far from Earth. Just as the U.S. railroad infrastructure began on shorter routes with lower capital requirements and shorter payback periods, asteroid mining can begin with our nearest neighbor, the Moon, where telepresence robotics, high-bandwidth communications and a short three-day trip for humans negate his premise. We know from the Apollo samples that plentiful metallic asteroidal materials exist in the lunar highlands. We also know from several missions that extensive water, titanium, thorium, uranium, aluminum and native iron all exist on the Moon, in easily separable oxide form. Improvements in remote sensing data from current missions and computer modeling continue to increase the amount of potential asteroidal material on the Moon, increasing confidence in the Moon first premise. The extensive resources of the Moon become the catalyst for an inner solar system-wide economy providing fuel, vehicles and the all-important experience in developing an industrial infrastructure off planet. The asteroids then become the force multiplier of inner solar system development with billions of tons of water, metals and free space energy from solar power. Mars figures in here as well as the second home of humanity, creating further demand for asteroidal resources, and providing something else that is becoming increasingly scarce on the Earth: hope for the future. The technical barriers that Mr. Harrison points to are being overcome just as those of the 19th century were. New technology developments in 3-D printing, additive manufacturing and advanced robotics are breaking down the final barriers to exploiting off-planet resources and indeed the industrial development of the inner solar system. It is not a question if, it is a question of when, and by whom. Just as the Pacific Railway Act of 1862 was a primary catalyst for a century of American economic growth, it should be the role of government to develop policies and concrete legislation to support this development for the continued health of the American economy and the future of all mankind.

#### 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.

#### Indo-Pak Water War goes Nuclear

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Interstate conflict over water might occur, the ICA indicated, when several states rely on a shared river system for much of their water supply and one or more of the riparian states sought to maximize the river’s flow for their own benefit at the expense of other states in the basin, amplifying any scarcities already present there. “We judge that as water shortages become more acute beyond the next ten years, water in shared basins will increasingly be used as leverage,” the ICA stated. An upstream state enjoying superior control over a river’s flow might exploit its advantage, say, to extract advantage in international negotiations or to attract international aid for infrastructure projects. As the ICA further noted, “…we assess that states will also use their inherent ability to construct and support major water projects to obtain regional influence or preserve their water interests.”16

The utilization of a state’s superior position in a shared river system to extract political or economic advantage can prove especially destabilizing, the ICA suggested, when weaker states in the system (typically the downstream countries) are especially vulnerable to water scarcity because of long-standing social, economic, and political conditions. Without identifying any particular states by name, the study suggested that this could occur when downstream states suffer from endemic corruption, poor water management practices, and systemic favoritism when it comes to the allocation of scarce water supplies. In such cases, any reduction in the flow of water by an upstream country could easily combine with internal factors in a downstream country to provoke widespread unrest and conflict. “Water shortages, and government failures to manage them, are likely to lead to social disruptions, pressure on national and local leaders, and potentially political instability,” the report noted.17

Although most discussion of the climate and water security nexus has continued to emphasize the risk of internal conflict arising from warming-related water scarcities, some analysts have pursued the line of inquiry introduced by the 2012 ICA, focusing on interstate tensions arising within shared river basins. This was a prominent theme, for example, of a 2013 study conducted by the National Research Council (NRC) on behalf of the IC. Entitled Climate and Social Stress: Implications for Security Analysis, the 2013 NRC report sought to better identify the links between global warming, pre-existing social vulnerabilities, and the likelihood of conflict. While it echoed earlier studies by the CNA and NIC in identifying internal factors like poverty, ethnic discord, and governmental ineptitude as likely pre-conditions for climate-related conflict, it also examined dangers arising from dependence on shared river systems, especially in cases where cooperation among the riparian powers in managing the system is limited and global warming is expected to reduce future water flows.18

For the NRC, the river systems of greatest concern in this respect were those that originate in the Himalayan Mountains and depend, for a significant share of the annual flow, on meltwater from the Himalayan glaciers. These glaciers are an important source of meltwater for many of Asia’s major rivers, including the Indus, Ganges, Brahmaputra, and

Mekong Rivers. These rivers originate in China but travel through India, Pakistan, Nepal, Bangladesh, Laos, Cambodia, Thailand, and Vietnam—countries with a combined population of over 3.4 billion people, or approximately 44 percent of the world’s total population.19 A large share of the population in these countries depends on agriculture for its livelihood, so ensuring access to adequate supplies of water is a prime local and national priority. During the monsoon season, heavy rains provide these rivers with abundant water, but during dry seasons they are dependent on glacial meltwater—and, with the rise in global temperatures, the Himalayan glaciers are melting, jeopardizing future water availability in these river basins. Given a history of ethnic and social discord within many of these countries and long-standing tensions among them, analysts fear that such shortages could aggravate both internal and external tensions and ignite interstate as well as intrastate conflict.20

As was the case of previous IC-initiated studies, the authors of the 2013 NRC report were reluctant to identify specific countries in their findings, referring again to “countries of security concern” or other such euphemisms. However, they did select one of these countries in particular: Pakistan. They chose that country for special analysis, the report indicated, because “Pakistan presents a clear example of a country where social dynamics and susceptibility to harm from climate events combine to create a potentially unstable situation.”21 Pakistan was said to suffer from multiple risk factors: Its economy is largely dependent on agriculture; much of the water used for irrigation purposes comes from just one source, the Indus River; control over the allocation of irrigation waters is often exercised by privileged elites, leaving millions of Pakistanis vulnerable to water shortages; and much of the water flowing into the Indus comes from China or from tributaries originating in India, leaving Pakistan in an unfavorable (downstream) position in the system. These conditions have led, in the past, to internal squabbles over water rights and to tensions with India over control of the Indus; now, with the likelihood of diminished meltwater from the Himalayan glaciers, the risk of water scarcity triggering violent conflict of one sort or another becomes that much greater.22

Pakistan, the Indus, and U.S. Security

There is no doubt that Pakistan is considered by U.S. security analysts as a “state important to U.S. national security interests,” the term used by the Defense Intelligence Agency to describe countries of concern in the 2012 ICA on water. Not only is Pakistan a critical—if not always wholehearted—partner in the global war on terror, but it also possesses a substantial arsenal of nuclear weapons whose security is a matter of enormous concern to American leaders.23 Should those munitions wind up with rogue elements of the Pakistani military (some of whose members are believed to maintain clandestine links to radical Islamic organizations), or even worse, should Pakistan descend into civil war and the weapons fall into untrustworthy or hostile hands, the safety of India and other US allies—as well as of American forces deployed in the region—would be at grave risk.24 Ensuring Pakistan’s stability therefore, has long been a major U.S. security objective, prompting regular deliveries of American arms and other military aid. Yet, despite billions of dollars in American aid, Pakistan remains vulnerable to social and ethnic internal strife.25

As noted, farming is the principal economic activity in Pakistan, and ensuring access to water is an overarching public and government concern. This means, above all, managing the use of the Indus—the country’s main source of water for irrigation and its major source of power for electricity generation. Pakistan’s rising population and growing cities, with their rings of factories, are placing an immense strain on the Indus, leading to competition between farmers, industrialists, and urban consumers. With water and power shortages becoming an increasingly frequent aspect of daily life, public protests—sometimes turning violent—have erupted across the country. In one particularly intense bout of rioting, following a prolonged power outage in June 2012, protestors burned trains, blocked roads, looted shops, and damaged banks and gas stations.26

However bad things might be in Pakistan today, climate change is likely to make conditions far worse in the years ahead. Prolonged droughts, climate scientists believe, will occur with increasing regularity, posing a severe threat to the nation’s agricultural sector and further reducing the supply of hydroelectric power. At the same time, warming is expected to increase the intensity of monsoon downpours, resulting in massive flooding (as occurred in 2010) and the loss of valuable topsoil, further adding to Pakistan’s woes. As the Himalayan glaciers melt, moreover, water flow through the Indus will diminish.27 With the competition for land and water resources bound to increase and with Pakistan already divided along ethnic and religious lines, widespread civil strife will become ever more likely, possibly jeopardizing the survival of the state.

It is impossible to predict exactly how the United States might respond to a systemic breakdown of state governance in Pakistan. One thing is clear, however: At the earliest sign that the country’s nuclear weapons are at risk of falling into the hands of hostile parties, the American military would respond with decisive force. In fact, research conducted by the nonpartisan Nuclear Threat Initiative (NTI) has revealed that the Joint Special Operations Command (JSOC) and specialized Army units have been training for such contingencies for some time and have deployed all the necessary gear to the region. In the event of a coup or crisis, the NTI revealed, “U.S. forces would rush into the country, crossing borders, rappelling down from helicopters, and parachuting out of airplanes, so they can secure known or suspected nuclear-storage sites.” Recognizing that any such actions by American forces could trigger widespread resistance by the Pakistani army and/or various jihadist groups, the U.S. Central Command, which has authority over all American forces in the region, has developed plans for backing up JSOC personnel with full-scale military support.28

Another scenario that has some analysts worried is the possibility that a time of sharply reduced water flow through the Indus will coincide with efforts by India to exploit its advantageous position as the upper riparian on three key tributaries of the Indus—the Ravi, the Beas, and the Sutlej—to divert water for its own use, thereby depriving downstream Pakistan of vital supplies and provoking a war between these two countries. India was granted control over the three tributaries under the Indus Water Treaty of 1960, and various Indian leaders have threatened at times to dam the rivers or otherwise reduce their flow into Pakistan as a reprisal for Pakistani attacks on Indian bases in the disputed territory of Kashmir (through which the tributaries flow); this, in turn, has provoked counter-threats from Pakistani leaders.29 What analysts fear most, in such a situation, is that India, possessing superior conventional forces, would overpower Pakistan’s equivalent armies, leading Pakistan’s leaders to order the use of nuclear weapons against India, igniting a regional nuclear war. Such a conflict, scientists have calculated, would result in 50 to 125 million fatalities, and produce a dust cloud covering much of the Earth, decimating global agriculture—an outcome with enormous implications for American national security.30

### Warming

#### Rocket launches aren’t appropriation – neither exclusive or permanent

Trapp 13, Timothy Justin. "Taking up Space by Any Other Means: Coming to Terms with Nonappropriation Article of the Outer Space Treaty." U. Ill. L. Rev. (2013): 1681. (JD Candidate at UIUC Law School)//Re-cut by Elmer

The issues presented in relation to the nonappropriation article of the Outer Space Treaty should be clear.214 The ITU has, quite blatantly, created something akin to “property interests in outer space.”215 It allows nations to exclude others from their orbital slots, even when the nation is not currently using that slot.216 This is directly in line with at least one definition of outer-space appropriation.217

[\*\*Start Footnote 217\*\*Id. at 236 (“Appropriation of outer space, therefore, is ‘the exercise of exclusive control or exclusive use’ with a sense of permanence, which limits other nations’ access to it.”) (quoting Milton L. Smith, The Role of the ITU in the Development of Space Law, 17 ANNALS AIR & SPACE L. 157, 165 (1992)). \*\*End Footnote 217\*\*]

The ITU even allows nations with unused slots to devise them to other entities, creating a market for the property rights set up by this regulation.218 In some aspects, this seems to effect exactly what those signatory nations of the Bogotá Declaration were try3ing to accomplish, albeit through different means.219

#### Extinction from warming requires 12 degrees, far greater than their internal link, and intervening actors will solve before then

Sebastian Farquhar 17, leads the Global Priorities Project (GPP) at the Centre for Effective Altruism, et al., 2017, “Existential Risk: Diplomacy and Governance,” https://www.fhi.ox.ac.uk/wp-content/uploads/Existential-Risks-2017-01-23.pdf

The most likely levels of global warming are very unlikely to cause human extinction.15 The existential risks of climate change instead stem from tail risk climate change – the low probability of extreme levels of warming – and interaction with other sources of risk. It is impossible to say with confidence at what point global warming would become severe enough to pose an existential threat. Research has suggested that warming of 11-12°C would render most of the planet uninhabitable,16 and would completely devastate agriculture.17 This would pose an extreme threat to human civilisation as we know it.18 Warming of around 7°C or more could potentially produce conflict and instability on such a scale that the indirect effects could be an existential risk, although it is extremely uncertain how likely such scenarios are.19 Moreover, the timescales over which such changes might happen could mean that humanity is able to adapt enough to avoid extinction in even very extreme scenarios. The probability of these levels of warming depends on eventual greenhouse gas concentrations. According to some experts, unless strong action is taken soon by major emitters, it is likely that we will pursue a medium-high emissions pathway.20 If we do, the chance of extreme warming is highly uncertain but appears non-negligible. Current concentrations of greenhouse gases are higher than they have been for hundreds of thousands of years,21 which means that there are significant unknown unknowns about how the climate system will respond. Particularly concerning is the risk of positive feedback loops, such as the release of vast amounts of methane from melting of the arctic permafrost, which would cause rapid and disastrous warming.22 The economists Gernot Wagner and Martin Weitzman have used IPCC figures (which do not include modelling of feedback loops such as those from melting permafrost) to estimate that if we continue to pursue a medium-high emissions pathway, the probability of eventual warming of 6°C is around 10%,23 and of 10°C is around 3%.24 These estimates are of course highly uncertain. It is likely that the world will take action against climate change once it begins to impose large costs on human society, long before there is warming of 10°C. Unfortunately, there is significant inertia in the climate system: there is a 25 to 50 year lag between CO2 emissions and eventual warming,25 and it is expected that 40% of the peak concentration of CO2 will remain in the atmosphere 1,000 years after the peak is reached.26 Consequently, it is impossible to reduce temperatures quickly by reducing CO2 emissions. If the world does start to face costly warming, the international community will therefore face strong incentives to find other ways to reduce global temperatures.

#### But warming melts the Arctic—allows trans-Arctic cables that solve cable cutting

Sorokanich 14

(Robert Sorokanich received his BS in Biochemistry from Syracuse University and attended the Jefferson Medical College at Thomas Jefferson University. He was a researcher at the James C. Dabrowiak Lab, Editorial Fellow at Gizmodo, and Auto News Reporter for Hearst Digital Media. Sorokanich, R. “The Trans-Arctic Internet Cable Project Made Possible by Climate Change,” Gizmodo, 8/09/2014, http://gizmodo.com/the-trans-arctic-internet-cable-project-made-possible-b-1618696732//ghs-kw)

Running a telecom cable from London through the Northwest Passage to Tokyo was, for a very long time, impossible: The sea route was solid ice year-round. Now, thanks to rising temperatures, the ice disappears from August to October, and a Canadian telecom startup wants to thread a 10,000-mile internet cable through that gap. Toronto-based Arctic Fibre will soon start surveying the underwater route that would connect the UK with Japan and several spots in between, diversifying the globe's fiber optic data network without relying on land-based cables going through volatile regions of the Middle East, as current connections do. Similar projects, on a much smaller scale, have recently been completed to connect Russia and Crimea. As BuzzFeed reports, telecoms and corporations are clamoring for redundant data connections, still wary of the trouble caused in 2008 when disruptions to the Mediterranean Sea cable slowed or stopped communications across Asia. But routes through the Middle East could make tempting targets for disruption. The Arctic Fibre project would avoid that exact scenario: Aside from its termini in England and Japan, and an anchor point in Canada, the cable would run almost entirely undersea. This, of course, will require elaborate surveying to find a path where the cable won't get snagged by rocks, pulled by tides, or crushed by rock slides. The $620 million project will also bring internet connections to northern Alaska and regions of Canada where data is often unreliable. Undersea surveying will begin in the next few months, using side-scan sonar, digital cameras, electromagnetic probes, and core samples to plot a route across the sea floor. In the past, such a surveying trip wouldn't have been feasible due to year-round ice. Doug Cunningam, Arctic Fibre's CEO, didn't mince words when he explained to BuzzFeed why this project is now feasible: "It is made possible by climate change."

#### Cable cuts deck military readiness

Sechrist 10

(Michael Sechrist is the former project manager and research fellow for ECIR. He is an expert on undersea communication cable security policies and economic models and is the author of "Cyberspace in Deep Water: Protecting Undersea Communications Cables", a policy paper presented to the Department of Homeland Security in spring 2010. He has presented these findings to the Pacific Telecommunications Council and the International Cable Protection Committee (ICPC) and has helped the ICPC develop the first international public-private partnership to protect undersea cables. Current Affiliation: Vice President for Threat and Risk Management. Prepared by Michael Sechrist of the Harvard Kennedy Schoool for the Department of Homeland Security, “CYBERSPACE IN DEEP WATER: PROTECTING UNDERSEA COMMUNICATION CABLES,” 3/23/2010. http://belfercenter.ksg.harvard.edu/files/PAE\_final\_draft\_-\_043010.pdf//ghs-kw)

A “September 10th” mindset permeates relations between the United States (“U.S.”) government and undersea communications cable companies. Communication before and after a cable break is sparse, disjointed and compartmentalized. For catastrophic cable outages, no coordinated mitigation plan exists. Nor is there adequate defense-in-depth in place. There is plenty of room for improvement among all parties. To improve the process, this paper proposes that the Department of Homeland Security create an international public-private partnership to prevent and prepare for the world’s next major cable outage. Cables are vital to global communications and U.S. interests. In the U.S., approximately 95% of all international internet and phone traffic travel through undersea cables.1 Nearly all government traffic, including sensitive diplomatic and military orders, travels these cables to reach officials in the field. In the military, DoD’s net-centric warfare and Global Information Grid (e.g., DoD’s information interoperable system) rely on undersea cables.2 The GIG uses undersea communication cables to provide large segments of DoD personnel living and working overseas with fast, reliable and relatively cheap communication.3 4 A major portion of DoD data traveling on undersea cables is unmanned aerial vehicle (UAV) video.5 In 2010, UAVs “will fly 190,000 hours”6 and the Air Force estimates that “it will need more than one million UAV hours annually to be prepared for future wars.”7 Without ensured cable connectivity, the future of modern warfare is in jeopardy. The stability of the modern financial system is also at risk. Companies use cables to transfer trillions of dollars every day. For example, the Society for Worldwide Interbank Financial Telecommunication (SWIFT), which describes itself as “the global provider of secure financial messaging services,” uses undersea fiber-optic communications cables to transmit financial data between 208 countries.8 In 2004 alone, nine million messages and approximately $7.4 trillion a day was traded on this network.9 Today, nearly 15 million messages a day are sent over it. The CLS Bank, which “operates the largest multi-currency cash settlement system,” conducts over one million transactions and trades over $4.7 trillion dollars a day on the same undersea cables.10 As Stephen Malphrus, Chief of Staff to Federal Reserve Chairman Bernanke recently noted, “When communications networks go down, the financial services sector does not grind to a halt, rather it snaps to a halt.”11 When a cable does lose service, the economic impact is difficult to quantify. One estimate from the International Cable Protection Committee’s legal advisor states that “…service interruptions of these high-bandwidth underwater fiber optics communications systems can result in excess of $1.5 million revenue loss per hour.”12 His estimate deals primarily with losses from cable operator, not those from companies or government entities that own bandwidth on the disrupted cable. In that respect, as well as the fact the estimate is five years old, it can be considered quite low.

#### Readiness collapse causes global war

Spencer 00

(Jack Spencer, Senior Research Fellow at The Heritage Foundation's Roe Institute for Economic Policy Studies, “The Facts About Military Readiness”, Heritage Backgrounder #1394, 9-15, http://www.heritage.org/research/reports/2000/09/bg1394-the-facts-about-military-readiness)

Military readiness is vital because declines in America's military readiness signal to the rest of the world that the United States is not prepared to defend its interests. Therefore, potentially hostile nations will be more likely to lash out against American allies and interests, inevitably leading to U.S. involvement in combat. A high state of military readiness is more likely to deter potentially hostile nations from acting aggressively in regions of vital national interest, thereby preserving peace.