# Harker Mining Case Hit

## Strategy Notes

#### NC

K strat

T – extra short, I don’t think this will be the ideal 2nr most times it’s only there to waste away the ar

K – two links (space war and mutilateralism), impact, alt, and fw. The FW card (peoples 11) can be spun as your PIK solvency advocate, it literally says the aff is good as long as the alt happens first

CP – It’s a recut of their debris internal link. It “solves” their multilat advantage too because their entire multilat advantage is just “we update space law!!” so cp solves case is a great argument to make

Case – this case page is humungous and really good – please lean on in the 2N to prove that their threats are constructed (b/c they are, the cards are all from salty hegemony enthusiasts)

#### Possible 2NRs

Regular K

Floating PIK

CP + a link (we solve case without the reps)

T

#### Some Security 2NR Notes from Max T!

the alt is way harder since it isn't an actual policy (like the communist party or decol)--ur just defending a rhetorical and epistemological shift in how we view IR. u kinda have to win stuff like reps outweigh or precede policy

cross-applying w/ case is really good--answers from case can be used to prove the aff's threat construction and links from the K can disprove the case

LINKS O/W AND TURN CASE--especially on this k since it has a lot of impacts for how realism and bad IR affects policymaking and how it can backfire. This is also good bc FW can be hard with the alt stuff so u can still win the debate if u prove the links are independent DAs

use examples to prove ur point. When u talk about things like threat construction, FoPo predictions are dumb and wrong, realism justifies imperialism or feedback loops from bad policy, make sure to use a lot of examples. this is pretty easy since there is a deluge of them, but u ca check my security file if u want some

interrogate their epistemology--they'll try to say stuff like "but threats real". How do they know the threats are real? Where does the info come from (I mean even further back than the author--how does the author know what they know)? What biases might scholarship have toward imperialist narratives

These are some of the key things I remember, if u have any questions just let me know

#### CX questions

Pelton and Beard say cooperatives space governance is cool, but how does an agreement solely about asteroids lead to full scale space multilateralism?

What are the warrants in Garcia that say mining is coming? The only stuff from the card that supports the tag just says “we are headed towards mining” and the rest of the card just says it is legal

The plan text “restricts asteroid mining by private entities”, how so?

Can countries mine asteroids?

Biggs 18 says we need environmental monitoring from space – why isn’t data collected from Earth enough?

Are there other places resources could be extracted from besides asteroids?

Who goes to war in the event of a debris collision?

IF ANSWER TO THE LAST QUESTION WAS ANYTHING EXCEPT US-RUSSIA:

Well, how does that cause extinction then? Edwards 17 is extremely specific to a US-Russia conflict.

How quickly does the entire satellite system go dark in a Kessler scenario

McKnight 17 says that the reason cluster debris is so dangerous is that it’s not being monitored. How does the plan change this?

## Off (5)

### T (40)

#### Interp: Affirmatives may not defend only specific instances of outer space appropriation by private entities as unjust.

#### Violation: They only identify asteroid mining as unjust

#### Moral statements are generic normative principles – necessitates the generic interpretation

McDonald 09 [Hugh P. McDonald, professor of philosophy at the New York City College of Technology. "Principles: The Principles of Principles." The Pluralist, vol. 4, no. 3, [University of Illinois Press, Society for the Advancement of American Philosophy], 2009, pp. 98–126, https://www.jstor.org/stable/20708996] HWIC

"Principle" has a great many meanings: origin, beginning, cause, rule, axiom, and so on.5 However, we cannot assume any necessary relation of these meanings. They may be distinct meanings without relations. Neverthe less we can trace some common roots and thereby interconnections of the meanings. I will concentrate here on certain meanings relevant to the prin ciple of principles, that principles are actual. One meaning is that principles are the "ultimate source, origin, or cause of something" or the "originating or actuating agency or force." Principles are connected with the origin and cause of any "something." Moreover, principles may cause the actuality of the something. A second meaning of principles is that they regulate change, whether internally, as the "method of operation of a thing," or as an external cause. That is, principles are regulative, especially including rules for opera tions, involving changes. As rules, they are universal for a kind, although there may be exceptions to them in certain modes. A principle, then, is an originating rule that universally regulates the formation, operation, or other changes of any actuality, which as universal applies to that kind of thing. Machines may be built according to a principle and operate on the same or even a different principle. Ships presume the principle of floatation but may be built according to principles of woodworking or those of other materials. The principle can have different modes?whether necessary, as in logical inference; general, as in scientific laws; or actualization of possibilities, as in machines or as in moral principles that we follow, but could do otherwise.6 I will cover modes below.

Principles are also a cause as regulative, combining cause and rule. The principle can be external, as in a chemical catalyst; or internal, as in geneti cally caused changes.7 Both kinds of causes involve relations. Internal prin ciples exhibit "tendencies," to borrow the word used in the dictionary. They continue to operate across time. Actions that come under principles may be of kinds whose causes are separate in time, since we may cease an action for a time and then take it up again; while genetic characteristics are tenden cies whose causes are connected by reproduction. As causal, principles may be originary for a kind. Especially in new technologies, for example, flying machines, the principle that organisms could fly (birds, bats, and insects) preceded the invention of the technology, although the principles of aero dynamics were discovered later. However, flying utilized and actualized the latter principles. In this sense, principles can be constitutive rules as the origin of a kind, whether generic or specific.

External principles are regulative and not attributes. They regulate change, such that change is not chaotic. Principles are not bodies, objects, or entities but are the basis of the judgment or evaluation that the latter will persist, since they follow or are regulated by principles. Moreover, there is another sense in which principles are not attributes, since the relation of bodies, ob jects, or other terms for actualities implies a common principle, an identity that is regulated and constituted by the same actual principle. "Object" is a principle uniting instances normatively, for example, that solids persist unless acted upon by heat, etc.

Scientific, engineering, and practical laws are cases of principles. The "law of gravity" is the principle of gravity. Rules of "right conduct" also exhibit laws. Principles form an identity of different instances that fall under the law, whether generally or invariably. Laws and rules are regulative identities, applicable to different instances, and whether originary, constitutive, or ex ternally regulative. Voluntary adherence to a rule is bringing actions in line with a principle or enacting a principle.

Since principles are general, the statement of a principle includes an abstraction of some identity element of the instance. Principles, then, can constitute the elements in any instance insofar as there are identical ele ments, such as matter, species, and genera. This abstraction both identifies the instance as alike with other instances in some respect and differentiates it from those that do not exhibit the principle. The instance may contain several principles conjointly, matter, the state of the matter, function, aes thetic element, and many others. Thus principles connect like instances in a very complex set of relations. A diamond and a painting may share aesthetic qualities but their material, functional, and cultural principles may be quite different. Since identity and difference are correlative terms, every identity is also a difference and this principle applies to actual principles in the world, one principle of principles. To identify a rock of a certain type as consisting in certain chemical combinations connects it with that kind of mineral in general but also certain chemical elements in general, their physical proper ties (such as consisting of a certain atomic number of protons, electrons, and the like), and other principles. However, it also differentiates the rock from other types with their own specific principles, although some generic prin ciples may overlap, namely, the physical properties of all chemical elements as consisting in protons, electrons, and other principles of atoms. Principles then mark both a difference and an identity. The principles identify a distinc tion, but such identifications differentiate from other identifying principles. The wavelengths for green light are identical at different times of emission from the sun but are not identical with those for red.

#### Negate –

**1] Precision:**

**A] Topicality is the most basic aff burden**

**B] Jurisdiction -- you can’t vote affirmative if they haven’t affirmed**

**C] It’s the only predictable stasis point**

**2] Limits: every specific instance of appropriation can be the aff of the week which kills our core generics and explodes our prep burden**

**T is DTD – our 1NC was influenced by the plantext and there’s no going back**

**Competing interps on T – topicality is a yes/no question, you can’t be reasonably topical, only competing interps create norms -- reasonability is arbitrary and invites judge intervention causing a race to the bottom**

**No RVIs – sandbagging, illogical**

### K (4)

#### Their scripts of escalation and threat in space ensure militarization – Xu 20, Johnson 13, and Grego 18 all spell out possibilities that the AC claims are facts – this rhetoric is dangerous and ensures securitization to continue American space dominance.

Peoples 11

Peoples, Columba (PhD international politics & Critical Security Expert), 2011, “The Securitization of Outer Space: Challenges for Arms Control” Contemporary Security Policy, 32(1), 76–98. doi:10.1080/13523260.2011.5568 // HW AW

It is worth noting that the securitization of outer space – in terms of the identification of space with security – is, in itself, not a novel phenomenon or development. The extent to which **ostensibly civil uses of outer space have been linked implicitly and explicitly to national security** functions historically – or, as in the case of the space race between the United States and Soviet Union, have **acted as a surrogate for direct military engagement** – is well documented.50 Similarly, the characterization of the Sputnik launch in 1957 as placing the United States ‘in the greatest danger in its history’ suggests that the representation of space technologies as potential existential threats is not entirely new either.51 What is of significance, though, is the intensification, expansion and entrenchment of securitizing moves as features of national space policies. The Space Security Index report Space Security 2009, in its overview of national policies, explicitly noted that, on the one hand, ‘National space policies consistently emphasize international cooperation and the peaceful uses of outer space’, but on the other hand that there is a ‘Growing focus within national policies on the security uses of outer space’.52 The report cited as evidence: THE SECURITIZATION OF OUTER SPACE 83 Downloaded by [University of Tennessee, Knoxville] at 06:10 01 January 2015 Japan’s 2008 space law framework, which lifted its previous ban on national security and military space activities; China’s 2006 National Defense White Paper, which identifies national security as principle of China’s emerging space programme; France’s White Paper on Defense and National Security, which calls for an overhaul of its national space strategy; and the renewed priority on ‘space for security’ within EU policy.53 Within recent **United States space policy securitization has been most noticeably prevalent and institutionalized, which is significant given the continued preeminence of the United States as a space power**. As is noted in one recent assessment, around 50 countries, intergovernmental consortia, and nongovernmental organizations have at least one satellite in space, ‘mostly for reasons that have more to do with economic performance and Earth monitoring than with military applications.’54 However, in spite of the increasing diversity of interests in space and the increased range of functions space-based technologies now fulfil, the United States defence budget still remains the single largest source of investment in space technologies. In part this sustained investment arises out of American deployment and development of missile defence systems. Space and missile defences have been intimately connected issues historically and there are obvious technological overlaps between the two. Missile defence systems, including the ground-based system (Ground-Based Midcourse Defence or GMD) currently deployed by the United States at sites in Alaska and California, are dependent on satellite and space-based tracking technologies to detect and track incoming missiles, and there is a possibility that the future connection between missile defence and space will be even stronger if current plans for missile defence are pursued to their fullest extent. Two such systems are already in the early stage of their development: the Space-Based Laser (SBL), which, like the Strategic Defence Initiative or Star Wars proposals of the 1980s, envisages using lasers to shoot down missiles in flight;55 and the ‘NFIRE’ or Near Field Infrared Experiment, a proposal to launch interceptor missiles not from the ground, as in the currently deployed GMD, but from space.56 Even if the developmental status of space-based missile defence interceptors remains uncertain (not least due to the budgetary constraints involved), the currently deployed ground-based system also poses a complex issue in terms of arms control. Though ostensibly intended for defensive purposes, ground and sea-based components of American missile defence could theoretically be employed as an ASAT – Anti-Satellite attack – device, and the use of sea-based Aegis ballistic missile defence capabilities and its Standard Missile 3 (SM3) to shoot down the malfunctioning USA-193 spy satellite in February 2008 has done little to dispel concerns over the offensive applications of current missile defence capabilities.57 In addition, the United States also conducts research into more exotic forms of space weaponry, and funds a variety of technologies aimed at creating a force application capacity from space. The Department of Defense has reportedly explored several highconcept space weapons systems such as Hypervelocity Rod Bundles (tungsten rods dropped on targets from space that would theoretically use gravity as accelerant in a manner akin to a meteor, or Rods from God as they are also colloquially known), the Experimental Spacecraft System (XSS) (a manoeuvrable microsatellite weighing 84 CONTEMPORARY SECURITY POLICY Downloaded by [University of Tennessee, Knoxville] at 06:10 01 January 2015 only 100 kilograms which could prospectively be used to attack other satellites), and the Common Aerospace Vehicle or CAV (this so-called Spaceplane would be unmanned and would orbit the earth, entering the atmosphere when needed to deploy precision guided munitions against selected targets). 58 Such programmes with possible space weapons applications (beyond ground-tospace ASAT capabilities) are still in their relative infancy, and the technical prospects for such technologies, as with the more exotic missile defence proposals outlined above, are far from certain.59 Yet **much of the rhetoric emanating from the United States in recent years has made expansive claims to space dominance far beyond existing capabilities.** In short, rather than seeking to control the means of violence in and from space, much of the military discourse on space has generally cast the United States as a trailblazer in this regard, with exotic systems cited as a necessity for future military dominance in and from space.60 Historically these claims have tended to emanate primarily from the Air Force and Air Force Space Command. In 1998, Space Command defined the control of space (‘space control’) as ‘The ability to assure access to space, freedom of operations within the space medium, and an ability to deny others use of space, if required’61, and space was also considered as part of the remit for ‘full spectrum dominance’ in Joint Vision 2020. 62 Space warriors within and beyond the United States military also make frequent reference to the ‘...importance of dominating space in peace and war’.63 Yet, ‘The **decision to weaponize space does not lie within the military** (seeking short-term military advantage in support of national security) **but at the higher level of national policy** (seeking long-term national security, economic well-being, and worldwide legitimacy of US constitutional values).’64 **Instances of the securitization of outer space within military circles are hardly surprising, given vested interests and the perceived utility of space support for American forces; what is more significant though is the extent to which national policy, though stopping short of explicit advocating of space weapons, has tended to similarly maintain the centrality of space for national security.** 65 As Moore’s ‘biography’ of the idea of unilateral space dominance in the United States attests to, this school of thought has long held a prominent place in American strategic circles.66 Of significance, though, is the extent to which this type of thinking has migrated into official policy, portraying American access to, and dominance of, outer space as key to national survival in the process. The tenure of the George W. Bush administration in particular saw military and policy discourse move much closer in terms of goals and language used, entrenching securitization within United States space policy as a whole. In the terms used above, **the views of space warriors made much greater inroads under the Bush administration, and this has had a significant bearing on how the United States has positioned itself in terms of arms control and how other states – particularly China and Russia – have subsequently defined their own positions**.67 The evolution of official American discourse on outer space over the past decade attests to this subtle shift. In 2001, the Commission to Assess United States National Security Space Management and Organization (or Rumsfeld Space Commission as it is often referred to owing to Donald Rumsfeld’s position as chair) pointed out that a number of states hostile to the United States could attain ASAT capabilities, and, THE SECURITIZATION OF OUTER SPACE 85 Downloaded by [University of Tennessee, Knoxville] at 06:10 01 January 2015 infamously, warned that if the United States did not secure space it would face a Space Pearl Harbor. Members of the Bush administration subsequently went on to effectively endorse the space control concept, asserting the primacy of space for security by openly linking its potential civil and military uses (and thus suggesting only a minimal distinction between the two). Then Deputy Secretary of Defense Paul Wolfowitz argued in a 2002 speech on missile defence that ‘as we look ahead we need to think about areas that would provide higher leverage. Nowhere is that more true than in space. Space offers attractive options not only for missile defense but for a broad range of interrelated civil and military missions. It truly is the ultimate highground.’68 The culmination of this line of thinking in policy terms came with the release of the National Space Policy (NSP) in August 2006, which stated that: The United States considers space capabilities – including the ground and space segments and supporting links – vital to its national interests. Consistent with this policy, the United States will: preserve its rights, capabilities, and freedom of action in space; dissuade or deter others from either those rights or developing capabilities intended to so; take those actions necessary to protect its space capabilities; respond to interference; and deny, if necessary, adversaries the use of space capabilities hostile to US national interests.69 The framing of the arguments from those within the Bush administration thus **clearly aligns with the dynamics of securitization as identified by Buzan et al**. The idea of a Pearl Harbor from Space invokes the nightmare scenario of a surprise attack on American interests in or from space, and was accompanied in the Rumsfeld Commission’s report by the sense of urgency characteristic of securitizing moves: ‘the present extent of US dependence on space [and] the rapid pace at which this dependence is increasing and the vulnerabilities it creates, all demand that US national security space interests be recognized as a top national security priority’.70 The Pearl Harbor analogy implied a focus on a surprise attack itself, but the rest of the report stressed the radical implications of such an attack, suggesting a **potential existential threat** to American commerce, society and, ultimately, way of life. As the report noted, ‘Space enters homes, businesses, schools, hospitals and government offices through its applications for transportation, health, the environment, telecommunications, education, agriculture and energy. Much like highways and airways, water lines and electric grids, services supplied from space are already an important part of the US and global infrastructures.’71 In turn, the NSP of 2006 repeated many of these same securitizing moves. It elevated national security functions of United States space policy, declaring these as vital to national interests, and national security as ‘critically dependent upon space capabilities... this dependence will grow.’ Similarly, the NSP described United States space systems as critical to ‘...a wide range of civil, commercial, and national security users’, identifying the wider security implications of space as well as its more direct military uses.72 **Crucially, this securitization of space was then used to justify exceptional measures with regards to arms control and the previous era of multilateral space agreements**. Among the ‘actions necessary’ to protect space capabilities the NSP declared that: 86 CONTEMPORARY SECURITY POLICY Downloaded by [University of Tennessee, Knoxville] at 06:10 01 January 2015 The United States will oppose the development of new legal regimes or other restrictions that seek to prohibit or limit US access to or use of space. Proposed arms control agreements or restrictions must not impair the rights of the United States to conduct research, development, testing, and operations of other activities in space for US national interests.73 This sentiment had effectively been put into practice even before its formalization in the NSP 2006, with the United States abstaining from votes on the UN General Assembly PAROS (Prevention of an Arms Race in Outer Space) resolution in 2000 and an amended version in 2003, and then voting against it in 2005.74 In this sense the 2006 NSP functioned as a kind of retrospective justification of the exceptional stance adopted – on security grounds – by the Bush administration in relation to space law and arms control. In addition, and moving away from a purely textualist understanding of securitization, the destruction of the USA-193 satellite in 2008 might be seen to constitute an extra-discursive instance of securitization. Although this action was not defined explicitly in terms of a military security rationale (government agencies stressed the rationale for the shoot-down in terms of preventing the malfunctioning satellite from crashing to Earth), it left clear room for interpretation, intended or not, of American willingness to display military space capabilities and further embellished the connection between space and (military) security.75

#### Reject no link arguments – Johnson 13 is a page of whining about how the American advantage might be lost

#### This link is concrete - the tag of Xu reads “mining WILL cause war”, but the card reads “private entities might militarize in a worst case scenario” – this exaggeration is what justifies preventative action

Fengna Xu 20, Law School, Xi’an Jiaotong University, “The approach to sustainable space mining: issues, challenges, and solutions,” Fengna Xu 2020 IOP Conf. Ser.: Mater. Sci. Eng. 738 012014

3.1. Conflicts between multiple States Space resources, as res communis [3], can be appropriated to some extent on the basis of freedom of exploration and use of the outer space. However, it is likely to follow a ‘first come, first served’ approach to space resources activities. In fact, the ‘first come, first served’ approach drove early and rapid development of oil industry of the US in the 19th century, although a frenetic race among surface owners followed and led to an extraordinary waste of oil and gas. Given that so far there are no agreement or property rights on space resources, they are essentially in a ‘state of nature’. Allocation by the ‘first come, first served’ approach is simple and requires very little government involvement to deter another one (called a ‘junior’) from displacing the rightful first comer (called a ‘senior’). However, overprotecting the senior by priority rights **could** run the risk of disorder, waste, inequality, and even monopoly. The Outer Space Treaty, requires State parties to conduct all their activities in outer space ‘with due regard to the corresponding interests of all other States Parties’. Without specific coordinating rules, conflicts between multiple States are likely to happen. Private entities **may** **choose** to arm themselves to safeguard their own interests. **In extreme cases**, States may also protect them by placing weapons of mass destruction in outer space if necessary [4]. As a result, priority rights should not be absolute but subjected to some arrangements. 7

#### Liberal optimism regarding the efficacy of multilat locks in biopolitical modes of governmentality which legitimize military interventions – reject using security as an objective to achieve it

Bosold, IR Prof @ University of Marburg, 8

(David Bosold, University of Marburg, Germany Nikola Hynek, Masaryk University in Brno, Czech Republic“Beyond liberal bio‐politics: Imagining a post‐human security form of individual security,” <http://www.eisa-net.org/be-bruga/eisa/files/events/turin/Bosold-Bosold&Hynek_SGIR.pdf>)

The current problem with the ‘human’ in human security can thus be seen in the apparent use as a so‐called referent object (in addition or instead of the state). The category ‘human’ as such, however, does not entail any accepted logic of how and by whom this state of security is to be realised, neither how this state of security is characterised. What can be observed, though, is a biopolitical and/or military enforcement of the ‘liberal peace’ in the name of universal principles which do, however, rest on the premise that the only legitimate form of governmentality able to secure humans is the liberal state (Chandler 2004; Cohen 2003). It is here where the nexus of sovereignty and legal universality finds a political expression. Although procedures and codifications exist to, both, legitimising military interventions through of an un‐vetoed UN Security Council mandate as well as securing the ‘human’ in the sense of economic, social and political rights to which he or she is entitled (including the most basic rights of human dignity and physical integrity) we can observe political practice that are intended to transcend the sovereignty of non‐ liberal states to a post‐national sphere of international legalisation. This type of analysis which observes a general shift in the locus of power away from the nation‐ state towards a post‐national liberal empire (most prominently proclaimed by Hardt and Negri 2000) or some kind of global governmentality (Larner and Walters 2004; Perry and Maurer 2004) however underestimates the willingness on behalf of liberal states to protect and defend their respective sovereignty. Secondly, it applies Foucault’s concepts of biopower and governmentality prematurely in ‘scaling them up’ to a political space beyond the nation‐state (cf. Selby 2007: 326, 334). We should thus rather proceed by analysing ‘human security’ as a form of concerted foreign policy. Hence, even if recommendations of how to redefine state sovereignty result in concrete policies of some states having the right to intervene (with the ICISS using the more euphemistic term: responsibility to react/protect) in the affairs of others, it remains still unclear which measures have to or should be taken to provide for the security of the individual. More fundamentally, however, actors from the outside define the state of security as well as the means to achieve it. This is because their conceptualisation (unsurprisingly) does not transcend the state but relates human security to a certain kind of governmentality that seeks to protect the individual from quantifiable and objectified threats. Following that logic the referent object of security becomes shifted from the state to the individual. Yet, only some states are allowed to protect an externally defined group by using certain kind of means. Put differently: while political decisions are taken to protect individuals neither are these individuals involved in some deliberative process whether they want to be freed from the externally specified threat(s) nor how this is going to take place. At the centre of this problematique lies a (self‐righteous) understanding of liberal governments to associate the external enforcement of human rights with a hybrid form of national/post‐national sovereignty and a narrative of progress. Increased legal regulation and codification in international law becomes equated with a teleology of the rule of law as superior to the political which is seen as an impediment to peace (Haltern 2007). This argument is in need of further elaboration. While we briefly discussed the changing locus of sovereignty from a ‘representative’ of the divine will in the form of the absolutist monarch to the ‘imagined community’ of the nation the idea of statehood, (post‐)national responsibility and the Westphalian (state) system has undergone a liberal metamorphosis that is hybrid and paradoxical in character. Human Security as a leitmotif of foreign policy reconstructs the legitimacy of liberal rule in Western societies through a narrative of interdependence, human insecurity abroad and a domestic politics based on values. As the Canadian White Book of 1995 puts it: “Successful promotion of our values ‐ respect for human rights, democracy, the rule of law, and the environment ‐ will make an important contribution to international security in the face of new threats to stability. Acceptance of such values abroad will help safeguard the quality of life at home: Canada is not an island able to resist a world community that devalued beliefs central to our identity” (DFAIT 1995: Summary). This new epistemic reality then translates into a reconsideration of the means to sustain the end: the ontological security of the liberal state (Mitzen 2006). While it is less challenged in its territorial integrity ‘new’ security threats make it more vulnerable than ever before. The claim of former German defence secretary Peter Struck that “Germany’s security is also defended at the Hindu Kush” (Netzeitung 2004) is on the one hand illustrative of this discursive shift to frame (national) security in terms of interdependence. On the other hand proponents of human security, such as the Study Group on Europe’s Security Capabilities working for Javier Solana have identified an “enlightened self‐interest” (SGESC 2004: 10) for adopting a human security approach and relate it to a moral dimension (ibid.: 9). Thus, the justification for acting becomes not only justified in cases where no ‘existential threat’ to the state exists (Buzan, Waever, de Wilde 1998: 21‐22). It is even portrayed as a legal obligation for the liberal state to extend its domestic duty to guaranteeing security (as rooted in the social contract) beyond its territorial border. Whatever the prospects for a new governmentality of ‘human’ security may be: the politics of human security – or better the biopolitical governance called human security – needs to be transcended in order to arrive at a point where ‘post‐human security’ politics is possible. Not only is human security in current academic and political discourse unthinkable without reference to the nation state, sovereignty and, thus: the conception of national security. Crucial to a different understanding of ‘human’ security is the imagination of a condition in which the individual is thought of as ‘human’ without reference to various forms of biopolitics. In that respect one has reflect on the liberal, euro‐centric character of contemporary security governance (Acharya 2000) and should try to re‐conceptualise the ‘human’ in the security discourse as: (a) a member of and individual belonging to diverse forms of community (Bauman 2003, Linklater 2005) rather than a citizen whose security is to be protected by the state (that is itself reduced to the governmental logic of advanced liberalism), (b) a culturally influenced (or constructed) human being with an individual (subjective) perception of his/her security (Barkawi and Laffey 2006) rather than a human with a quantifiable and generalisable need of protection (c) an individual able to exert ‘choice’ (Booth 1991) as opposed to an ‘over‐ securitised’ victim of a biopolitics through intervention. In doing so, we think that the current securitisation of humans or individuals does not secure humans, rather it – successfully – securitizes the political means and ends of a politics proclaiming to secure individuals. Put differently: not the individual and its freedoms become secur(itis)ed, but the political machinery to define who is to be secur(itis)ed and from what (one might argue from exercising his/her own freedom thereby creating his/her security). Worse, no teleological character or component of human security (beyond a global political space of liberal states) exists, hence making individual security the object of forces legitimised (or claiming legitimacy) for any alteration in their unrestricted course of action. What is thus needed in order to push for a different form of human security politics is not a debate on the relationship of the state vs. the individual but rather on the governmental practices who define which kind of actor is given the right (or power) to define who is to be protected and how that this is going to happen. Since security is not only a ‘contested concept’ (Connolly) but an ambigous term entailing the subjective feeling of being secure and the (objective?) absence of a threat it becomes obvious that human security must take into account various subjectivities of security.

#### Threat imagery impoverishes scholarship and policy making- their claims can't be evaluated outside of the project of security that created them. Self Fulfilling prophecy outweighs aff predictions offense

Gregory D Foster, J. Carolton Ward Distinguished Prof. National Defense University, West Point Grad 69, PhD from GWU, Interrogating the Future: The Question of Long-Term Threats, Alternatives 19 1995

Where, then, does this leave us—in an elevated state of awakening or in a depressed state of confusion and resentment? It is, admittedly, burdensome and intimidating to face a deluge of questions without being afforded the intellectual crutch of an authoritative answer or two. That is the price we pay, though, for having allowed our minds to be crippled by Cold War dogma. Possessed of truth, we ignored, we denied, we disdained anyone or anything that contradicted our certainty. We did not question, we did not seek answers other than the ones we already had. To do so would have been superfluous, and clearly suspect. Now we must undergo corrective surgery. Whatever answers might emerge from the questions posed here, three fundamental issues deserve our attention. The first concerns the very language—the terminology—we use in public discourse. In his rather well-known 1946 essay, "Politics and the English Language," George Orwell drew the link between the debasement of language and the decline of civilization. He was convinced that both conditions were taking place in tandem at the time he wrote. By the same token, he believed the problem could be reversed. By ridding oneself of the many bad habits of English usage we have adopted, one can think more clearly, he said, and thereby take the first step toward political regeneration.74 The use of the word "threat" certainly seems to fit here. Although it is not a new word, the Cold War gave it heightened visibility, broadened and obscured its meaning, and made it part of the lingua franca of contemporary international politics. What should be all too obvious is the adversarial image the term conveys and the Manichean world view it engenders. Threattalk becomes threatthink. The resultant paranoia and intolerance invariably blind us to emerging developments and conditions that truly threaten our well-being but fall outside the bounds of our distorted perception. This brings us to a second fundamental issue: the effect our image of threat has on reality. The late Kenneth Boulding made the astute observation that there is a reciprocal, escalatory dynamic associated with threat imagery. For example, Country A, feeling itself threatened (however and for whatever reasons) by Country B, increases its armaments to reduce its insecurity. This makes B feel threatened, and so B increases its armaments to bolster its security. This makes A feel even more threatened, so A again increases its armaments. This growing threat "forces" B to further increase its armaments. And so on until either war breaks out or some other change (such as internal economic collapse) reverses the process.75 This is how threatthink becomes threat. If there is a single, documentable truth to be derived from an assessment of threat-based thinking, it is that the perception of threat— at least where that threat has a human component—almost invariably becomes a self-fulfilling prophecy. For this reason alone—the fact that we have shown ourselves perversely capable of creating unwanted inevitability—we must face up to a third fundamental issue: the more general failure of our overall approach to envisioning the future. Most of us justifiably consider ourselves unqualified to divine the future. We therefore typically defer to experts and authorities—futurists and assorted government technocrats presumably possessed of special powers or information the rest of us do not have—who end up thereby dictating not only our future but our present as well. These are the individuals who tell us not only that there are threats, but what they are and how we must deal with them. What we refuse to recognize is that the future these purported visionaries are able to see is invariably nothing more imaginative than a simple projection of what already is happening. It also is an assured way for them to solidify and perpetuate their own power over us. The future they see, because the rest of us accept it on authority as all but inevitable, closes out any perceived need to pursue other potentially fruitful possibilities; it provides an excuse for ignoring present needs that, if fulfilled, might well produce a markedly different future; it ensures nothing more enlightened or progressive than creeping incrementalism and evolutionary drift; it creates false expectations about what can and will be; and when it fails to materialize—as it so often does because of the unexpected-it produces feelings of helplessness, not among the purveyors of the deception, but among those of us who have so carelessly relinquished our fate to them.76 Threats are in the future. Threat assessment is about the future. Vision is of the future. The Cold War clouded our vision and crippled our ability to determine, objectively, whether there are threats that should concern us, what they are, why they are important, and how we should deal with them. Our future will depend in large measure on our willingness to overcome our Cold War myopia and to demonstrate a newfound degree of individual and collective vision. Whether vision is a gift or an acquired skill, we will have to seek out the visionaries in our midst who can either lead the rest of us less gifted out of our self-imposed darkness or at least stand as models on which we can pattern ourselves. And how will we know vision when we see it? We need not doubt that its presence will be so unlike anything we are used to, we will know. But if we are searching for a standard against which to judge, we could do no better than to recall the surpassing insight Abraham Lincoln demonstrated on at least one occasion at the height of the US Civil War. At an official reception, the president referred to Southerners rather as erring human beings than as foes to be exterminated. An elderly lady, a fiery patriot, rebuked him for speaking kindly of his enemies when he ought to be thinking of destroying them. "Why, madam," said Lincoln, "do I not destroy my enemies when I make them my friends?',77 (86-88)

#### The alternative is to reject the AFF’s security representations as a critical intellectual labor that makes imagination of a more peaceful future possible. Neocleous 08

(Neocleous 8 — Prof of Government @ Brunel University; London (Mark, Critique of Security, pg. 184-5)

Anyone well versed in history or with experience of university life will know about the shameful ways in which large numbers of academics have elevated venality into the cardinal academic virtue, complying with the demands of those in power and the wishes of those with money: witness the political scientists, historians, anthropologists, geographers, cartographers, sociologists, linguists and many others who reworked their disciplines according to the principles and myths, and the principle myths, of fascism.' 'Academic life under fascism', notes Christopher Hutton, 'is a dismal ... episode in an unedifying story of relations between the modem academic and the state, and between academics and power both within and outside the university. But this part of the history of fascism is merely the worst moment in the wider and equally unedifying story of relations between academics and the state more generally, merely one way m which intellectuals have kowtowed to the principles and myths, and the principle myths, concerning security and the state. Spouting the jargon of security and enthralled by the trappings of power, their intellectual labour consists of nothing less than attempts to write hand-books for the princes of the new security state. The death of countless numbers in a more 'efficient' bombing of a city, the stationing of troops halfway around the World in order to bring to an end any attempt at collective self-determination, the use of military machines against civilians, the training of police forces in counter-insurgency practices, but more than anything the key concepts and categories used to explain and justify these things - all defended, supported and even ‘improved” by security intellectuals for whom, ultimately, intelIecua1 labour boils down to little more than the question of the most efficient manner. In which to achieve the security demanded by the state and bourgeois order. In rationalizing the political and corporate logic of security, the security intellectual conceals the utter irrationality of the system as a whole. The security intellectual then is nothing less than the security ideologue, peddling the fetish of our time. The only way out of such a dilemma, to escape the fetish, is perhaps to eschew the logic of security altogether - to reject it as so ideologically loaded in favour of the state that any real political thought other than the authoritarian and reactionary should be pressed to give it up, That is clearly something that can not be achieved within the limits of bourgeois thought and thus could never even begin to be imagined by the security intellectual. It is also something that the constant iteration of the refrain ‘this is an insecure world’ and reiteration of one fear, anxiety and insecurity after another will also make it hard to do, but it is something that the critique of security suggests we may have to consider if we want a political way out of the impasse of security. This impasse exists because security has now become so all-encompassing that it marginalizes all else, most notably the constructive conflicts, debates and discussions that animate political life. The constant prioritizing of a mythical security as a political end - as the political end - constitutes a rejection of politics in any meaningful sense of the term. That is, as a mode of action in which differences can be articulated, in which the conflicts and struggles that arise from such differences can be fought for and negotiated, in which people might come to believe that another world is possible - that they might transform the world and in turn be transformed. Security politics simply removes this; worse, it removes it while purportedly addressing it. In so doing it suppresses all issues of power and turns political questions into debates about the most efficient way to achieve ‘security’, despite the fact that we are never quite told - never could be told – what might count as having achieved it. Security politics is, in this sense, an anti-politics,” dominating political discourse in much the same manner as the security state tries to dominate human beings, reinforcing security fetishism and the monopolistic character of security on the political imagination. We therefore need to get beyond security politics, not add yet more ‘sectors to it in a way that simply expands the scope of the state, and legitimizes state intervention in yet more and more areas of our lives. Simon Dalby reports a personal communication with Michael Williams, co-editor of the important text Critical Security Studies, in which the latter asks: if you take away security, what do you put in the hole that’s left behind? But I’m inclined to agree with Dalby: maybe there is no hole. The mistake has been to think that there is a hole and that this hole needs to be filled with a new vision or revision of security in which it is re-mapped or civilised or gendered or humanised or expanded or whatever. All of these ultimately remain within the statist political imaginary, and consequently end up re-affirming the state as the terrain of modem politics, the grounds of security. The real task is not to fill the supposed hole with yet another vision of security, but to fight for an alternative political language which takes us beyond the narrow horizon of bourgeois security and which therefore does not constantly throw us into the arms of the state. That’s the point of critical politics: to develop a new political language more adequate to the kind of society we want. Thus while much of what I have said here has been of a negative order, part of the tradition of critical theory is that the negative may be as significant as the positive in setting thought on new paths. For if security really is the supreme concept of bourgeois society and the fundamental thematic of liberalism, then to keep harping on about insecurity and to keep demanding ‘more security’ (while meekly hoping that this increased security doesn’t damage our liberty) is to blind ourselves to the possibility of building real alternatives to the authoritarian tendencies in contemporary politics. To situate ourselves against security politics would allow us to circumvent the debilitating effect achieved through the constant securitizing of social and political issues, debilitating in the sense that ‘security’ helps consolidate the power of the existing forms of social domination and justifies the short-circuiting of even the most democratic forms. It would also allow us to forge another kind of politics centered on a different conception of the good. We need a new way of thinking and talking about social being and politics that moves us beyond security. This would perhaps be emancipatory in the true sense of the word. What this might mean, precisely, must be open to debate. But it certainly requires recognizing that security is an illusion that has forgotten it is an illusion; it requires recognising that security is not the same as solidarity; it requires accepting that insecurity is part of the human condition, and thus giving up the search for the certainty of security and instead learning to tolerate the uncertainties, ambiguities and ‘insecurities’ that come with being human; it requires accepting that securitizing an issue does not mean dealing with it politically, but bracketing it out and handing it to the state; it requires us to be brave enough to return the gift.

#### The K comes first – scholarly analysis is a prior task to effectively regulating private enterprise

Peoples 11

Peoples, Columba (PhD international politics & Critical Security Expert), 2011, “The Securitization of Outer Space: Challenges for Arms Control” Contemporary Security Policy, 32(1), 76–98. doi:10.1080/13523260.2011.5568 // HW AW

The context in which outer space is used by international actors is evolving rapidly and in potentially divergent directions. Most prominently, the increased use of space-based technologies to provide critical elements of national and international infrastructure (such as media, communications, and environmental monitoring) has been accompanied by growing dependence on space-based elements of military support such as reconnaissance, military surveillance, and targeting. At the same time, **the variety of actors claiming an interest in access to, and use of, outer space is also proliferating rapidly to include states, regional organizations, and private enterprise**.1 The combination of these developments raises the question of whether outer space is the site of a nascent security dilemma, wherein even ostensibly nonmilitary uses of outer space may generate dynamics of military competition due to the latent dual-use potential of many commercial space technologies.2 In light of the above, many have argued that the existing regulation of the use of outer space (originally developed within the Cold War context and the era of the ’space race’ between the United States and Soviet Union)3 needs to be reviewed, revised and updated, particularly with the emergence of new space powers such as China, India and, as a regional actor, the European Union.**4 Before this can proceed**, however, and given that a shared consensus on a revised international framework on the use of outer space has thus far been elusive, **greater research needs to be undertaken into the terms in which key international actors view outer space and how they perceive and construe their interests in this regard.** With regard to the current state of the field of space security, academic considerations of this subject recurrently tend to break down into a distinction between militarization and weaponization, and discuss the relative merits of each for space powers.5 Space militarization generally denotes the use of space-based technology and infrastructure for the purposes of supporting military operations and functions (including reconnaissance, navigation, and use of satellite targeting systems for terrestrial weapons). Space weaponization is usually taken to refer to the actual placement of weapons in outer space, although the precise definition of the term is often muddied by issues of whether targeting from space itself represents de facto weaponization, and considerations of whether the capacity to attack satellites with land-based ballistic missiles (or other such forms of rudimentary Anti-Satellite Attack Technologies [ASATs]) constitutes a latent form of space weaponization. As a result, academic analysis has tended to become bogged down in the same debates over the finer points of distinguishing between militarization and weaponization that have persistently dogged proposals for new international frameworks on the Contemporary Security Policy, Vol.32, No.1 (April 2011), pp.76–98 ISSN 1352-3260 print/1743-8764 online DOI: 10.1080/13523260.2011.556846 # 2011 Taylor & Francis Downloaded by [University of Tennessee, Knoxville] at 06:10 01 January 2015 use of outer space. **By contrast, this article proposes the introduction of the alternative concept of securitization from the field of critical security studies as a better means of capturing the exact relationship between space and security within the contemporary policy discourses of major space-faring powers, and as a means to open up a broader discussion of Controlling the Means of Violence (CMV) in relation to outer space.** Securitization refers to the discursive processes by which a particular issue comes to be spoken and thought of as a security issue, with particular reference to the ways in which policy makers successfully employ securitizing moves or speech acts. 6 Taking this perspective it is possible to argue that outer space is rapidly becoming securitized in important aspects that are largely missed by current academic accounts, and this has implications both for thinking through more traditional forms of arms control and the more expansive CMV perspective suggested in this special issue. To make this argument, the article maps the current context of space arms control and the contemporary challenges it faces, assessing key definitional issues with regard to debates over space security and arms control in further detail. It then outlines an alternative framework for understanding and conceptualizing space security based on the idea of securitization, illustrating this via an analysis of space securitization in American and European Union space policy discourses. Here it compares the historical understanding of space security in the established discourse of American space policy with the more recently emergent discourse of the EU. This comparative analysis is used to generate critical reflections on the idea of space securitization and its implications for thinking through both arms control (in a more traditional understanding) and the more expansive idea of CMV with regard to outer space. In particular, the concluding section of the article uses the previous analysis to open up a broader debate on whether the securitization of outer space is to be avoided or encouraged from a CMV perspective.

## Case (2)

### Adv 1

#### Probability – 0.1% chance of a collision.

Alexander William Salter, Economics Professor at Texas Tech, ’16, “SPACE DEBRIS: A LAW AND ECONOMICS ANALYSIS OF THE ORBITAL COMMONS” 19 STAN. TECH. L. REV. 221 \*numbers replaced with English words

The probability of a collision is currently low. Bradley and Wein estimate that the maximum probability in LEO of a collision over the lifetime of a spacecraft remains below one in one thousand, conditional on continued compliance with NASA’s deorbiting guidelines.3 However, the possibility of a future “snowballing” effect, whereby debris collides with other objects, further congesting orbit space, remains a significant concern.4 Levin and Carroll estimate the average immediate destruction of wealth created by a collision to be approximately $30 million, with an additional $200 million in damages to all currently existing space assets from the debris created by the initial collision.5 The expected value of destroyed wealth because of collisions, currently small because of the low probability of a collision, can quickly become significant if future collisions result in runaway debris growth.

#### Garcia 18 doesn’t say mining is increasing now, it says mining is legal, but doesn’t account for all of the technological barriers. Hold ev to a super high standard – if we prove mining won’t happen, then all of their advantages are false. Pref our ev for specificty and recency

Fickling 20

David Fickling (columnist covering commodities and industrial and consumer companies, reporter for Bloomberg, Dow Jones, WSJ, Financial Times, Guardian.; “We’re Never Going to Mine the Asteroid Belt”; *Bloomberg News*; December 21, 2020; <https://www.bloomberg.com/opinion/articles/2020-12-21/space-mining-on-asteroids-is-never-going-to-happen>; HW-EMJ

It’s wonderful that people are shooting for the stars — but those who declined to fund the expansive plans of the nascent space mining industry were right about the fundamentals. Space mining won’t get off the ground in any foreseeable future — and you only have to look at the history of civilization to see why. One factor rules out most space mining at the outset: gravity. On one hand, it guarantees that most of the solar system’s best mineral resources are to be found under our feet. Earth is the largest rocky planet orbiting the sun. As a result, the cornucopia of minerals the globe attracted as it coalesced is as rich as will be found this side of Alpha Centauri. Gravity poses a more technical problem, too. Escaping Earth’s gravitational field makes transporting the volumes of material needed in a mining operation hugely expensive. On Falcon Heavy, the large rocket being developed by Elon Musk’s SpaceX, transporting a payload to the orbit of Mars comes to as little as $5,357 per kilogram — a drastic reduction in normal launch costs. Still, at those prices just lofting a single half-ton drilling rig to the asteroid belt would use up the annual exploration budget of a small mining company. Power is another issue. The international space station, with 35,000 square feet of solar arrays, generates up to 120 kilowatts of electricity. That drill would need a similar-sized power plant — and most mining companies operate multiple rigs at a time. Power demands rise drastically once you move from exploration drilling to mining and processing. Bringing material back to Earth would raise the costs even more. Japan’s Hayabusa2 satellite spent six years and 16.4 billion yen ($157 million) recovering a single gram of material from the asteroid Ryugu and returning it to Earth earlier this month. What might you want to mine from space? Water is an essential component of most earth-bound mining operations and a potential raw material for hydrogen-oxygen fuel that could be used in space. The discovery in October of ice molecules in craters on the Moon was taken as a major breakthrough. Still, the concentrations of 100 to 412 parts per million are extraordinarily low by terrestrial standards. Copper, which typically costs about $4,500 per metric ton to refine, has an average ore grade of about 6,000 ppm. The more promising commodities are platinum, palladium, gold and a handful of rare related metals. Because of their affinity for iron, these so-called siderophile elements mostly sunk toward the metallic core of our planet early in its formation, and are relatively scarce in the Earth’s crust. Estimates of their abundance on some asteroids, such as the enigmatic Psyche 16 beyond the orbit of Mars, suggest concentrations several times higher than can be found in terrestrial mines. Still, human ingenuity is all about cutting our coat according to our cloth. If such platinum-group metals are going to justify the literally astronomical costs of space mining, they’ll need to count on sustained high prices for the decade or so that would be needed to get such an operation up and running — and that sort of situation is all but unheard-of in the materials industry. When prices of an essential commodity get excessively high, chemists get extraordinarily good at finding ways to avoid using it, scrap merchants improve their recycling rates, and miners discover new deposits that wouldn’t have been viable at lower prices. Even criminals get in on the game. That eventually pushes supply up and demand down, so that prices rebalance — a dynamic we’ve seen play out in the markets for rare earths, lithium and cobalt in recent years. The world mines about three times more platinum than it did in the early 1970s, but prices have barely changed once adjusted for inflation. That might sound a disappointing prospect to those looking for excuses for humanity to colonize space — but really it should be seen as a tribute to our ingenuity. Humanity’s failure to exploit extraterrestrial ore reserves isn’t a sign that we lack imagination. If anything, it’s a sign of the adaptive genius that put us in orbit in the first place.

#### Gent 20 says that US policy is terrible, stops multilateralism, and lets countries mine without restriction. This ev proves the plan will get fought tooth and nail by the us and inevitably get watered down

#### Johnson 13 is classic exceptionalism– it spells out the problem that everyone, including the US contributes to and then says only the US capabilities deserve to be preserved – this is the exact logic that justifies securitization and intervention

#### Edwards 17 is ONLY about us-russia war, but their internal link is about every space-faring nation. They’re missing a card that says russia attacks if our sats go out – Johnson 13 is too old and isn’t russia-specific. Their link chain isn’t complete

#### Environmental monitoring as per biggs 18 is a joke and only is the oil industry’s current ploy to say “we don’t have enough tech to know we are killing the environment” – it’s just false

#### Grego 18 is also in the context of international war, and no nations are going to war to protect the asteroid that a given company wants

### Adv 2

#### Wall 20 concedes public sector alt cause in the small text:

For decades, spacefaring nations have been licensing launches internally, without much international coordination, cooperation or long-term planning. In recent years, low-Earth orbit has become crowded enough with satellites and hunks of debris that collisions are a real concern. For example, the International Space Station has had to maneuver itself away from potential impacts three times so far in 2020 alone.

#### Beard 17 says every country has to be involved for it to be fair, but the plan only involves space-faring nations – treat this as a terminal solvency takeout because their internal link disagrees with the plan text

#### Pelton 17 and gallagher 13 says if we had an international space framework that would be cool, but all the plan does is making mining a little harder for companies – they don’t make the progress that either card sets the threshold for solvency at

#### Blake 17 says that establishing such a framework is super hard and won’t happen naturally – another instance of terminal defense on their multilat advantage since there’s no chance for spillover

### Xt if time 1NC – AT: Debris Advantage

#### Time frame – Kessler effect 200 years away.

Peter Stubbe, PhD in law @ Johann Wolfgang Goethe University Frankfurt, ’17, State Accountability for Space Debris: A Legal Study of Responsibility for Polluting the Space Environment and Liability for Damage Caused by Space Debris, Koninklijke Brill Publishing, ISBN 978-90-04-31407-8, p. 27-31

The prediction of possible scenarios of the future evolution of the debris p o p ulation involves many uncertainties. Long-term forecasting means the prediction of the evolution of the future debris environment in time periods of decades or even centuries. Predictions are based on models84 that work with certain assumptions, and altering these parameters significantly influences the outcomes of the predictions. Assumptions on the future space traffic and on the initial object environment are particularly critical to the results of modeling efforts.85 A well-known pattern for the evolution of the debris population is the so-called Kessler effect’, which assumes that there is a certain collision probability among space objects because many satellites operate in similar orbital regions. These collisions create fragments, and thus additional objects in the respective orbits, which in turn enhances the risk of further collisions. Consequently, the num ber of objects and collisions increases exponentially and eventually results in the formation of a self-sustaining debris belt aroundthe Earth. While it has long been assumed that such a process of collisional cascading is likely to occur only in a very long-term perspective (meaning a time 1 n of several hundred years),87 a consensus has evolved in recent years that an uncontrolled growth of the debris population in certain altitudes could become reality much sooner.88 In fact, a recent cooperative study undertaken by various space agencies in the scope of i a d c shows that the current l e o debris population is unstable, even if current mitigation measures are applied. The study concludes:

Even with a 90% implementation of the commonly-adopted mitigation measures [...] the l e o debris population is expected to increase by an average of 30% in the next 200 years. The population growth is primarily driven by catastrophic collisions between 700 and 1000 km altitudes and such collisions are likely to occur every 5 to 9 years.89

#### Status quo solves – mitigation and remediation compliance growing.

Colombo et. al 18—Camilla Colombo, PhD, visiting academic in Spacecraft Engineering within Engineering and Physical Sciences at the University of Southampton; Francesca Letizia, PhD, Space Debris Engineer at ESA Space Debris Office; Mirko Trisolini, PhD, Postdoctoral researcher at the Politecnico di Milano Department of Aerospace Engineering; Hugh Lewis, PhD, Professor within Engineering and Physical Sciences at the University of Southampton (“Space Debris: Risk Mitigation,” from Frontiers of Space Risk: Natural Cosmic Hazards & Societal Challenges, Chapter 5, p 128-136)

5.4 MITIGATION MEASURES The space debris problem is nowadays internationally recognized, therefore mitigation measures are being taken and guidelines discussed. These can be divided into two classes: The avoidance or protection measures and the active and passive debris removal measures. The avoidance or protection measures include the design of satellites to withstand impacts by small debris, or the selection of safe procedures for operational spacecraft such as orbits with less debris, specific attitude configurations, or implementing active avoidance maneuvers to avoid collisions. On the other hand, measures for debris removal currently consist in limiting the creation of new debris (by prevention of in-orbit explosions and ensuring spacecraft subsystems reliability), to free some orbital implementing end-of-life disposal maneuvers protected regions, or to reenter in the atmosphere. Active debris removal is also being considered as a mean to stabilize the growth of space debris by removing from orbit some selected noncompliant objects. The e.Deorbit mission will target an ESA-owned derelict satellite in low orbit, capture it with a net or robotic arm technology, and reenter with a controlled atmospheric reentry (Biesbroek et al. 2014). Acknowledging the fact that the projected growth in the number of satellites orbiting the Earth will increase in the future, space agencies and international organizations have been discussing and building a set of guidelines to ensure the sustainability of future space activities. The InterAgency Debris Coordination Committee (IADC) was founded in 1993 by ESA (Europe), NASA (the United States), the Japan Aerospace Exploration Agency (JAXA, Japan), and the Roscosmos Russian Federation. As of January 2017, the IADC also includes the Italian Space Agency (ASI, Italy), the Centre National d'Études Spatiales (CNES, France), the China National Space Administration (CNSA, China), the Canadian Space Agency (CSA, Canada), the German Aerospace Centre (DLR, Germany), the Korea Aerospace Research Institute (KARI, South Korea), the Indian Space Research Organisation (ISRO, India), the National Space Agency of Ukraine (NSAU, Ukraine), and the UK Space Agency (UKSA, United Kingdom). This international cooperation decided a set of space debris mitigation measures (Inter-Agency Space Debris Coordination Commitee, 2002), which includes: 1. Limitation of debris released during normal operations. 2. Minimization of the potential for on-orbit breakups (resulting from stored energy after the completion of mission operations, or during the operational phases of the mission and by avoiding intentional destruction and other harmful activities). 3. Post Mission Disposal in particular in geosynchronous regions and for objects passing through the LEO region. 4. Prevention of on-orbit collisions. The IADC guidelines were presented to the United Nations Committee on the Peaceful Uses of Outer Space (UN COPUOS) and contributed to the creation of the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space to be considered for the mission planning, design, manufacture and operational phases of spacecraft and launch vehicle orbital stages” (United Nations Office for Outer Space Affairs 2010): 1. Limit debris released during normal operations. 2. Minimize the potential for breakups during operational phases. 3. Limit the probability of accidental collision in orbit. 4. Avoid intentional destruction and other harmful activities. 5. Minimize potential for post-mission breakups resulting from stored energy 6. Limit the long-term presence of spacecraft and launch vehicle orbital stages in the low Earth orbit region after the end of their mission. 7. Limit the long-term interference of spacecraft and launch vehicle orbital stages with the geosynchronous region after the end of their mission. 5.4.1 Mitigation Guidelines for Post Mission Disposal In this section we focus on the third of the measures dictated by the IADC, namely Post Mission Disposal. A “25-year rule” was defined to limit the presence of satellites in the LEO region to no more than 25 years after their decommissioning. The 25-year limit was selected to ensure that a reasonable reduction in lifetime could be achieved without greatly affecting satellite resources. After 25 years a satellite has to be removed from the LEO protected region by placing it in a graveyard orbit or by disposing of it through atmospheric reentry. According to the IADC Space Debris Mitigation Guidelines (Inter-Agency Space Debris Coordination Commitee 2002) if "a spacecraft or orbital stage is to be disposed of by re-entry into the atmosphere, debris that survives to reach the surface of the Earth should not pose an undue risk to people or property.” The low Earth orbit protected region (LEO region) is the spherical shell region that extends from the Earth's surface up to an altitude of 2000 km. The geosynchronous protected region (GEO region) is a segment of a spherical shell with a lower and upper altitude boundary of 200 km below and above the geostationary altitude of 35,786 km, and which is constrained by a latitude sector extending between plus and minus 15 degrees from south to north (Inter-Agency Space Debris Coordination Committee 2002; United Nations Office for Outer Space Affairs 2010). At altitudes below 600 kilometers, spacecraft with a conventional area-to-mass ratio (i.e., conventional satellites have a value of area-tomass ratio around 0.012 m?/kg) will reenter within a few years due to atmospheric drag. Intervention to remove and prevent further creation of debris above that altitude should therefore be the primary focus of passive mitigation measures. As described in the document on the “Requirements on Space Debris Mitigation for ESA Projects” (ESA 2008) and the "ESA Space Debris Mitigation Compliance Verification Guidelines” (ESA 2015), end-of-life measures can be distinguished in: (1) Disposal, (2) passivation, and (3) reentry. Required measures for disposal currently cover spacecraft in LEO and GEO through a series of Operational Requirements (OR) (ESA 2008): "OR-01. Space systems operating in the LEO protected region shall be disposed of by reentry into the Earth's atmosphere within 25 years after the end of the operational phase." "OR-02. Space systems operating in the GEO protected region shall be disposed of by permanently removing them from the GEO protected region.” The GEO disposal orbit should be almost circular (i.e., eccentricity less of equal to 0.005) and with a minimum perigee altitude above the geostationary altitude, which is given as a function of the solar radiation pressure coefficient of the space system at the beginning of its life and its cross-sectional area. This is done to take into account the eccentricity oscillation due to the effects of solar radiation pressure and to ensure that such oscillation would not make the orbit interfere with the GEO protected regions. "OR-03. Where practicable and economically feasible, space systems outside the LEO and GEO protected regions shall implement means of end-of-life orbit disposal to avoid long-term interference with operational orbit regions, such as the Galileo orbit." OR-04. Launcher stages shall also perform end-of-life disposal maneuvers by targeting "direct reentry as part of the launcher sequence.” Alternatively, they should be injected into a LEO orbit with a maximum reentry time of 25 years. As other space systems, they should be removed from LEO and GEO protecting region and orbit that interfere with other operational orbits such as the one of the Galileo orbit. OR-05. Passivation of the system (spacecraft or launcher stage) has to be completed within 2 months of the end of mission. End-of-life measures for reentry include: OR-06. "For space systems that are disposed of by reentry," an "analysis has to be performed to determine the characteristics of fragments surviving to ground impact, and assess the total casualty risk to the population on ground assuming an uncontrolled reentry.” OR-07. Such a casualty risk has to be lower than 10-4 if an uncontrolled reentry is targeted; otherwise if the casualty risk is higher than the threshold of 10-4, "a controlled reentry must be performed such that the impact footprint can be ensured over an ocean area, with sufficient clearance of landmasses and traffic routes." The rate of compliance of missions to the end-of-life mitigation guidelines was analyzed by the ESA Space Debris Office in 2017). Between 2006 and 2015, the rate of compliance of LEO missions (including naturally compliant missions and satellites performing end-of-life maneuvers) was 53.3% for the payloads (corresponding to 60.3% of the payload mass), reaching end of life in the LEO protected region (Frey and Lemmens 2017). The compliant objects, with a lifetime after decommissioning of less than 25 years, include naturally compliant objects due to their initial altitude well inside the Earth's atmosphere (this constitutes the biggest part of the compliant share), compliant objects after a deorbit maneuver, or spacecraft having performed a maneuver leading to a direct reentry. In terms of mass, this share is constantly sloping downward. Between 2007 and 2016, 71.6% of the rocket bodies reaching end of life in the LEO protected region was compliant, and this fraction has remained virtually unchanged for 8 years in a row despite an increase in end-of-life maneuver activity. 5.4.2 Passive End-of-Life Disposal In order to meet the mitigation guidelines LEO satellites at the end of their life would use the remaining propellant to perform either a perigeelowering maneuver (to decrease the orbit perigee well inside the Earth's atmosphere to guarantee a reentry within 25 years) or a direct reentry. Spacecraft in GEO are instead currently re-orbited to quasi circular orbits outside the GEO protected ring, with a perigee line aligned with the SunEarth direction (where possible) in order to bind the long-term oscillations in the eccentricity caused by solar radiation pressure. Recently, ESA funded projects on the design of disposal trajectories for medium Earth orbits (MEO) (Alessi et al. 2014; Rossi et al. 2015), highly elliptical orbits (HEO), and libration Earth orbits (LPO) (Armellin et al. 2014; Colombo et al. 2014; Colombo et al. 2015). These have demonstrated the possibility of exploiting natural orbit perturbations for designing passive mitigation strategies for debris disposal. Disposal strategies enhancing the effects of orbit perturbations have been further analyzed in LEO (Alessi et al. 2017), in MEO (Rosengren et al. 2015; Alessi et al. 2016; Armellin and San-Juan; Daquin et al. 2016; Gkolias et al. 2016), in GEO (Colombo and Gkolias 2017), and in HEO (Colombo et al. 2014; Armellin et al. 2015). Indeed, it was shown that, rather than performing an expensive maneuver to lower the perigee, the optimal maneuver should be given in a way to change the disposal orbit to another neighborhood orbit where the effect of orbit perturbations causes the orbit perigee to enter into the atmosphere. Indeed, the effects of luni-solar perturbation causes long-term oscillation on the eccentricity, which can be exploited so that the spacecraft's trajectory over a long period (from 5 to 70 years, depending on the initial orbit) could lead to natural reentry. This effect can be enhanced by solar radiation pressure, especially if considering a spacecraft equipped with large solar panels or a deployable reflective surface (Lücking et al. 2012, 2013). Moreover, resonances with the Earth's nonuniform potential can enhance the eccentricity growth effects. 5.4.2.1 An Example of End-of-Life Deorbiting Exploiting Luni-Solar Perturbations One of the most beautiful demonstrations of how natural dynamics can be enhanced is given by the INTEGRAL mission designed by ESA, the United States, Russia, the Czech Republic, and Poland. The INTErnational Gamma-Ray Astrophysics Laboratory, launched in 2002, gathered some of the most energetic radiation from space (Eismont et al. 2003). A reentry of this spacecraft with a pure impulsive maneuver would have not been possible due to the limited amount of propellant left onboard. In an ESA-funded study, the end-of-life disposal of INTEGRAL mission--expected to end in 2016-was designed with a time window for disposal between January 1, 2013 and January 1, 2029. Reentry solutions with a delta-velocity requirement below 40-50 m/s were found (Colombo et al. 2014). The main perturbations acting on the dynamics of the reentry were luni-solar perturbations, which affect the evolution of eccentricity, inclination, and anomaly of the perigee measured with respect to the Earth-Moon plane. It was shown that depending on the set of initial elements, which depends on the date the reentry maneuver is performed, the proposed maneuver would then aim at further increasing or decreasing the eccentricity. In particular, if we focus on the natural evolution of the eccentricity under luni-solar perturbation and Earth's oblateness, when the nominal eccentricity is low, the optimal reentry maneuver further decrease the eccentricity value; as a consequence, the following long-term propagation will reach a higher eccentricity, corresponding to a reentry. In this case, the maneuver is more efficient (i.e., lower delta velocity is required) (Colombo et al. 2014). Once the initial disposal maneuver is performed, the spacecraft evolves under natural perturbations and the reentry can then be semicontrolled. The high inclination of HEOs represents an advantage as the final reentry phase can target regions at higher latitudes on the Earth's surface thereby reducing the ground hazard. In the case of HEOs, reentry is caused by luni-solar perturbation (not air drag), therefore the orbit reenter with quite a high eccentricity (high apogee and low perigee) and does not circularize. Due to the oscillations in eccentricity, the next optimal window for injecting the spacecraft into a reentry trajectory is between 2013 and the first half of 2018 for a final reentry in 2028. After that, the required maneuver would increase until reaching a next window for performing the maneuver between the second half of 2021 and the first half of 2026, for a reentry in 2028. These analytical studies were used for high fidelity parametric analyses performed by the ESA (Merz et al. 2015) to investigate the effect of a maneuver at apogee to change the perigee altitude. The final maneuver sequence was given at the beginning of 2015 and split into three major burns plus a touch-up for final fine-tuning. The spacecraft is now on its course to reentry in 2028 (see Figure 5.11).