### Advantage

#### Space is privatizing. The resulting orbital debris production will become unsustainable.

**Muelhapt 19** (Theodore J. Muelhapt, et al., Center for Orbital and Reentry Debris Studies, Center for Space Policy and Strategy, The Aerospace Corporation, 30 year Space Systems Analyst and Operator, Marlon E. Sorge, Jamie Morin, Robert S. Wilson, 6/18/19, “Space traffic management in the new space era,” Journal of Space Safety Engineering, https://doi.org/10.1016/j.jsse.2019.05.007)

The last decade has seen rapid growth and change in the space industry, and an explosion of commercial and private activity. Terms like NewSpace or democratized space are often used to describe this global trend to develop faster and cheaper access to space, **distinct from more traditional government-driven activities** focused on security, political, or scientific activities. The easier access to space has opened participation to many more participants than was historically possible. This new activity could profoundly worsen the space debris environment, particularly in low Earth orbit (**LEO**), but there are also signs of progress and the outlook is encouraging. Many NewSpace operators are actively working to mitigate their impct. Nevertheless, NewSpace represents a significant break with past experience and business as usual will not work in this changed environment. New standards, space policy, and licensing approaches are powerful levers that can shape the future of operations and the debris environment.

2. Characterizing NewSpace: a step change in the space environment

In just the last few years, commercial companies have proposed, funded, and in a few cases begun deployment of very large constellations of small to medium-sized satellites. These constellations will add much more complexity to space operations. Table 1 shows some of the constellations that have been announced for launch in the next decade. Two dozen companies, when taken together, have proposed placing well over ~~20,000~~ [twenty thousand] satellites in orbit in the next ~~10~~ [10]years. For perspective, fewer than ~~8100~~[eight thousand one hundred] payloads have been placed in Earth orbit in the entire history of the space age, only 4800 [1] remain in orbit and approximately 1950 [2] of those are still active. And it isn't simply numbers – the mass in orbit will increase substantially, and long-term debris generation is strongly correlated with mass.

This table is in constant flux. It is based largely on U.S. filings with the Federal Communications Commission (FCC) and various press releases, but many of the companies here have already altered or abandoned their original plans, and new systems are no doubt in work. Although many of these large constellations may never be launched as listed, the **traffic created if just half are successful would be more than double the number of payloads launched in the last 60 years and more than 6 times the number of currently active satellites.**

Current space safety, space surveillance, collision avoidance (COLA) and debris mitigation processes have been designed for and have evolved with the current population profile, launch rates and density of LEO space.

By almost **any metric** used to measure activity in space, whether it is payloads in orbit, the size of constellations, the rate of launches, the economic stakes, the potential for debris creation, the number of conjunctions, NewSpace represents a **fundamental change.**

#### It’s on a first come first serve basis.

Supancana 10 [(Supancana, I. B. R, Chairman and Founder of the Center for Regulatory Research) "GUARANTEEING ACCESS OF DEVELOPING COUNTRIES TO OUTER SPACE," 2010] TDI

4.1 Access of Developing Countries to the Taking of Benefits from Natural Resources in Outer Space, including the Moon and other Celestial Bodies With the rapid growth of comer-cialization and privatization of space activities in the era of global market economy, **the issue of access of developing countries to space is relevant** and therefore, should be seriously considered. Especially **when it deals with** fulfillment of their basic needs of which space **science and technology** may contribute at an affordable price. This makes sense as developing nations are in general lacks of financial and technical capabilities (In addition, they also lack of scientific infrastructure; lack of data and information; lack of sufficient scientific infrastructure etc. For detail analysis, see I.B.R Supancana, The Commercialization of Space Activities, Challenges an, Opportunities for Developing Countries" paper presented at UN/Indonesia Regional Conference on Space Science and Technology for Sustainable Development, Bandung Indonesia, 17-21 May 1993. See also I.B.I Supancana, "Commercial Utilization o Outer Space and Its Legal Formulation Developing Countries' Perspectives", Bra ceedines of the DM Thirty-Fourth Collomuium rm the Law of (Inter Spar. Montreal Canada, 1991, pp 348 - 356). In recent years, we can observe the **increasing utilization of natural resource in outer space**, especially earth-orbits spectrum resource (GEO, HEO, MEO/ICO, LEO) for certain activities. As it is generally recognized, that earth-orbits spectrum resources are limited natural resources, there must be an evaluation to the existing law whether it i able to accommodate the interest of both developed and developing countries in fair, just and equitable manner. Previously **regulations** concerning access to earth-orbits spectrum resources. **are** mainly **based on "first come, first serve** principle which are more favorable it **accommodating the interest of developed countries**. However, **consistent efforts** on the part **of developing countries** to get a fair and just access to this limited natural resource **have shown** substantial progress This can be seen in the outcome of Work Administrative Radio Conferences of th. ITU at their 1985 and 1988 sessions. The. concept of "apriori planning' and "simplifier improved procedures" provides guarantee. for access, particularly those of develop\* countries. Furthermore, the concepts an elaborated in the amendment of the ITC Convention as appears in ITU Constitution of 1992. In the practical management o: earth-orbits' utilization some new rules hay. been applied such as ...administrative du. diligence' and 'financial due diligence' ti prevent the abuse of rights in the ITU ' registration process like: "paper satellites' "excessive and un-proportional" application.

#### Orbital debris prevents developing country regional space associations.

**Ngcofe 16** (L.Ngcofe, Chief Directorate: National Geo-Spatial Information, Department of Land Reform, South Africa, et al. K. Gottschalk, Department of Political Studies, University of the Western Cape, Cape Town S.Madlanga, 3 National Research Foundation: Hartebeesthoek Radio Astronomy Observatory ’16, “THE SPACE RUSH - THE COST OF BEING A LATE STARTER FROM AN AFRICAN PERSPECTIVE,”African Association of Remote Sensing of the Environment, http://www.africanremotesensing.org/page-1524987/4136883)

Abstract The costs of Africa being a late starter in space include the exponentially accumulating space debris. This threat to space assets is worse in low earth orbit (LEO), where it has already destroyed an Irridium operational US comsat.

The current discussions in international forums about mitigating the creation of new space debris, has not yet gone to the next stage to **discuss financial liability for collisions caused by such debris**. Late starters in space need to table the responsibility of the historic space powers to seek ways to remove their cumulative debris from orbit, and finance this.

Introduction

The ability to observe the Earth from space has enhanced accurate-up-to-date environmental monitoring, thus overcoming some of the environmental challenges experienced by humankind. Investment in space activities has endless, long term, benefits including diplomatic relations; technological advancement through collaboration with other countries; improving overall economic activities in the global arena, which in turn vastly contributes towards addressing social ills. Acknowledging this Chung et al., (2010) argues that where ground based systems are limited in frequency, continuity and coverage of important ecosystems, satellites can provide essential earth observation data on a continuous basis and over a range of scales, from local, regional, to global. Access to and the development of space technology has historically been a key determinant of a country’s **wealth**, **power**, **influence**, status and **prestige**. However, space exploration has been an issue of marginal political interest in Africa, thus leading the continent to be the late starter in space matters. Sharpe (2010) shows Africa as the least active continent with regards to space exploration activities. Aganaba-Jeanty (2013) cites a lack of consistent funding as the greatest barrier of the African space technology development. He argues that according to 2009 to 2012 the countries within Africa represent the lowest spending countries in space exploration when compared to developed and developing countries. Africa as a late starter in space might be seen through Abiodun (2012) words of wisdom starting that “the quality and character of a man’s perceptions as well as his subsequent responses are determined in part by limitations imposed by or opportunities available in his environment. If he is to manifest any real growth and reach his higher potentials, his creativity would need nourishment from his environment”. Currently there are recent strides documented in literature showing Africa’s growing interest and participation in space exploration (Ngcofe et al., 2013; Abiodun, 2012; Wood & Wiegel, 2012; Gottschalk, 2010; Martinez, 2008; Mostert, 2008). It is of this view that this paper attempts to examine the impact of being a late starter on space exploration, particularly looking at the issue of space debris and its potential impact on Africa as a developing space fearing nation.

Space debris

The current major threat of space exploration is the risk pertaining to **space debris relative to the cost of launching satellites** in space. The need to justify expenditure on space-related endeavours competes with other pressing expenditure needs such as provision of food, clean drinking water, housing, electricity, roads infrastructure and other commercial development. Space debris also known as orbital debris, or space junk, or space waste, is the collection of man-made objects that have exceeded its service life and broken down while in orbit around the earth (Interagency Report on Orbital Debris 2005; UN, 1999; Sénéchal, 2007; Colliot, 2002; Glassman, 2009; Griffiths, 2010). These include everything from spent rocket stages, old satellites, and fragments from disintegration erosion and collision. Space debris has vastly increased since the beginning of space travel in 1957 thus leading to orbit congestion (Colliot, 2012; Figure 2). According to NASA (2013), there are 500 000 pieces of debris tracked in orbit on Earth.

Collision at orbital velocity can be extremely dangerous to functioning satellites and space manned missions. Sénéchal (2007) argues that at orbital velocity of more than 28000 km/h, an object as small as 1 cm in diameter has enough kinetic energy to produce significant impact damage, to partially or completely destruct an operational satellite. While an object of 1mm size can cause surface pitting and erosion, with larger objects of about 10 cm totally destroying operational satellites, and may even kill space explorers. According to the Kessler Syndrome space debris model, as the number of debris object increases, collisions become more likely to occur thus creating yet more debris (Griffiths, 2010; Colliot, 2012; Durrieu & Nelson, 2013). This is an immense concern, which threatens safety of future space explorations. Though space is a large environment, satellites are actually concentrated in a few orbits that are currently optimal, namely:

Low Earth Orbit (LEO) – this is the altitude from 160 km to 2000 km above the earth’s surface. LEO is largely used for earth monitoring, military surveillance, and communication satellites, especially around 350 km.

Medium Earth Orbit (MEO) – this is an area from 2000 km to 35 000 km and is mainly used by navigation satellites such as global position system (GPS) networks at around 20 000 km.

Geostationary Orbit (GEO) – this is the belt at 36 000 km and is optimal for communication satellites. However, Griffiths (2010) argues that it is more expensive to launch satellites to this orbit. Hence, many communication satellites are placed at LEO.

High Earth Orbit (HEO) – This is the area above 36 000 km, and used almost only by satellites researching the magnetosphere or other solar-terrestrial physics.

LEO is regarded as the major used space orbit environment and therefore has a larger record of space debris than any other orbit. There has been four accidental collision events up-to-date (Durrieu and Nelson 2003), with a recent collision incident occurring in 2009 where a United States communication satellite collided with a defunct Russian satellite (Glassman, 2009; Griffiths, 2010; Smitham, 2010). These satellites collided at a speed of over 40 000 km/h, causing complete destruction of both satellites. Thus resulting in around 1400 recorded debris objects (Glassman, 2009; Griffiths, 2010; Smitham, 2010). The available computer models based on observation of debris used to predict future growth of the debris population and probability of collision with satellites under different assumptions reveal that in the next 40 years, collisions with objects larger than 10 cm in LEO are expected to occur on average every 5 years (Griffiths, 2010). This statistics coincide with Sénéchal (2007); Williamson (2003); Liou and Johnson (1996) who argued that in LEO the spatial density of objects is above critical point and the continuation of debris in this orbit may render it inaccessible in the future.

Space availability

The vulnerability of space asserts interference and disruption, led to the view, held by the USA security space community, that space is a contested domain. Whoever seizes space has a powerful advantage both for social and economic enhancement together with military applications (Sadeh, 2009). Space asserts provide a persistent view of the earth and offer ability of real or near real time global collection and dissemination of crucial information. Although, recently, there have been vast strides by Africa within the space arena, the continent still lags behind in space matters. Out of 53 countries in Africa, only four countries (Algeria, Egypt, Nigeria and South Africa) have successfully participated in space activities, through the development of their own space agencies which led to launching of their own satellites in space. The development of **micro sat**ellite technology and multiple constellations is now making space technology more affordable for developing countries to utilise the space environment (Durrieu & Nelson, 2013). Thus debate about the **African Space Agency**, which will cater for participation in space activities for Africa’s needs, is gaining momentum. Currently, Africa has an inspiring mission to the moon (http://africa2moon.developspacesa.org). With the vast interest in space activities by the African continent, one wonders, is there still space in space? Rex (1998) on his paper seeking to answer ‘will space run out of space’. He argues that there would be no major risk for space endeavours from current operational satellites **only if it were not for space debris**. The issue of space availability in space has been, and is still a major area of concern, more especially for Africa. Since the initial space exploration, the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPOUS) was established in 1959 in order to safeguard the use of space and promote space sustainability. This resulted in five UN treaties on Outer Space (http://www.oosa.unvienna.org/oosa/COPUOS/copuos.html) namely:

Outer Space Treaty (1967) - This treaty promotes the international cooperation in the exploration and use of space, however, prohibits the usage of space for any nuclear weapons and / or any kind of weapons of mass destruction. It clearly emphasises that no state can claim sovereignty of or occupy outer space, the moon or any other Celestial Body. This treaty further deals with liability and states responsibility as to inform the UN secretary general and the international scientific community of the nature, conduct, location and results of their activities in outer space.

Rescue Agreement Treaty (1968) - This agreement deals with the rescue of astronauts, the return of astronauts and the return of objects launched into outer space. This agreement has a legal framework for emergency assistance of astronauts and the notification of launching of any space objects which has to return to earth and express who should be responsible for all the cost incurred for such a particular mission.

Liability Convention (1972) - This convention is a pact of international liability for damage caused by space objects. It imposes an international and absolute liability on a launching state, or states as well as on those states who are members of inter-governmental organisations, for any damage caused by their objects. Launching state is defined as the state which launches or procures the launching of a space object or from whose territory or facility a space object is launched, irrespective of the success or not of the launch. Damage includes the loss of life, personal injury or any other impairment or health or loss of damage to property of state or of persons, natural or juridical or property of international, intergovernmental organisations. This also applies to any damage caused by a space object on the surface of the earth or to an aircraft flight.

Registration Convention Treaty (1974) - The treaty obliges states to register all space objects in a register, which is maintained by the UN secretary general since 1962.

Moon Treaty (1979) - The treaty declares that the moon is a global common for all humankind and is not subject to national appropriation and occupation. It further stresses that no private ownership is allowed but all state parties have the right to exploration and use of the moon. In practice, this treaty has no force, because none of the space powers who engage in lunar exploration have ratified it: USA, Russia, China and India.

Although, these treaties exist there has been non-compliance by those leading space faring countries. Since the 1960s, the United States and Russia have conducted dozens of anti-satellite (ASAT) test missions in space, which resulted in most of orbital debris experienced even today (Weeden, 2013). Most recently China has performed an ASAT mission against its aging FY-1C weather satellite at 855 km altitude on the 11/01/2007. It launched a missile, which destroyed the satellite, resulting in 3000 pieces of debris larger than 10 cm in size (Glassman, 2009; Weeden, 2013). This event was further followed by the United States ASAT in 21/02/2008, firing a missile that destroyed one of its military satellites at around 250 km altitude. The US ascertained that the satellite was uncontrollably descending into the atmosphere with nearly fully fuelled tank of toxic hydrazine. Furthermore, its altitude was low enough to ensure swift re-entry of all the resulting space debris, and so, harmless to the space environment. The US delegate fully briefed the UN COPUOS unlike the Chinese. The outcome by the US in destroying its satellite is applaudable. However, ignorance has been shown by the former President George W. Bush when asked what would the people say about the mission? He said “I don’t care what people will say. We’re doing it for the right reason, and it’s transparent” (Oberg, 2008). These clearly are signs of bullying with regard to space matters by space powers with advanced space technologies.

Conclusion

The act of destroying a satellite can damage the space environment by creating dangerous amounts of space debris. Space debris can, therefore, lead to collisions and loss of important satellites, which has tremendous cost effects for Africa’s participation in space activities. Losing a satellite in-orbit due to space debris is no longer hypothetical, but rather a harsh reality and is likely to increase with years to come (Smitham, 2010). Grego (2014) argues that deliberate space debris creation might result in conflict between space fearing nations with unpredictable and dangerous consequences. Such consequences might trigger an arms race which would further divert the economic and political resources from other pressing issues like food security, climate change, health issues, etc. The need to sustain benefits of space for present and future generations and other countries that have not explored space as yet is vital if we are to obtain continuous benefits from space activities. Glassman (2009) suggests that a number of activities and commitments need to be revitalised. Current space best practice, also termed rules of the road, seek to minimize causing new space debris, through careful revision of both design and operational protocols:

· Separation of satellites from their carrier rocket should no longer result in loose bolts and other metal pieces flying off;

· satellites should have some propulsion capability to initiate collision avoidance manoeuvres;

· at the end of their service life, satellites, especially those in geosynchronous orbit (GSO), should be manoeuvred into a “graveyard orbit” at a different altitude;

· and valves should open to discharge any remaining propellant, to prevent overheating and explosive disruptions.

#### The current structure in space denies the global south their rights to geostationary orbit – the north crowds out the lower orbit.

Viikari 7 [(Lotta, PhD in Faculty of Law @ International Institute of Air and Space Law, Leiden University) “The Environmental Element in Space Law, ” 2007, ISBN 978-90-04-16744-5, Koninklijke Brill, p 21-23.] TDI

At the beginning of the space era, **not many** **other states possess**ed any **capacity to engage in space activities**. Nevertheless, the UN space treaties constantly use phrases such as “province of all mankind”, “for the benefit and in the interests of all countries”, or “common heritage of mankind” when referring to outer space and the activities relating thereto. Accordingly, one would imagine that this ‘mankind’ (or humankind) plays a prominent role in the governance of space activities. In the same vein, speaking about outer space and its resources in terms of ‘global commons’67 suggests that **it is the global community that is in charge of the management** of these areas **which fall outside the scope of national jurisdictions**. This global community has been, first and foremost, the community of states, which has concluded international conventions for managing outer space relatively early in the history of human space activities. In practice, the language of the **space treaties promises** much **more for** the **humankind** as a whole **than what** space utilization **actually provides it with**. The benefits do not accrue evenly among humanity (or even the state community) in accordance with some common regime. Instead, the space sector largely follows the far less noble principles of the modern industrial economy. Furthermore, states are increasingly not the unitary rational actors of the traditional assumptions. Neither are they autonomous but embedded in a framework of interactions among numerous entities in the international system. **Despite** the fact that space **activities continue** **to be extremely hazardous and costly, there exist** today a variety of different **actors who are willing to invest** in this sector. This is obviously **due to the** significant potential benefi**ts** which the use of outer space entails. The universe contains a myriad of natural resources, varying from solar power to minerals in celestial bodies. Also **outer space** as a whole **has been depicted as a resource**: one need only consider, for instance, the possibilities that the mere existence of Earth orbits provides for satellite activities. Now that technological development has enabled the utilization of space also for those capable of lesser investments, states comprise only a part of the global network of entities active in the space sector. In such a setting, the management of space activities by states alone is proving increasingly complicated and inefficient. Indeed, states are facing serious legitimacy problems in the space sector. In order to retain their focal position, states need to demonstrate that they are relevant agents also as regards the new challenges confronted in this area. They have not succeeded very well here, however. The international legal instruments thus far adopted for the regulation of space activities have mostly proven far too vague, and the state community has failed to reach agreement on new instruments (other than legally non-binding declarations and the like) for some decades already. Moreover, considering that states have faced major difficulties in achieving substantial improvements in any natural conditions of global magnitude, their possibilities in the environmental management of outer space seem less than promising. Nevertheless, in the formation of the international law of outer space, the focal organ still is the United Nations. It was originally founded for very different purposes than solving today’s global crises, which center around environmental and development issues rather than questions of world peace.68 As an organization of states, the UN also directly reflects the problems related to states and their role in the international system. One is the fact that there are many kinds of states. For instance, although **sovereign states formally are** all **equal, some** of them **are** in reality far **more influential and active in** the **space** sector **and**, accordingly, **have** much greater practical **interests in** the international **regulation** of this area. In addition to being ‘big business’ economically, space activities play a major role politically. This was particularly evident during the Cold War in the ‘space race’ between the US and the Soviet Union, but the political and strategic relevance of space by no means vanished at the end of the Cold War.69 **The** space **sector** also **needs to cope with the** global differences **in development**. Despite the global commons rhetoric, **the relationship between** more and less developed areas **(‘the North’ and** ‘the **South’) is** most often **depicted in terms of conflict. Outer space** **as** an environment and a resource is typically perceived as some sort of **a limited ‘pie’ of rights,** to which all states aspire. However, such rights often appear in practice as something very close to a right to destroy and pollute the environment if needed (in the name of utilization). **Conflicts will unavoidably arise**, as more or less all states today share the same basic ideology of industrial development, for the purposes of which outer space is seen as a mere resource available for exploitation by all who have the necessary means. This is only likely to intensify the competition for the limited possibilities. In such a situation, it is no surprise that **the North**, which has the means to conduct space activities, is eager to **perceive** outer **space** and its resources **as common property**, available on the basis of the ‘first come, first served’ principle. **The South**, on the other hand, **is concerned about being guaranteed** adequate **possibilities for equal benefits** either now or in the future. **Southern states expect** technical assistance to enable them to utilize outer space, the reservation of ‘their share’ for possible future use, or financial compensation **for allowing the exploitation of ‘their’ resources** by others.70 Typically, those states have also been in favor of the inclusion of liability regimes in international environmental agreements whereas the North has more often resisted provisions to that end.71 Environmental degradation is making the picture increasingly complicated: if space activities need to be limited already in the name of environmental protection, the prospects for the current non-spacefaring nations to realize their ‘reserved’ rights in the future do not look too bright. As a matter of fact, **increased environmental standards** could **generate** even **more benefits for** the technologically most **developed nations** **and** thereby **widen the gap between the North and** the **South**. If, for instance, technical standards or pollution reductions are made mandatory, this will give a competitive advantage to the countries which can afford the technology needed to comply with such norms. Moreover, such requirements would necessitate further development of technology, which is likely to create still further competitive advantage. Hence, it seems inevitable that tensions between the environment and development cannot be averted in the space sector, nor can a setting be avoided where many of the key issues pit developed against developing countries.

#### Regional space assets are key to development goals. Status quo foreign aid competition fractures regional alliances.

**Liao 15** (Xavier L.W. Liao, PhD in Political Science at Ghent University, ’15,“The Growing Space Regionalization of the Global Space Regime Complex” The Aviation & Space Journal, January/March 2015, No 1.)

Dynamics of regional astropolitics

Regional spacefaring countries often seek to demonstrate their regional leadership, or to ensure the **regional power** - balance equilibrium by creating a regional space - related regime under their **cooperative supremacy**. In order to counter their political adver-saries and strategic competitors in the same geographical region, these regional space regimes provide technological facilities and space applications incentives to involve neighbouring allies into the interdependency of a regional space system. These region-al space regimes determine what would be the centralities for the cooperation net-works. They set up norms, rules or practical arrangements for security, safety, com-mercial and ecological cooperation. When one regional space power starts up a space regionalism process, the other regional powers will duplicate the same action to counter it. Quite often, space regionalism of this kind might not aim to enhance substan-tial regional space cooperation, but aims to counter other space regionalization initia-tives led by other spacefaring countries in the same region. In practice, these regional regimes offer cooperation incentives that are similar to what their counterpart organi-zations offers in order not to loose the overlapping member states that are affiliated with the competing regional space regimes. But, these regional space regimes normal-ly only provide vital exclusive cooperation projects to satisfy the loyal allies who stand **historically**, **ideologically** or **culturally** on the same side of the leading space power. The regional space leaders cautiously release any critical technology or know - how if they are unsure about the possible fair return from or possible leaks lamed by their protégés.

An example, which demonstrates that the dynamics of regional astropolitics sparked duplicate space regionalization processes led by adversary or competitive regional spacefaring states occurred in the 1970s among the Arab League states. In principle, it would be perfect if a unique Arab regional satellite system regulatory and cooperation mechanism can be established in order to efficiently coordinate national satellite communication frequency attribution, avoid transnational radio signal interference, and to disseminate a pooled satellite TV and radio broadcasting program gathered from different Arabic - speaking states for the benefits of the entire Arab League states. But the reality was, when Saudi Arabia was arising during the 1970s oil boom and Egypt endured the subsequent expulsion from the Arab League following its 1979 peace treaty with Israel, the competing space regionalism between Egypt and Saudi Arabia has led to the consequence that the Cairo - led Arab States Broadcasting Union (ASBU) created in the 1960s was heavily challenged by the Riyadh - led Arab Satellite Communication Organization (ARABSAT) founded in 1970s. The two regional satellite related operations organizations, which shared the overlapping membership of the Arab League states, could hardly work together. Further to the ASBU - ARABSAT com-petitive regionalization story in the 1970s, it occurred recently that competition be-tween the Japan - led APRSAF and the China - led APSCO, and perhaps soon the neces-sary addition of an India - led SAARC satellite network, are vying for leading a regional-ism of their own in the Asia - Pacific region. The different regional space regimes with overlapping objectives and membership are created based on the competition be-tween the leading regional spacefaring states. Since the functioning of these regional regimes is highly connected to the regional astropolitics, the regional member states will choose their affiliation by pragmatism to fulfil their own short - term interests, noted as ‘ regime shopping ’. In the case of APRSAF vs. APSCO, the overlapping member states are mostly from the ASEAN countries. These countries take part in both regional space regimes but only pick the issue - relevant cooperation, which fits their respective national interest instead of being fully engaged into any regional astropolitical strate-gic interdependency.

The quest for regional space capacity - building

The collective quest for developing common **regional** space capacity or a specific or exclusive regional space system ( e.g. for satellite TV and radio broadcasting, disaster mitigation, navigation safety, and Earth Observation) can also stimulate and nourish space regionalisation. The regionalisation is therefore undertaken with actors ’ func-tional or cost - benefit logic. By knowing the fact that developing space capacity and upholding it is an expensive and highly risky business, there is no country, **even not the US** that can handle it alone. Pooling different material or immaterial resources to de-velop regional space capacity doubtlessly becomes the optimal and legitimate strate-gy for collective and individual prosperity and benefits. Since the space ‘ democratization ’ after the Cold War, emergent industrial countries and developing continents have various ways to continue or to start up their **own space capacity**. Hence, they are all keen to enjoy the utilities of space technology applications for military, civil or dual - use.

The path of the European space regionalization in pursuit of its collective prosperity and common benefits was a well - known example. Europe started its space regionaliza-tion from the early 1960s by having established two different space agencies. The Eu-ropean Launch Development Organisation (ELDO) to develop a European launcher sys-tem with six member states and one associate member. The other, the European Space Research Organisation (ESRO) with 10 members was created to develop Europe-an spacecraft. Soon after, the ELDO and the ESRO were merged to become the Euro-pean Space Agency (ESA) in 1964. It was only in 1975 the ESA formally and operation-ally replaced the two organisations. One of the reasons for that the European states explored a regional space institutional centrality, such as the ELDO, ESRO and ESA, were based on the aforementioned strategic and functional logics for their respective national interests. These regional space institutions gradually created a interdepend-ent space network which gathered the crucial space capability elements among the intra - regional partners and facilitate the member states to exchange resources, rein-force their own national space capability, share financial burdens and reduce the risks of marketing failure. Additionally, the space regionalization has strengthened European regional political and economic position to on the one hand, reduce the dependen-cy on the US space capacity. It offered the leverage to allow Europe to explore possi-ble space cooperation with the Soviet Union. Until now, the European space regionali-zation is subsequently viewed as the most inspiring model and was duplicated by other regional spacefaring countries that also try to create their respective space regionali-zation.

Another case was the ARABSAT, the ARABSAT established in 1976 was dedicated to answers the regional request for providing satellite services in order to facilitate tele-communication, promote common culture and education programs in the light of the commitments of the Arab League Charter member states. The ARABSAT became the major regional space mechanism for the Arab League member states to coordinate satellite industries and services operators. Similarly, the enthusiast initiatives and debates about a start - up of an expected Latin - American Space Agency (LASA) (Monroy 2010) 10 and the recent kick - off of the 1 st Latin American Satellite Communication and Broadcasting Summit ( Space Mart 2014) 11 , an ASEAN Space Organization (ASO) (Noichim) 12 , or an African Space Agency (ASA) (Martinez 2012 13 ; Aganaba - Jeanty 2013 14 ) took place constantly. These space regionalism initiatives mostly stress indigenous regional space capacity building. Yet, due to a lack of a strong spacefaring nation to continuously lead and carry on these space regionalization initiatives, concrete **start - up hardly takes off**. In these cases, extra - regional assistance is expected to bring suit-able technology and sufficient means, but this causes worries of triggering an unex-pected **regional astropolitics reshuffle** that can destabilize the equilibrium of the en-tire regional homo astro ecosystem.

In the Asia - Pacific region, the Japan - led APRSAF and the China - led APSCO are both committed to establish a regional space technology cooperative regime for their over-overlapping Asia - Pacific member states. The APRSAF, claimed as a voluntary regional space agency cooperation mechanism, aims to lead a long - term and mid - term space capacity building regionalization throughout space science and technology coopera-tion activities though the Japanese Space Basic Law, approved by the two Parlia-ments in 2005, explicitly states that ‘ space diplomacy ’ is one of the objectives that Japan shall integrate into its future national space policy. The APSCO, particularly after the launch of the Chinese Beidou (COMPASS) Satellite Navigation System, pro-motes APSCO regional partners e.g. Thailand, Pakistan (and it is expected other ASEAN states) to share the benefits of China ’ s satellite navigation system by hosting the ground network facilities in their territories. Until now, the question whether these two regional space regimes could respond to the quest for regional space ca-pacity needs further observation, particularly since the India - led South Asian Associa-tion of Regional Cooperation (SAARC) ( The Times of India 2014) 15 seems also enthusi-astic to gain the regional space leadership by exploring the similar method with a South Asian approach for proposing a tentative SAARC Satellite Service project.

Necessity of regional space governance

Nowadays, it occurs that the **neighbouring states develop their own space systems for national satellite telecommunication, weather monitoring, TV and radio broadcast-ing, and navigation services for** military or **civil utilities.** Subsequently, these systems are not compatible due to the blockage based on the national security concerns or simply caused by technical incompatibility. Throughout the regionalisation process, states negotiate common measures, such as regulations, standards, tariffs, and inter-ference avoidance rules for heterogeneous national space systems within a given geo-graphical region. Especially nowadays, the growing commercialization of space tech-nology for its design, manufacture, launch and operations and its application for tele-communication, TV and radio broadcasting, remote sensing and navigation are in-creasingly taking more ground, the quest of establishing regional common conduct rules and operational standards become more and more important. The necessity for institutionalise such regional space governance architecture is **doubtless uncontested**. These space regimes are created to respond to these specific needs. Yet, whether the design as well as the perfection path for building any regional space regimes de-pends on whether the desired regime meets its member states ’ strategic calculation and functional concerns. This often made the managerial manoeuvre of a given space regionalisation more complicate and complex.

The aforementioned Arab Satellite Communications Organization (ARABSAT since 1976) that established an Arab Space Communication network, the Asia - Pacific Broad-casting Union (ABU since 1964) - a regional platform for national TV and radio broad-casters (which are mostly state - owned at least from their staring period) the Asia Pacific regional – set up the ABU Emergency Warning Broadcasting Systems (EWBS) to disseminate information to alert people of neighbouring countries before a disaster occurs. Together with ARABSAT and ABU the Regional African Satellite Communica-tions Organization (RASCOM) were all created for the reason of regional space gov-ernance in Africa, and are examples of the space regionalization for improving re-gional space governance. To enable this space governance regionalization, the parties of a regional group seemingly need to posses similar space capacities and the willing-ness to share a common development strategy. Nowadays, as the commercialization of all development steps of satellite technology (production, launch and operations) and all utilities of satellite technology applications (communication, broadcasting, remote sensing and navigation) are growingly taking more ground, which increasingly the quests of coordinating common regional conduct rules and operational standards may become more important but will also become more complex.

Extra - regional inputs

Apart from the intra - regional inputs, the inputs from the extra - regional dimension also offer sounding influences in sparking and to fuelling the rise of space regionalisa-tion. These extra - regional inputs can be perceived from three dimensions of the glob-al space regime complex: (1) the stimuli from extra - regional space powers, (2) the inspiration other regionalisation from other regionalisation ( mirror effect ), and (3) the endorsement from global space related regimes. It is important to state that never a single one of these inputs but always a mix of them results in the activation and the growth of these space regionalisation processes in different regions.

Space powers ’ stimulation

The stimuli from extra - regional space powers, namely from the US, Russia and nowa-days China, India or others, are **centripetal forces** that congregate various new regional space centralities. These space powers, with their crucial technology know - how and financial supports, push to institutionalise a regional space centrality is either to en-hance their ties with the extent allies, make new friends or attract new followers from non - spacefaring countries in a given region. This outreach toward the regional level is supposed to increase the respective space power ’ s political and strategic in-fluences on both regional and global astropolitics. It is also commercially interesting for the space powers to **conquer foreign regional markets** more efficiently. As for the choice where to do such space power stretch exercises, it depends on every space power ’ s geopolitical concerns and strategic interests. Furthermore, while sponsoring a given space regionalisation, the space powers do not provide full space capacity assis-tance and do not offer it for free neither. The attractive incentives for the accommodating countries for having and keeping the deals are often accompanied with **strict conditions**.

The U.S. has supported most of their allies in the Western European and Asia - Pacific regions by sharing American space technologies, know - how , as well providing finan-cial aid to the regional leading states for building their space capacities, though often through bilateral cooperation channel. This bilateral cooperation has indirectly facili-tated the foundation of space regionalization. While building these strategic space interdependencies, Washington usually requires the beneficiary states of American space system and products to behave strictly under the US International Traffic in Arms Regulations (ITAR). The ITAR has unilateral power to decide whether a piece of technology can be sold to the US allies or interested states or companies, but it can also sanction the contractor if contracted project is leaked to a third party. Conse-quently, European states were somehow pushed to seek their independency or at least non - dependency from the US, and therefore wanted to create their own regional space cluster. The Soviet Union was doing the same during the Cold War by forcing the Eastern European socialist states into a closer regional space community. Finally, whether a targeted region has political desires and adequate capacity to host and develop a given space regionalisation sponsored by extra - regional space powers has no co - relationship to the efforts provided by the space powers. The former Soviet Union has incorporated the Eastern European socialist states into a closer regional space community. These days, Russia is doing it again with the Eurasia states via the space related regional cooperation, such as the Russia - Kazakhstan - Belarus formed Eurasia Economic Union (EEU). Russia also claimed to study Armenia ’ s capacity of using space for peaceful purposes under the Russia - Armenia cooperation framework in scientific, technical and industrial areas. However, after the Russia - Ukraine stand-off, Russia cessed the longstanding space cooperation with Ukraine ( Space News 2015) 16 . With a strong geopolitical mind - set, **Africa**, **Latin America**, **ASEAN** and **Central Asia** became nowadays the new power playground for the US, Russia and China to bid for allies or followers. In this circumstance, non - spacefaring states from a given re-gions often undertake the practice of ‘ regime shopping ’ (Keohane & Victor 2011) by opting the most advantageous regimes in accordance to their functional interests and preferences to gain beneficial issue linkages. The stimuli from the space powers are valuable to help the space regionalization. Yet, it **can hardly be the only factor** to lead such processes to its final goal.

#### Regional cooperation is crucial to effecitive data integration and reducing interoperability costs.

**Gottschalk 08** (K. Gottschalk, Political Studies Department, University of the Western Cape, ‘8, “The Roles of Africa’s Institutions in Ensuring Africa’s Active Participation in the Space Enterprise: The Case for an African Space Agency (ASA), ”African Skies/Cieux Africains, No. 12)

By contrast, the underdeveloped, poorer countries of our continent only managed to re-engineer the ineffective OAU into the African Union in 2002 — and have not yet pooled their resources to form an African space agency. Let us spell out explicitly the case for continental coordination.

First is the efficient and effective use of our **scarce resources**. Africa is a capital-scarce continent. The allocation of resources to the extreme cost of access to space requires solid justification. The space enterprise also demands an allocation of scarce high-level human resources, plus costly hi-tech peripherals. Even combined as a whole continent, Africa will command less space resources than an individual member of ESA such as France. Consequently, the space enterprise in Africa needs such coordination far more than Europe does.

Second is the argument from **spherical geometry**. The geosynchronous orbit footprint of a satellite is continental, and of all the continents Africa more than any other has the equator at its centre, **optimal for geo-stationary orbit-keeping**. Medium-Earth Orbit satellites have a footprint which covers the whole of a Regional Economic Community, such as the Economic Community of West African States (ECOWAS), the East African Community (EAC), or the Southern African Development Community (SADC).

One after another, Algeria, Egypt, Nigeria and South Africa are now launching national constellations of micro sats whose image swathes **run through each other’s countries** — but we download data from **less than 1%** of each orbit of our satellites. It is logical to download data continuously during the transect of every satellite’s orbit over the whole of Africa, and to centrally archive and process such data. South Africa is discussing co-ordinated satellite programmes with African countries.1 As a continent we will be able to **negotiate better offers** for satellite construction, space launches, technology transfer, and share data, scarce facilities and infrastructure, than as individual small countries alone. Security issues, such as images of a specific location, or of a specific resolution, can be easily resolved by inter-governmental agreement. The African **Resource Management** Constellation will be best operated by a continental space agency.

#### African space independence is possible – countries want regional programs, but Chinese intervention will always be easier.

Devermont and Oniosun 20 [(Judd, is the director of the Africa Program at the Center for Strategic and International Studies) (Temidayo, a Nigerian space scientist and entrepreneur] “IS THE UNITED STATES LOSING THE AFRICAN SPACE RACE?” War On the Rocks, 6/23/2020 https://warontherocks.com/2020/06/is-the-united-states-losing-the-african-space-race/ ] Lex AL

Africa’s space programs account for a very small part of the world’s space activity. But the continent’s profile in space is growing, and if decision-makers in Washington don’t start paying closer attention to Africa’s orbital ambitions, the United States will see itself outpaced in this critical space race by China and Russia.

Since 1999, 11 African countries (Algeria, Angola, Egypt, Ethiopia, Ghana, Kenya, Morocco, Nigeria, Rwanda, South Africa, and Sudan) have successfully launched 38 unilateral and three multilateral satellites into orbit. Space in Africa, which was co-founded and managed by one of the authors, [estimates](https://africanews.space/by-2024-more-than-19-african-countries-would-have-launched-satellite-into-space/) that by 2024, at least 19 African countries will have launched at least one satellite into space, with the total number of satellites launched by African countries rising to over 90. In 2017, the African Union [passed legislation](https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-st20676_e_original.pdf) to establish the African Space Agency and recently approved Egypt as host country for the new agency’s headquarters. South Africa’s ambassador to the United Nations recently [declared](https://www.un.org/press/en/2019/gaspd703.doc.htm) that “Africa’s demand for space products and services is among the world’s highest as the continent’s economy becomes increasingly dependent on space.”

The United States, however, has been a minor player in these developments. The U.S. private sector has expressed minimal interest, and American policymakers have done little to drum up support. It has been minimally engaged in the development of the region’s satellite programs, launching less than 18 percent of Africa’s satellites. Not only has it missed several opportunities to benefit from Africa’s burgeoning $7 billion space industry, but the United States has not reckoned with the potential consequences of growing Russian and Chinese prominence in the African space sector. If the United States wants to help shape the emerging ecosystem, it needs to compete in Africa’s space race.

U.S. critics have been quick to [dismiss](https://www.npr.org/sections/goatsandsoda/2018/08/28/641245377/a-new-taxonomy-of-corruption-in-nigeria-finds-500-different-kinds) African governments’ entrance into the space age as a vanity project at best and a corruption scheme at worst. Innovations around satellite technology, however, have dropped the cost of the devices, making it increasingly viable for low-income nations in Africa to design or manufacture their own small satellites. In many cases, it is less expensive to launch and maintain a satellite than to purchase imagery and other services from commercial companies and foreign governments. For instance, NileSat, Egypt’s publicly-traded communications satellite company, makes an average of $200 million in revenue each year from its satellites, offering communications services locally and to neighboring countries. The satellites have made Egypt less dependent on outside services for its satellite broadband and television needs. Space infrastructures, when used well, improve the African market and help countries to be less reliant on other countries.

Africa’s Space Race and National Security

Advancing American economic and development goals in Africa will translate into influence in harder national security spheres. Africa’s space industry is projected to grow to over $10 billion in the next five years, according to Space in Africa’s [African Space Industry Annual Report](https://africanews.space/african-space-industry-now-generating-over-usd-7-billion-annually-to-exceed-usd-10-billion-by-2024/). This is a significant opportunity for the United States to expand bilateral trade with African countries, which rested at a mere [$40 billion in 2018](https://ustr.gov/countries-regions/africa). U.S. companies are well-positioned to sell space equipment and services to African governments. Specifically, the U.S. private sector could build new satellites, sell ground station equipment, provide capacity training, and offer launch services. These investments in the region’s space sector could support [America’s goal](https://www.commerce.gov/news/speeches/2019/06/remarks-deputy-secretary-karen-dunn-kelley-corporate-council-africas-us) of substantially increasing two-way trade.

The nascent space industry in several African countries also furthers USAID’s efforts to [foster self-reliance,](https://www.usaid.gov/selfreliance) boosting growth and employment in sectors such as telecommunications, navigation, and Earth observation. These systems and services help to address major societal challenges including imperfect markets, climate change, scarce resources, health systems, and an aging population. For example, about 61 percent of Africans do not have access to the internet, a problem communications satellites could address.

#### Lack of African ICT infrastructure makes telemedicine implementation impossible.

Bisu et al 18 [(Anas A., Department of Engineering, Durham University)(Andrew Gallant, Hongjian Sun, Katharine Brigham, and Alan Purvis) “Telemedicine via Satellite: Improving Access to Healthcare for Remote Rural Communities in Africa” IEEE Region 10 Humanitarian Technology Conference, 2018] TDI

I. INTRODUCTION

The population of Africa is increasing rapidly with projected growth from 1.288 billion to 2.528 billion people by 2050 [1]–[3], yet Sub-saharan Africa (SSA) has lowest health workforce capacity of 3% and healthcare expenditure of 1% globally, which has contributed to the region’s highest burden of communicable diseases (25% of global) such as malaria, HIV/AIDS tuberculosis [5]. Today, about 58% of African population live in remotely isolated rural areas [3], mostly sparsely populated with little or no access to medical care due to the lack of medical facilities and professionals at a time when 55% of the world population lives in urban areas with 53% of the world digitally connected and having advanced healthcare [4, 6]. Moreover, 3.4 billion of the world population live in rural areas and this figure is expected to rise before its decline in 2050 due to urbanisation. Africa and Asia contribute about 90% of the global rural population [4].

Although sustainable urbanisation has been identified as key to successful development as the world continues to urbanise, sustainable development largely depends on successful management of urban growth, particularly in low-income and lower-middle-income countries like Africa [4]. However, policies to improve the lives in both urban and rural areas are required to ensure access to infrastructure and services such as healthcare for all [4]. Telemedicine is becoming vital to the healthcare system as it has the potential to help deliver quality medical care to isolated rural areas and, when implemented correctly, it can be a cost-effective way of expanding access to excellent medical care. However, because it is a relatively new and quickly changing field, some challenges need to be addressed.

Telemedicine, which *is* the use of telecommunications and information technology also known as the use of Information and Communications Technology (ICT) to extend access to quality medical care and to provide improved health care using remote diagnosis, treatment and health information to underserved isolated rural areas by removing distance and cost barriers [5, 7].

The Telemedicine Task Force (TTF) set up in Brussels in January 2006 during a workshop sponsored by European Space Agency (ESA) and European Commission (EC) is tasked with the mandate to develop a comprehensive picture of telemedicine opportunities in Africa on recognition of the potential of Satellite Communications (SatComs) technology to strengthen health systems in Africa and significantly extend the reach of communication to remote and isolated areas of the continent, given the limited reach of terrestrial communication networks. Africa remains the most disenfranchised region in the world with regards to Internet access, with only 34% internet users as of 2018 [6]. The TTF is convinced that by complementing terrestrial infrastructure with SatComs, complete coverage of the African region can be achieved thereby enabling effective and sustainable telemedical services in the region [5].

#### Space assets provide information communication technology and telemedicine.

Ferreira-Snyman 13 [(Anél, B Juris (PUCHE); LLB (PUCHE); LLM (PUCHE); LLD (UJ). Professor: Department of Jurisprudence, at University of South Africa) “The environmental responsibility of states for space debris and the implications for developing countries in Africa” The Comparative and International Law Journal of Southern Africa, Vol. 46, No. 1, 44-49, 2013] TDI

* Space debris makes resources scarce and not accessible to the Global South because they are late comers.

As was pointed out at the onset, the involvement of states in space activities is no longer a mere luxury, but is increasingly becoming a necessity. Although it may be argued that African states are already struggling merely to meet the UN Millennium Development Goals and cannot, therefore, be expected to engage in space activities, space technology can be used in a number of beneficial ways,152 and involvement in space activities is especially important for their development and human security.153 This will also answer the objectives of NEPAD, which has identified the development of science and technology on the African continent as one of its sectoral priorities.154 In terms of section 13 of the Constitutive Act of the Africa Union,155 the Executive Council of the Union shall coordinate and take decisions on policies in certain areas of common interest to member states, including science and technology.156 Specifically, the use of satellite technology has the potential to promote a state's development and assist in transforming the socio-economic needs of its citizens.157 Communication satellites can provide developing states with the opportunity to communicate freely and to access in imperative for their economic, social, and technical development.158 Satellites are used for disaster management through remote sensing in order to promote human safety in the instance of disasters such as, floods, earthquakes, volcanic eruptions, landslides, and wildfires.159 Space telecommunication systems can also play an important role in promoting education on the African continent by, for example, providing for distance education via satellite, and by giving advice to farmers on the planting of their crops.160 In the health sector, too, space technology has a significant role to play in areas of tele-medicine (where specialists assist health care workers in remote areas by providing diagnostic and curative assistance), preventative health care, and infant mortality.16 These socio-economic benefits have made the development of space programmes attractive to a number of developing states.162 Several African states have also realised the importance of space technology in achieving their national development goals, as well as the Millennium Development Goals.163 Modest space programmes have, therefore, been launched which are mainly focused on earth observation for the purpose of environmental and agricultural monitoring in order to serve social and development goals. The main actors in this field are Nigeria, South Africa and Algeria. Nigeria has already launched a number of satellites on foreign launchers.164 After launching a government-owned earth observation satellite in 2009, South Africa established a national space agency165 in 2010 to implement South Africa's space policy166 which is focused on capacity-building, the development of space applications, and international space cooperation. South Africa has also created the South African National Space, Science and Technology Strategy. Algeria has a national space agency, and has constructed a centre for the development of satellites.167 Other states in North Africa, including Tunisia, Morocco, and Egypt (the fourth state to launch a satellite in Africa) also have space agencies or space application centres.168 Angola has shown an interest in space technology and concluded a contract for a communications satellite with Russia in 2009.169 A number of African states, including South Africa, have also enacted their own domestic space legislation. On a regional level, the African Leadership Conference on Space Science and Technology for Sustainable Development was established by South Africa, Algeria, Kenya, and Nigeria to discuss space-related issues. Between 2005 and 2011, four conferences have been held and their recommendations have been shared with non-African member states of the UNCOPUOS.171 A declaration of intent on the African Management and Environmental Constellation was signed by South Africa, Nigeria, and Algeria in 2008. The data accumulated by earth observation satellites in the lower earth orbit will be shared by these three states.172 On an international level, South Africa has shown that it has a role to play in the international space arena. It served as co-chair of the Group on Earth Observations in 2005, and it chaired the Committee of Earth Observation Satellites in 2008. In 2009, the European Union-South Africa Space Dialogue was established. In May 2012, an independent advisory committee decided that the world's largest and most advanced radio telescope, the Square Kilometre Array (SKA) will be constructed on sites in South Africa (with the majority of transmitters being sited here), Australia, and New Zealand. The telescope will be used to explore deep space in order to study the origins of the universe and detect weak signals indicating possible extraterritorial life.173 These opportunities for international cooperation have the potential of increasing the space capacity of developing states in Africa. As African states realise the socio-economic and human security benefits of space applications and thus become increasingly involved in space activities, the issue of space debris will inevitably also become a greater concern for these states. The consequences of damage as a result of satellites being involved in accidents with space debris will be especially serious for the developing states which have limited resources.175 There is also a possibility of environmental damage on the territories of the developing states as a result of falling space debris. It is, therefore, imperative that more African states (including states not involved in space activities) become parties to and comply with the space treaties. They should further increase their representation in the UNCOPUOS in order to have stronger bargaining power and influence in this Committee, by presenting a united African position on space issues One of the issues that will need to be negotiated between developing and developed states, is the responsibility for current and future levels of space debris. As the current levels of space debris are proportionate to the number of space launches to date, a greater responsibility for the maintenance of the environment should be assigned to the space powers that have carried out these launches.177 This is in accordance with the environmental law principle of ' common but differentiated responsibilities ' that is enunciated in a number of international environmental law instruments.178 In terms of this principle, which is based on the idea of international equity, environmental degradation has its origin mainly in industrialised countries and they should, therefore, be primarily responsible for eradicating environmental pollution. These countries usually also have greater capacity to respond to environmental problems and they should, therefore, assist developing countries in accessing relevant resources and technologies to achieve sustainable development.179 As a result of the difference in the social, economic, and ecological circumstances of states, the environmental standards applied to industrialised and developing countries cannot be the same, hence the need for a differentiated approach. In the context of outer space, non-space-faring nations insist that the space faring nations (thus mainly industrialised countries) that have caused (and continue to cause) the current levels of space pollution, should bear the main responsibility to improve the situation, so as to guarantee the possibility of future space activity (including that of developing states). Space-faring nations are obviously in a better position to take the necessary action in this regard.181

#### Telemedicine substantially reduces Africa’s disease burden.

Mbarika and Okoli 2 [(Victor W. A. Mbarika, Department of Information Systems and Decision Sciences)(Chitu Okoli, Department of Information Systems and Decision Sciences)“Telemedicine in Sub-Saharan Africa: A Proposed Delphi Study,” Proceedings of the 36th Hawaii International Conference on System Sciences, IEEE, 2002] TDI

1.2. Telemedicine in Sub-Saharan Africa

Numerous studies documenting the spread of the Internet in various parts of the world have highlighted the fact that Sub-Saharan Africa (SSA)— part of the world’s second largest continent—is the region with the lowest level of economic, technological, and Internet development in the world [15, 16]. The delivery of healthcare is unarguably one of the most fundamental needs for SSA, considering the region’s medical nightmare of growing medical problems with an acute shortage of medical facilities and personnel. Both academic and practitioner literature report on the many medical problems of SSA. The World Health Organization reported that by the end of 2001, an estimated 40 million people worldwide—2.7 million of them younger than 15 years—were living with HIV/AIDS. More than 70 percent of these people (28.1 million) live in SSA; another 15 percent (6.1 million) live in South and Southeast Asia [26]. Furthermore, malaria kills more than a million children each year—2,800 per day—in Africa alone. This represents as many as half the deaths of African children under the age of five. In regions of intense transmission, 40% of toddlers may die of acute malaria, even though there would be a good chance of survival with timely medical attention. Other diseases that kill millions of Africans each year include dysentery, cholera, typhoid, yellow fever, and diarrhea; there are many others. Another major problem faced by Sub-Saharan countries is the shortage of medical personnel. Many developing countries have an acute shortage of doctors, particularly specialists. SSA has fewer than 10 doctors per 100,000 people, and 14 countries do not have a single radiologist. The few specialists and services available are concentrated in cities. Rural health workers, who serve most of the population, are isolated from specialist support and up to date information by poor roads, scarce and expensive telephones, and a lack of library facilities [5].

Telemedicine overcomes the barriers of physical distribution of medical resources by bringing medical personnel and expertise virtually to those who need them in SSA. In a bid to find a solution to the growing medical problems of SSA, many governmental, non-governmental, and international developmental organizations have engaged in an endless effort to implement telemedicine. For example, during the period 1996-2000 the International Telecommunications Union organized several missions of telemedicine experts to selected African countries. These missions tried to identify Africa’s needs and priorities for the introduction of telemedicine services taking into account the state-ofthe-art of the local telecommunications networks and their evolution [9].

However, most of SSA’s telecommunications networks are very poorly developed [12]. Another obstacle is that few African countries have experience in the application of telemedicine, even in urban areas equipped with telecommunications infrastructure. Furthermore, African countries cannot afford the very sophisticated telemedicine solutions involving ATM, virtual reality, etc. Notwithstanding these obstacles, among many others, telemedicine adoption is still important and feasible for most, if not all, Sub-Saharan countries (Table 1).

#### AND Data integration provides malaria mapping that reduce’s disease incidence.

Ceccato 5 [(P. Ceccato1,1International Research Institute for Climate Prediction, The Earth Institute, Columbia University, S.J. Connor1, I. Jeanne2, M.C. Thomson) “Application of Geographical Information Systems and Remote Sensing technologies for assessing and monitoring malaria risk,” 2005, Parassitologia 47: 81-96] TDI

Operational use of remotely sensed images has taken a long time to be implemented in technologically developing regions because image and processing software costs were prohibitive. This problem is now diminishing since: (i) computer processing and data storage facilities are now accessible at lower cost, (ii) satellite images at high spatial resolution have become accessible free of charge (MODIS data) via the Internet and (iii) processing tools such as Healthmapper (GIS tool), Windisp (image display tool), and ADDAPIX (image analysis tool) are being made available to the user community at no cost by organizations such as the World Health Organization and the UN Food and Agriculture Organization (FAO).

The recent availability of free images and processing tools has enabled the rapid development of applications using RS and GIS for operational purposes. In the case of Desert Locust monitoring using RS, GIS and data collection tools including GPS and palmtop computers shows that technology can be made operational in Africa under harsh conditions and at low cost. This successful operational early warning system for Desert Locust monitoring developed by FAO could also be applied for Malaria Early Warning System. The major challenge would be to harmonize data collection and tools in the Malaria community in order to enable data dissemination and analyses. This harmonization for the African continent should be made by an organization such as the UN which has the ability to develop standards and negotiate processes to reach consensus on methodologies and best practices between countries. Thanks to the availability of free image data at high spatial resolution (MODIS images), a new generation of applications can be now implemented to help decisionmakers in the field. The image (Fig. 5) shows the area between Niger-Mali and Burkina Faso where a project is currently underway (NOMADE project). The following image (Fig. 6) shows the presence of vegetation and water bodies with sufficient spatial resolution to allow analyses of where and when (i) vector can develop and (ii) where nomad herds can congregate for food and water and therefore be at risk of malaria. The NOMADE project will allow direct access of information to the user community by using MODIS images which are free of charge via the Internet. The use of MODIS images is also operational in the desert locust monitoring systems implemented in 20 countries where the Department of Plant Protection (DPP) of the Ministry of Agriculture has access via a FTP site at FAO to the MODIS images processed locally in Rome. Each DPP downloads the images and integrates them into a customized GIS developed specifically to monitor desert locust. The desert locust Officer is then able to analyze where and when to send survey teams in the desert to scout for desert locust. Once found, information can be provided to the control team on the area to be treated (Ceccato, in press). This approach can also be adapted for the malaria control community. The launch of initiatives to reduce malaria such as the Roll Back Malaria (RBM), the Millennium Development Goals (MDGs) and the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) can also provide a platform to help the transfer of these new technologies toward the most affected countries. Data and good intentions alone, however, are not sufficient. Developing countries will also need assistance in the process of technology transfer, and in structuring their national information systems and decision-making processes, if they are to derive full benefit from this exceedingly powerful technology.

Integration GIS-RS-Models to produce Malaria Early Warning System

The ready availability of frequently updated data on environmental variables pertinent to malaria transmission over large and remote regions makes RS a useful source of information for epidemic early warning systems. The concept of an early warning system for the prediction of malaria epidemics predates satellite technology by many decades. In fact an early warning system in response to the massive epidemics that occurred periodically in pre-independence India was operated routinely in the Pubjab from the early 1920s until the early 1950s (Najera, 1999). Christophers (1911) observed that between 1868-1908 severe and explosive ‘fever’ epidemics of two-three month duration (AugustOctober) were common in the region. In particular he noted that the worst of the epidemics, which had a periodicity of 7-8 years, coincided with high grain prices and famine. Christophers saw this ‘human factor’ as an ‘essential requirement’ which undermined the population and resulted in high death rates as a result of the epidemics (Christophers, 1911). Christophers’ suggestions for an early warning system were taken up by Gill (1923) who developed a system based on a set of risk indicators: epidemiological assessment of previous infection, economic assessment of grain prices; the JulyAugust rainfall levels; and occurrence of an epidemicwithin the last 5 years (Gill, 1923). Gill tested the system in 1921 and it went into routine operation in 1923. Retrospective reviews of the system outlined the statistical significance and its operational value in epidemic early warning (Yacob and Swaroop, 1944; Swaroop, 1949) but also identified the potential significance of May rainfall, offering a lead warning time of three months (Connor et al., 1999). Despite this example, much of the interest in early warning systems for malaria epidemics was lost during the Global Malaria Control/Eradication Era (Najera, 1998). It was not until the 1990s when a number of epidemics were reported from the East African highlands and a regional epidemic in Southern Africa stimulated renewed interest. At its launch in 1998 the Roll Back Malaria partnership identified Early Detection and Control of Epidemics as one of its four key elements (RBM, 1998). RBM established a Technical Resource Network on Epidemic Prevention and Control which held its first meeting in Geneva in 1998. Among the recommendations of the meeting was the development of a research framework to establish Malaria Early Warning Systems (MEWS) in sub-Saharan Africa and the identification of indicators and thresholds which could be used for early detection of epidemics by epidemiological surveillance systems. The MEWS framework was developed and published in 2001 (WHO, 2001). It set out a series of activities which together form the basis of an integrated monitoring process to identify changes in epidemic potential and increased risk of transmission in areas prone to epidemics (Fig. 7). A pre-requisite to MEWS is the mapping of areas prone to epidemics, either through historical analysis, or in combination with climatic suitability and environmental suitability for malaria transmission. Epidemic risk mapping should be dynamic and updated frequently to reflect changes in vulnerability factors. Clearly an epidemic response plan and the capacity to respond in the vulnerable areas are also essential. The first of the MEWS monitoring processes involves consideration of the dynamic factors which may make populations more vulnerable to severe epidemic outcome. As with the Punjab model, drought, inadequate food security and nutritional/economic status may be important. Increasing levels of drug or insecticide resistance, reduction in health service provision or a high burden of other diseases, such a HIV/AIDS, may also compromise any immunity and increase vulnerability to epidemics. While these factors are unlikely to give an indication of when an epidemic might occur, they do provide some warning of the severity that can be expected if one does occur and is not prevented. The second MEWS monitoring process considers the forthcoming season’s climate. Will it be a drier, normal, or wetter season? What does this mean for epidemic risk considering the recent history? A number of years of drought may disrupt populations, may lower immunity and make populations more susceptible when higher, or even normal, rainfall levels occur. In recent years there have been a number of regular regional meetings (Regional Climate Outlook Fora) where available climate forecasts for the forthcoming seasons are discussed, and considered by the various sectors, such as agriculture, water resources and, increasingly, health. In September 2004, the first Southern African Regional Epidemic Outlook Forum was held in Harare, Zimbabwe. The forthcoming seasons’ climate was presented and discussed to develop action plans for epidemic preparedness and response in the countries that are part of the Southern Africa Development Community (SADC) (http://www.malariajournal.com/content/3/1/37). The third MEWS process is monitoring the weather as it occurs. Are temperatures unusual for this time of year? Is the rainfall higher than would normally be expected? The latter is now freely monitored through meteorological satellites and these are often more readily and frequently available than rain station data through the local meteorological services, who often have to charge for their data. Considering where high rainfall, following two or three years of drought occurs on a vulnerable population in a desert-fringe area which has had epidemics in the past may be one of the most realistic early warning systems available in many African countries. However, the interplay of temperature with rainfall are crucially important in highland-fringe epidemic settings, where the impact of high rainfall may increase epidemic risk or cool the environment to levels which lower transmission potential. Current work is investigating the development and implementation of near-real-time temperature information along with rainfall as a routinely available environmental monitoring product for use in the highland-fringe epidemic settings (Fig. 8) The fourth monitoring process is epidemiological surveillance. Entomological surveillance may offer valuable insights into the vector- parasite-host dynamics and provide warning of changes in epidemic risk. This is generally beyond the scope of most African health services. However, the example of Desert Locust monitoring at Ministry of Agriculture level in 15 countries in Africa, Middle East and South-West Asia showed that surveillance is possible using simple GIS tools (Ceccato, in press). It may be possible to establish sentinel sites in particular locations, known to be epidemic prone and where rapid detection and reporting is possible, and a number of studies are attempting this. While the detection of an epidemic through a rapid increase in the number of cases would be the most reliable, it is unfortunate that routine case reporting systems in sub-Saharan African countries are, at present, unable to detect epidemics in sufficient time to enable an effective response. Due to the complexity of the variables to be considered and the remoteness of the areas affected, RS is an ideal source on which to base an early warning system for malaria epidemics. The research framework established by the RBM partnership provides a useful structure on which to base the required system. Specifically, a comprehensive system must take into account 1) population vulnerability, 2) the forthcoming season’s climate, 3) current weather conditions and 4) vector/parasite/host dynamics. Ideally a country will monitor all of these processes in an integrated framework, which when taken together act as a series of compounding indicators which give control services sufficient confidence to prepare and act early (in accordance with their pre-formulated epidemic response plan) to prevent the rapid rise in cases before they occur.

Conclusions

Malaria is a deadly but preventable and curable disease. Although the environmental drivers that determine the life cycles of both the vector, host and the Plasmodium parasite are complex, they can be monitored and analyzed using newly available technologies such as RS and GIS. Research has shown that the technological building blocks are available to create an operational early warning system which could prevent epidemics and limit the scale of outbreaks until such time as the disease can be eradicated, as it has in Europe and the USA.

A holistic early warning system must consider all of the factors that influence the development of malaria as well as their interactions. Rainfall, temperature, humidity, vegetation and seasonality in weather and climate can all have an effect on the vector, the parasite and susceptibility of the human to the disease. Over the years, many tools have been developed to monitor these factors which are currently available. Rainfall Estimates and Malaria Risk Analyses are available on the ADDS FEWS web page. The vectorial capacity model was developed to express malaria transmission risk and has since been extended to enable temperature and rainfall to drive the model. Information on climate forecast and climate anomalies is becoming more reliable with recent scientific advances and is made available through the IRI Data Library mining factor. Effective control systems should: 1) have access to forecast information on diseases outbreaks and 2) have the means and the organization required to implement control measures. A good early warning system should take into account the effect of any strengths or weaknesses in these areas.

#### Malaria, tuberculosis, and AIDS are all preventable, but kill 5 million annually – “acceptable losses” frame cements inequality.

Murphy 6 [(Sean C., MD, Assistant Professor, Laboratory Medicine at the University of Washington) “Malaria and Global Infectious Diseases: Why Should We Care?,” Virtual Mentor, 2006;8(4):245-250] TDI

In the US and Europe, Ross’s prediction has come true. Although 1 million malaria cases occurred annually in the US throughout the 1930s, today the disease is virtually nonexistent. The story of malaria eradication in the US recounts the development of our health care infrastructure and the success of public health programs. However, in the developing world where such advances are absent’, malaria rages as one of the worst infectious killers. And yet malaria is by no means the only one. Infectious diseases are the leading cause of global morbidity and mortality [2]. The “big 3” pathogens—HIV, tuberculosis, and malaria—cause hundreds of millions of infections annually and collectively kill more than 5 million people each year, mostly in sub-Saharan Africa and Asia. The great travesty of these statistics is that all 3 “perpetual” epidemics are preventable and largely treatable. Why do preventable, treatable diseases continue to weigh heavily on the poor? What are the ethical implications for the medical profession and society when drastic health disparities are perpetuated? What arguments can be made for changing the status quo? Since the history of malaria encapsulates our failure to combat global health threats, it is worth exploring the above issues as they relate to malaria in particular and all “forgotten epidemics” in general.

Poverty and Health

Bacterial, viral, and parasitic diseases cause approximately 163 000 deaths in the developed world annually (mostly among the elderly and those with compromised immune systems) compared to 9.2 million deaths (mostly among children) in the developing world [3]. Communicable diseases cause 56 percent of deaths in the poorest fifth of the world compared to only 8 percent in the richest fifth [4]. Infectious diseases are the world’s leading killers of children and young adults [5]. By every measurable health statistic, the developing world is at an extreme disadvantage in matters of infectious disease.

In addition to morbidity and mortality, infectious diseases are bidirectionally linked to poverty. Malaria has micro- and macroeconomic consequences for affected regions: decreased income, tourism, and foreign investment and increased health expenditures [6]. In contrast, areas that control malaria realize higher life expectancies and economic gains. Malarious countries face far more than the parasite itself; they must also grapple with limited access to essential medicines or health care, poor hygiene and sanitation, low subsistence incomes, limited education, and scant health information.

Unfortunately, the developed world has not committed to addressing these problems. Ninety percent of health care dollars treat a mere 10 percent of the world’s population. This skew is reflected in pharmaceutical portfolios; only 13 of 1233 drugs licensed from 1975 to 1997 were approved for tropical diseases, despite the overwhelming burden imposed by these diseases [7]. Current antimalarial drugs are being rendered ineffective by parasite resistance. Without colonial interests to mandate tropical disease research, and with these diseases virtually eliminated from developed countries, governments have refocused their attention on health problems at home. Meanwhile, as “acceptable losses,” millions continue to die from malaria and other infections, leaving us with intensifying disease burdens among the poor, limited interest among the rich, and a dangerous and ever-widening gap between these spheres. According to public health expert Paul Farmer, the world’s double standard for health is the leading bioethical problem of our time [8].

### Plan

#### Plan – appropriation of outer space by private entities is unjust.

### Framework

#### The standard is maximizing expected well-being.

#### 2] Prioritize probability.

Kessler and Daase 08 (Dr. Oliver Kessler, Research and Teaching Associate for International Relations (University of Bielefeld), Ph.D. in International Relations. Dr. Christopher Daase, Professor (C4) for Political Science and Ordinarius for International Politics at the Ludwig-Maximilian University Munich. “From Insecurity to Uncertainty: Risk and the Paradox of Security Politics.” Vol. 33, April 1, 2008, https://doi.org/10.1177/030437540803300206)

The problem of the second method is that **it is very difficult to "calculate**" politically **unacceptable losses**. If the risk of terrorism is defined in traditional terms by probability and potential loss, then the focus on dramatic terror attacks leads to the marginalization of probabilities. The reason is that **even the highest degree of improbability** becomes irrelevant **as the measure of loss goes to infinity**. ^o The mathematical **calculation of** the **risk** of terrorism thus **tends to overestimate** and to dramatize the **danger**. This has consequences beyond the actual risk assessment for the formulation and execution of "risk policies": **If one factor** of the risk calculation **approaches infinity** (e.g., if a case of nuclear terrorism is envisaged), then there is no balanced measure for antiterrorist efforts, and risk managementas arational endeavor **breaks down.** Under the historical condition of bipolarity, the "ultimate" threat with nuclear weapons could be balanced by a similar counterthreat, and new equilibria could be achieved, albeit on higher levels of nuclear overkill. Under the new condition of uncertainty, no such rational balancing is possible since knowledge about actors, their motives and capabilities, is largely absent. The second form of security policy that emerges when the deterrence model collapses mirrors the "social probability" approach. It **represents a** logic of catastrophe. In contrast to risk management framed in line with logical probability theory, the logic of catastrophe does not attempt to provide means of absorbing uncertainty. Rather, it takes uncertainty as constitutive for the logic itself; uncertainty is a crucial precondition for catastrophes. In particular, catastrophes happen at once, without a warning, but with major implications for the world polity. In this category, we find the impact of meteorites. Mars attacks, the tsunami in South East Asia, and 9/11. To conceive of terrorism as catastrophe has consequences for the formulation of an adequate security policy. Since catastrophes hap-pen irrespectively of human activity or inactivity, no political actioncould possibly prevent them. Of course, there are precautions that can be taken, but the framing of terrorist attack as a catastrophe points to spatial and temporal characteristics that are beyond "rationality." Thus, political **decision makers are exempt**ed **from** the **responsibility** to provide security—as long as they at least try to preempt an attack. Interestingly enough, 9/11 was framed as catastrophe in various commissions dealing with the question of who was responsible and whether it could have been prevented. This makes clear that under the condition of uncertainty, there are no objective criteria that could serve as an anchor for measuring dangers and assessing the quality of political responses. For ex- ample, as much as one might object to certain measures by the US administration, it is almost impossible to "measure" the success of countermeasures. Of course, there might be a subjective assessment of specific shortcomings or failures, but there is no "common" currency to evaluate them. As a consequence, the framework of the security dilemma fails to capture the basic uncertainties. Pushing the door open for the security paradox, the main problem of security analysis then becomes the question how to integrate dangers in risk assessments and security policies about which simply nothing is known. In the mid 1990s, a Rand study entitled "New Challenges for Defense Planning" addressed this issue arguing that "most striking is the fact that we do not even know who or what will constitute the most serious future threat, "^i In order to cope with this challenge it would be essential, another Rand researcher wrote, to break free from the "tyranny" of plausible scenario planning. The decisive step would be to create "discontinuous scenarios ... in which there is no plausible audit trail or storyline from current events"52 These nonstandard scenarios were later called "wild cards" and became important in the current US strategic discourse. They justified the transformation from a threat-based toward a capability- based defense planning strategy.53 The problem with this kind of risk assessment is, however, that **even the most** absurd scenarios can **gain plausibility. By constructing a** chain of potentialities, i**mprobable events are linked and brought into** the realm of **the possible, if not** even the **probable**. "**Although** the **likelihood** of the scenario **dwindles with each step, the** residual **impression is** one **of plausibility**. "54 This so-called Othello effect has been effective in the dawn of the recent war in Iraq. The connection between Saddam Hussein and Al Qaeda that the US government tried to prove was disputed from the very beginning. False evidence was again and again presented and refuted, but this did not prevent the administration from presenting as the main rationale for war the improbable yet possible connection between Iraq and the terrorist network and the improbable yet possible proliferation of an improbable yet possible nuclear weapon into the hands of Bin Laden. As Donald Rumsfeld famously said: "Absence of evidence is not evidence of absence." This sentence indicates that under the condition of genuine uncertainty, different evidence criteria prevail than in situations where security problems can be assessed with relative certainty.

#### 3] All risks of extinction events together are 0.2% per year.

Simpson 16 (Fergus Simpson, Mathematician at the University of Barcelona. [Apocalypse Now? Reviving the Doomsday Argument, https://arxiv.org/abs/1611.03072] // BPS

Whether the fate of our species can be forecast from its past has been the topic of considerable controversy. One refutation of the so-called Doomsday Argument is based on the premise that we are more likely to exist in a universe containing a greater number of observers. Here we present **a** Bayesian reformulation of the Doomsday Argument which is immune to this effect. By marginalizing over the spatial configuration of observers, we find that any preference for a larger total number of observers has no impact on the inferred local number. Our results remain unchanged when we adopt either the Self-Indexing Assumption (SIA) or the Self-Sampling Assumption (SSA). Furthermore the median value of our posterior distribution is found to be in agreement with the frequentist forecast. Humanity's prognosis for the coming century is well approximated by a global catastrophic risk of 0.2% per year.