Cooperation in Outer Space Activities: South Africa's Role as a Member State of the African Union and BRICS

*Anél Ferreira-Snyman**

Abstract

The complex nature of outer space activities and the high cost involved in the development of space technologies have increasingly necessitated inter-state cooperation and partnerships. Global issues such as environmental protection, natural disaster management and climate change have again highlighted the need for cooperation between states, also in the realm of outer space. Pressure on national budgets as a result of various global economic crises experienced over the last few years, has further incentivised cooperation in the structuring of space programmes. Moreover, as a result of the significant increase in space actors, outer space has become a congested and competitive environment. Greater international cooperation is, therefore, imperative in order to ensure that outer space activities are carried out peacefully, for the benefit and in the interest of all nations and that outer space is preserved for future generations. The socio-economic benefits have made the development of space programmes attractive to a number of developing states, including states in Africa. Africa is becoming one of the most important markets for telecommunication development. Sustained development in this area will, however, be dependent on the safety and integrity of space assets. In this regard, outer space cooperation to develop instruments and norms regulating the space domain is imperative. Effective cooperation between developed and developing countries is, however, dependent on the negotiation of a number of contentious issues, including the use of the Geostationary Orbit, the mitigation of space debris and the militarisation of outer space. The formulation and successful application of measures addressing these issues are reliant on cooperation between space-faring and non-space-faring states. It is submitted that South Africa, as a member of both the African Union and BRICS, has an important role to play in this regard.

INTRODUCTION

The complex nature of outer space activities and the high cost involved in the development of space technologies have increasingly necessitated inter-

* Professor, School of Law, University of South Africa. B Juris, LLB, LLM (PUCHE); LLD (UJ).

state cooperation and partnerships.[1] Although the advantages of cooperation in space are self-evident, the early years of modern space flight were rather characterised by a reluctance to cooperate.[2] This was primarily due to the polarising effect of the Cold War and the race between the two superpowers—the USA and the former USSR—for dominance in outer space.[3] However, after the launch of the first artificial satellites in the late 1950s, the need for 'international cooperation in the study and the exploration of outer space'[4] gave rise to the creation of the United Nations Committee on the Peaceful Uses of Outer Space.[5] The subsequent adoption of the Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space[6] paved the way for the Outer Space Treaty[7] with its clear emphasis on the importance of outer space cooperation.[8]

During the 1990s, such cooperation was specifically evident during the Gulf War where American and British communications, reconnaissance and early-warning satellites played a crucial part in the military operations of these allies.[9] Also during this decade, many astronauts worked on the space station Mir and the first segment of the International Space Station (ISS) (the most obvious example of international cooperation relating to outer space) was launched into orbit.[10]

More recently, global issues such as environmental protection, natural disaster management and climate change have again highlighted the need for cooperation between states, also in the realm of outer space.[11] In this regard, the International Charter on Space and Major Disasters[12] is an apt

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1 Simonetta Cheli, 'Cooperation in Space' in Christian Brünner and Alexander Soucek (eds), *Outer Space in Society, Politics and Law* (Springer 2011) 178.

2 ibid.

3 ibid. Also see Robert C Harding, *Space Policy in Developing Countries: The Search for Security and Development on the Final Frontier* (Routledge 2013) 7.

4 UNGA Resolution 1348 (XIII).

5 Cheli (n 1) 179.

6 General Assembly 1962 (XVIII).

7 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1967) (General Assembly resolution 2222 (XXI), annex) — adopted on 19 December 1966, opened for signature on 27 January 1967, entered into force on 10 October 1967) 610 UNTS 205.

8 For example, in the preamble the importance of international cooperation in the field of activities in the peaceful exploration and use of outer space, including the Moon and other celestial bodies, and the importance of developing the rule of law in this new area of human endeavour is recognised, and in Article 1 it is stated that '[t]here shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.' Also see Cheli (n 1) 179.

9 Hannes Mayer, 'A Short Chronology of Space Flight' in Brünner and Soucek (eds) (n 1) 25.

10 ibid. See further on cooperation in the context of the ISS, Cheli (n 1) 188.

11 Cheli (n 1) 180–181.

12 See Disasters Charter, 'International Charter Space and Major Disasters' <https://www.disasterscharter.org/web/guest/home;jsessionid=94218811A1177ED49EE576F3A6FEDDC9.jvm1> accessed 26 May 2018.

example. The Charter 'aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through Authorized Users.' These users include developing space actors such as Brazil and Russia.[13] Pressure on national budgets as a result of various global economic crises experienced over the last few years, has further incentivised cooperation in the structuring of space programmes.[14]

Moreover, because of the significant increase in space actors, outer space has become a congested and competitive environment.[15] The need for cooperation has also been specifically highlighted by the increased involvement of developing states in outer space activities. It is generally accepted that the participation in outer space activities is no longer a mere luxury, but increasingly becoming a necessity, due to, amongst others, the socio-economic benefits it offers. Due to the high cost for developing states to become involved in space activities, the level of involvement differs and is often through cooperative arrangements with established space actors or other emerging space actors.[16] It is interesting to note that, already in 2010, three quarters of the twenty states with launching capabilities were classified as developing states in accordance with the criteria of the World Bank.[17] There are at present at least twenty-five developing states with space programmes aimed at enhancing their international, security and

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13 Cheli (n 1) 189.

14 Id 180–181.

15 UNODA, *Transparency and Confidence-building Measures in Outer Space Activities* (UN Office for Disarmament Affairs, New York, 2013) 8.

16 Harding (n 3) 74.

17 Id 78. Harding id 78–79 classifies the space programmes of developing states into the following three groups: 1. First tier states are the most advanced space actors in the developing world. These states 'have developed (or are on the cusp of developing) indigenous launch capability for both orbital and geosynchronous satellite placements, and have national space agencies, and whose space programs evolved from research development (or attempted development) of ballistic and nuclear program.' First-tier space actors are Brazil, China and India. 2. Second tier states are those 'that produce some of their own space technology, have basic launch capacity (typically sounding rockets), have national space agencies, and frequently, out of necessity, collaborate with more advanced states' programs in the production of space-related technology.' Second-tier space actors are Iran, Iraq, Israel and South Africa. Third-tier states 'occasionally make contributions in space-related technology, almost always purchase space-related technology from more advanced producers, and almost always collaborate with other more developed space actors to achieve their space policy goals. Rather than being space-faring, third tier space actors have made the policy decision to invest in space technology to accomplish which could not be done otherwise.' Third-tier space actors are Argentina, Mexico, Peru, Ecuador, Venezuela, Colombia, Bolivia, Chile, Egypt, Nigeria, Algeria, Tunisia, Asia, North Korea, Kazakhstan, Azerbaijan, Vietnam, Indonesia, Bangladesh, Pakistan, Malaysia, Taiwan, the Philippines, and Thailand. For a comprehensive discussion on these developing states' space activities, see Harding id 78–193.

economic positions.[18] In this regard, Harding[19] submits that the expansion of space programmes by developing countries 'reflects an emerging democratization of outer space' and he points out that the 'broadening and expansion of the usage of outer space and the attendant transformation of power distribution is seen by some observers as leading to a new space race.' Greater international cooperation is, therefore, imperative in order to ensure that outer space activities are carried out peacefully, for the benefit and in the interest of all nations, and that outer space is preserved for future generations.[20] Transparency and confidence-building measures (so-called TCBMs), which include international cooperation, provide a means for states to share information on space-related activities in order to reduce misunderstandings and misconceptions, and to ensure that space operations are safe, secure and sustainable.[21] International cooperation between space-faring and non-space-faring states in the peaceful uses of outer space, as well as in scientific and technical projects can assist in strengthening states' capacity to undertake space activities and contribute to confidence-building.[22]

AFRICA[23]

Space programmes in the developing world are often criticised by arguing that the money spent on these activities, could rather be used for pressing domestic needs.[24] Emerging space actors, however, regard the establishment of national space programmes and the development of space-based technologies as not only yielding short-term benefits, but also foresee that it will promote the state's economic and strategic position in the longer term.[25] In his work on space policy in developing countries, Harding[26] convincingly argues that 'the pursuit of space activities brings with it the assurance of state sovereignty and the promotion of national development'. Although it may thus be argued that African states are already struggling just 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

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18 Harding id 2. Harding id 74 points out that the main objective of the space policies of emerging space powers is to promote the sovereignty and socio-economic development of the state.

19 Id 3.

20 Id 9.

21 UNODA (n 15) 11. Also see UNGA Res 69/38 'Transparency and Confidence-building Measures in Outer Space Activities' (2 December 2014) A/RES/69/38.

22 Id UNODA 17.

23 This section is an updated version of earlier research by the author in the article 'The Environmental Responsibility of States for Space Debris and the Implications for Developing Countries in Africa' (2013) XLVI CILSA 19–51.

24 Harding (n 3) 73.

25 ibid.

26 Harding (n 3) 101.

beneficial ways[27] and involvement in space activities is especially important for the development and human security of developing states in Africa.[28] This will also answer the objectives of the New Partnership for Africa's Development (NEPAD), which has identified the development of science and technology on the African continent as one of its sectoral priorities.[29] In terms of Article 13 of the Constitutive Act of the Africa Union,[30] 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.[31]

A number of factors may motivate the decision to become involved in space activities. First, it has obvious strategic advantages to gain new knowledge in space technologies.[32] Second, most space applications (for example, reconnaissance, surveillance, and communication assets) have a dual use and can thus be used for various purposes.[33] Third, some space

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27 N Jasentuliyana and Kiran Karnik, 'Space Features and Human Security' (1997) *Space Policy* 258.

28 Jo-Ansie van Wyk, 'Overview of the Implementation Status of the Five United Nations Treaties on Outer Space in African Countries' (2008) African Skies/Cieux Africains 91–92.

29 See NEPAD <http://www.nepad.org/>. UNESCO has compiled a Draft Report on the need for a combined strategy by the African Union and NEPAD in the area of satellite remote sensing, in order to promote Africa's sustainable development. See UNESCO Draft Report on the Needs for an African Union/NEPAD Strategy for Satellite Remote Sensing Applications for Africa's Sustainable Development (on file with author). It is noted in the Draft Report that NEPAD has identified a number of science and technology priorities, including space science and technology. It therefore proposes a number of remote sensing strategies that NEPAD can adopt to assist Africa in achieving its sustainable development and Millennium Development Goals (at 7). In addition, satellite technology is also used to monitor internal conflicts, for example, in the DRC, Rwanda and Sudan, as well as for the detection of nuclear explosions. The Draft Report identifies the following areas of immediate need for remote sensing in Africa: water and sanitation; agriculture; energy; environment and disaster mitigation (at 20).

30 Full text to be found in Christof Heyns and Magnus Killander (eds), *Compendium of Key Human Rights Documents of the African Union* (4 edn, PULP 2010) 4–11.

31 Article 13(i). See further Van Wyk (n 28) 97.

32 Thomas Neger and Alexander Soucek, 'Space Faring: A Short Overview of the Present Situation' in Brünner and Soucek (eds) (n 1) 165 refer in this regard to the advantages of having capabilities in the areas of launchers (rockets) and application technologies (such as communication, observation and navigation systems).

33 In this regard Harding (n 3) 76 provides the example of an imaging satellite that can be used for agricultural purposes, but also to track another state's military activities. Neger and Soucek (n 32) 65 gives the example of a rocket that can be used to deliver a payload into space, but also to deliver a payload in a short time over long distances to a target on the ground. Also, see Norbert Frischauf, 'Satellite Navigation' in Brünner and Soucek (eds) (n 1) 126–133 on the dual use of satellite navigation systems.

capabilities have become a necessity.[34] In this regard, 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.[35] Communication satellites can provide developing states with the opportunity to communicate freely and to access information, which is imperative for their economic, social and technical development.[36] In Africa specifically, the telecommunications sector—which is dependent on space-based technologies—is growing rapidly.[37] Satellites are used for disaster management through remote sensing, in order to promote human safety in the instance of disasters such as pest outbreaks, floods, earthquakes, volcanic eruptions, landslides, and wildfires.[38] The South African Space Agency (SANSA), which is the largest in Southern Africa, provides disaster monitoring and post-disaster management for South Africa and the region.[39] 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.[40] Also in the health sector, 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 help), preventative health care and infant mortality.[41] In addition,

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34 Neger and Soucek (n 32) 165 explain as follows: 'Space capabilities have become a *sine qua non* in selected areas, and the "must-have" in these areas is less luxury than necessity. The best example is global positioning (navigation); but also weather forecasting and global communication or reconnaissance activities rely heavily on satellite technology: "space systems have so outclassed former competitors that these functions soon (if they're not already) will be nearly impossible to perform without the space systems, as ground-based systems atrophy and wither away". As is the case in many technological fields, relying on space means also depending on space.'

35 Yvonne Schmidt, 'International Space Law and Developing Countries' in Brünner and Soucek (eds) (n 1) 705. Also see Cheli (n 1) 184.

36 Schmidt ibid.

37 UNIDIR, *The Role of Norms of Behaviour in African Outer Space Activities* (United Nations Institute for Disarmament Research, 2012) 1.

38 Schmidt (n 35) 705; Jasentuliyana and Karnik (n 27) 258. Also see Luncedo Ngcofe and Keith Gottschalk, 'The Growth of Space Science in African Countries for Earth Observation in the 21st Century' (2013) SA J of Sciences 1. UNIDIR (n 37) 2, points out that a number of African states have recently acquired the ability to monitor environmental and climate activity on the African continent to assist them in dealing effectively with natural disasters. Mapping images provided by Nigerian launched satellites played a crucial role in managing floods in Africa; the South African Space Agency established an online catalogue of earth observation dates that is accessible by the general public; and the Algerian Space Agency has the capacity to obtain high-quality earth observation imagery to manage natural disasters and to use for land planning and forestry.

39 Scott Firsing, 'Africa and Space: The Continent Starts to Look Skyward' *The Conversation* (11 May 2015) <http://theconversation.com/africa-and-space-the-continent-starts-to-look-skyward-41336> accessed 26 May 2018.

40 Jasentuliyana and Karnik (n 27) 261; Schmidt (n 35) 705.

41 Jasentuliyana and Karnik ibid. Also see Cheli (n 1) 184.

satellites have been successfully used in the fight against extremist groups such as Boko Haram. In 2014, Nigeria used satellite imagery to locate the 273 young girls abducted by this group.[42] Apart from these 'tangible technological benefits',[43] the development of a space programme is obviously also motivated by the 'intangible'[44] benefit of granting a state enhanced international prestige and status.[45]

The socio-economic advantages of space activities have made the development of space programmes attractive to a number of developing states.[46] Also, several African states have realised the important role of space technology in achieving their national development goals, as well as the Millennium Development Goals.[47] Small space programmes have 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. Algeria and Nigeria have already launched a number of satellites (built in cooperation with a British space company) on foreign launchers.[48] In addition, Egypt has launched earth observation and communication satellites, some in collaboration with the Ukraine.[49] Due to the dual-use nature of specifically space assets used for telecommunication and earth observation, satellite data can be used for both civilian purposes and for enhancing national security capabilities. South Africa, for example, has been using satellite imagery to monitor illegal fishing and piracy off its coast.[50]

South Africa has been involved in space science since the 1950s, in areas such as the tracking of satellites and the support of lunar and interplanetary missions at a tracking station at Hartebeesthoek.[51] During the apartheid era, it cooperated with countries such as Germany, Israel, and the United States of America in the areas of rocketry and missile development, as well as other

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42 Firsing (n 39).

43 Harding (n 3) 8.

44 ibid.

45 Harding id 9 explains as follows: '[A] space program has become an almost obligatory step in becoming a regional and/or world power. Developing states as diverse as Malaysia, Mexico, and Nigeria have all pursued space programs that have contributed to the development of space programs that have contributed to the development of technology for satellite telecommunications, global positioning systems (GPS), and surveillance, and have even produced home-grown astronauts.'

46 Christophe Venet, 'The Political Dimension' in Brünner and Soucek (eds) (n 1) 76.

47 Id 78, 84. In this regard, Harding (n 3) 165, points out that even relatively poor African countries have included space-based technologies in their socio-economic development plans.

48 Id 85. Also see Ngcofe and Gottschalk (n 38) 2.

49 See further Ngcofe and Gottschalk ibid.

50 UNIDIR (n 37) 3.

51 Keith Gottschalk, 'South Africa's Space Programme – Past, Present, Future' (2010) Astropolitics 2.

space-related activities.[52] The country also pursued a space programme from the mid-1980s to the mid-1990s with the purpose of developing an earth-observation satellite (Greensat) and the necessary launch system and ground segment. However, the programme was terminated in 1994.[53] South Africa's involvement in space activities only really expanded after the birth of the new constitutional dispensation in 1994.[54] In 1999, the University of Stellenbosch launched South Africa's first earth-observation satellite (Sunsat). South Africa launched a government-owned earth-observation satellite (SumbandilaSat) in 2009. This microsatellite monitors climate change, takes reconnaissance photos for agricultural purposes and monitors the weather conditions of Southern Africa.[55] These satellite launches were followed by the establishment of the national space agency (SANSA)[56] in 2009, which implemented South Africa's space policy,[57] which is focused on capacity-building, the development of space applications and international space co-operation. One of SANSA's main objectives is to 'foster international co-operation in space-related activities'.[58] Both South Africa's earth-observation satellites were launched through international co-operation efforts—Sunsat[59] through a working collaboration with NASA,

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52 For example, South Africa cooperated with the USA to provide telemetry services for space probes during the space race. During the 1970s and 1980s, the technical cooperation between Israel and South Africa increased, including assistance by Israel in the areas of advanced rocket and nuclear weapons technology. South Africa signed the Nuclear Proliferation Treaty in 1991, making it the only state who produced nuclear weapons, only to give them up voluntarily. For a detailed discussion, see Harding (n 3) 138–142.

53 Department of Science and Technology, *National Space Strategy* <http://www.sansa.org.za/attachments/article/1351/National%20Space%20%20Strategy.pdf> accessed 26 May 2018.

54 Ngcofe and Gottschalk (n 38) 1. Gottschalk (n 51) 2–12, divides South Africa's space programme into three eras: 1947–1962, which was the era of amateur rocketry; 1963–1993, which saw South Africa's apartheid regime initiating various missile projects (which were later cancelled); and 1994 to present, when the new democratically elected government rolled out the legal and institutional infrastructure for a space programme and started to participate in international space forums such as the UNCOPUOS. Harding (n 3) 140, points out that notwithstanding the termination of its space launcher development programme, South Africa still has an 'impressive' space programme infrastructure in place today which 'includes (1) the Council for Scientific and Industrial Research, with various aerodynamic and material testing facilities; (2) the Satellite Application Centre, used for advanced telemetry abilities; (3) the Denel Overberg coastal space launch facility; and (4) numerous industrial aerospace and software producers.'

55 Harding (n 3) 141. Also see Ngcofe and Gottschalk (n 38) 2.

56 See South African National Space Agency, <http://www.sansa.org.za/> accessed 8 September 2017.

57 Full text available at South African Space Council, <http://www.sacsa.gov.za/policy/> accessed 26 May 2018. Other African states with national space policies are Algeria, Egypt, Tunisia and Nigeria. See further Harding (n 3) 165.

58 Section 4*(e)* of the South African National Space Agency Act 36 of 2008.

59 The sixty-kilogram microsatellite was launched into low earth orbit on an American Delta II launcher and provides high-resolution images of South Africa. See Harding (n 3) 141.

and SumbandilaSat[60] by collaborating with the Russian Space Agency.[61] In 2013, the Cape Peninsula University of Technology launched South Africa's first nano-satellite (ZACUBE-1), also with the assistance of Russia.[62] The National Space Strategy[63] has been adopted 'as an implementation framework for a national space programme.' The Strategy envisages that South Africa will 'be a primary user of space-based products and services, be a thriving space nation and be an important contributor to the global space science and technology arena.'[64]

A number of other African countries has also been increasingly active in the area of outer space activities. Algeria has a national space agency and it has constructed a centre for the development of satellites.[65] Other states in North Africa, including Tunisia, Morocco, and Egypt (the fourth state to launch a satellite in Africa) have space agencies or space application centres.[66] Angola has shown an interest in space technology by concluding a contract for a communications satellite with Russia in 2009.[67] On 26 December 2016, Angola launched its first satellite, Angosat-1, on a Zenit Rocket lifting off from the Baikonur Cosmodrome in Kazakhstan.[68] Ghana also recently entered the field of space exploration by launching a miniature satellite (CubeSat) that was built by a group of Ghanaian engineers. The satellite was launched on a SpaceX-rocket from the Kennedy Space Centre, and was deployed from the ISS in July 2017.[69] Apart from South Africa, a number of other African countries have already adopted space legislation in their domestic systems.[70]

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60 The eighty-one-kilogram microsatellite was launched from a Russian Soyuz-2 launcher in Kazakhstan and is used to track climate change, take reconnaissance photos for agricultural purposes and monitor the weather in the Southern half of Africa. See Harding (n 3) 141.

61 Gottschalk (n 51) 8. Harding (n 3) 141, points out that South Africa has already produced 64 per cent of the published science research in Africa. The University of Stellenbosch was the first academic institution to establish a satellite engineering programme already in 2005.

62 Firsing (n 39) 5. The Russian Space Agency, Roscosmos, announced in an official press release the successful launching into orbit of a military reconnaissance satellite for the South African Ministry of Defence. The Kondor-E project has however been marked by controversy and the satellite's exact purpose and whether it was indeed launched, remain uncertain. See Anatoly Zak, 'Russia Orbits South-Africa's First Spy Satellite Kondor-E' <http://www.russianspaceweb.com/kondor-e.html> accessed 26 May 2018.

63 (n 53).

64 Id 5.

65 Venet (n 46) 85.

66 Neger and Soucek (n 32) 173; Van Wyk (n 28) 96–97. Also see Ngcofe and Gottschalk (n 38) 2; Firsing (n 39).

67 Venet (n 46) 85.

68 Caleb Henry, 'Zenit Rocket Launches Angola's Long-awaited First Satellite' (*Space.com*) <https://www.space.com/39210-angola-first-satellite-launch.html> accessed 21 September 2018.

69 David Love, 'Ghana Launches its First Satellite as Part of a New Era of African Space Exploration' *Atlanta Black Star* <http://atlantablackstar.com/2017/08/12/ghana-launches-first-satellite-part-new-era-african-space-exploration/> accessed 26 May 2018.

70 For example, Morocco, Tunisia, Nigeria and Algeria. See Van Wyk (n 28) 95.

At the 69th Session of the General Assembly Special Political and Decolonization Committee in October 2014, South Africa expressly stated that international co-operation, including inter-regional co-operation, was one of the best ways to preserve the use of outer space for peaceful purposes. Therefore, it committed itself and its African partners to ensuring that the benefits of space technology were extended to the rest of the African continent. In a similar vein, Nigeria expressed its commitment to engage with private, regional and international space-faring entities in order to promote the peaceful use of outer space. Although Nigeria's national space agency was foremost established to promote the development and application of space science and technology for the socio-economic benefit of the nation, the country recognises the importance of the equal and non-discriminatory access to outer space (as the common heritage of humankind), in order to improve living conditions, regardless of a particular state's scientific, technological and economic development.[71]

Following the example of developed space nations, regional co-operation has also become an increasing trend amongst emerging space powers,[72] including those in Africa. Already in 1992, the Regional African Satellite Communication Organisation (RASCOM) was created as 'an intergovernmental, commercial satellite organization and the expression of the strong willingness of the African Governments and telecommunications operators to pool their efforts in a view to providing the African continent with telecommunications infrastructure based on space technology'.[73] The African Leadership Conference on Space Science and Technology for Sustainable Development was established by South Africa, Algeria, Kenya, and Nigeria with the purpose to discuss space-related issues. Since 2005, a number of conferences have been held by this group of states, and their recommendations have also been shared with non-African member states of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS).[74] 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

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71 United Nations (Meeting coverage and press releases), 'Outer Space Benefits Must Not Be Allowed to Widen Global Gap between Economic, Social Inequality, Fourth Committee Told, Concluding Debate on Item' (17 October 2014) <http://www.un.org/press/en/2014/gaspd.doc.htm-0> accessed 30 May 2018.

72 Harding (n 3) 191. For a discussion of regional cooperation on a global scale, see Harding id 191–193.

73 RASCOM <http://www.rascom.org/info_detail_neo.php?langue_id=2&info_id=122&id_r=39&id_sr=0&id_gr=3> accessed 26 May 2018.

74 Werner Balogh, 'Institutional Aspects' in Brünner and Soucek (eds) (n 1) 212. Also see Ngcofe and Gottschalk (n 38) 3.

lower earth orbit will be shared by these three states.[75] As was recognised by European states with the establishment of the European Space Agency (ESA), the implementation of an African Space Agency is a necessity for developing African states' capacity to participate in outer space activities.[76] Sudan and Egypt have been leading calls to establish an African Space Agency in order to address monetary and skills issues hampering outer space activities by individual African states. As a result, the African Union Working Group on Space has approved a draft African space policy and is currently developing a comprehensive space strategy.[77] Although some commentators argue that the establishment of an African Space Agency should be placed on hold until all African states have developed their space capabilities to the extent that they can contribute to the establishment of such an agency, it is agreed with Gottschalk that the implementation of the envisaged African Space Agency is a necessary instrument for the continent to 'negotiate better offers for satellite construction, space launches, technology transfer and infrastructure, than could individual countries alone.'[78]

Apart from its regional involvement, South Africa has shown that it also has a role to play in the international space arena. It was co-chair of the Group on Earth Observations in 2005, and it has chaired the Committee of Earth Observation Satellites in 2008. In 2009, the European Union–South Africa Space Dialogue was established.[79] In May 2012, an independent advisory committee decided that the world's largest and most advanced radio telescope, the Square Kilometre Array (SKA),[80] will be constructed on sites in South Africa (with the majority of transmitters being sited here) and Australia. The telescope will be used to explore deep space in order to study the origins of the universe, and to detect weak signals indicating possible extraterritorial life.[81] These opportunities for international co-

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75 Venet (n 46) 88. In this regard Cheli (n 1) 184 refers to the *data democracy concept* which is promoted by South Africa and Brazil 'as means for developing countries to be granted access to data and to benefit from Earth Observation data for implementing actions and policies in the field of environment, natural resource management, risk management and climate change.'

76 Ngcofe and Gottchalk (n 38) 3.

77 Firsing (n 39).

78 Ngcofe and Gottchalk (n 38) 3.

79 Cheli (n 1) 184.

80 Harding (n 3) 141, points out that it is submitted by some that the SKA project will 'contribute to the region's human and technological development by building capacity in engineering and information technology, and will help to inspire young Africans to study science'.

81 See Nicole Holgate, 'SA Wins Lion's Share of Super-telescope' *The South African* (29 May 2012) <http://www.thesouthafrican.com/news/sa-wins-lions-share-of-super-telescope.htm> accessed 28 November 2016; Chris Wickham and Sara Webb, 'Giant Radio Telescope gets Split Location' *Reuters* (25 May 2012) <http://www.reuters.com/article/2012/05/25/uk-science-telescope-idUSLNE84O02520120525> accessed 26 May 2018; Michael Lucibella, 'Radio Telescope Boosts South Africa's Science Credentials' 21 (7) *APS Physics* (July 2012) <https://www.aps.org/publications/apsnews/201207/upload/July-2012.pdf> accessed 26 May 2018.

operation have the potential to increase the space capacities of developing states in Africa.

BRICS

In 2010, South Africa joined the original four BRIC[82] nations, Brazil, Russia, India, and China, as part of the (emerging) economic bloc,[83] to form BRICS. These five countries are considered to be among the biggest and fastest growing emerging markets, and it is estimated that, if combined, they would constitute the largest entity on the global stage. Because of their growing populations, infrastructure building, and expansive middle class, the BRICS nations are particularly attractive to investors.[84]

After the seventh BRICS Summit held in Ufa, Russia, in 2015, the BRICS members made a formal declaration in which the benefits of 'opportunities for outer space co-operation in order to promote the application of relevant technologies for peaceful purposes' were recognised. The BRICS countries have, on a number of occasions, stressed that the use of outer space should be for peaceful purposes and for the benefit of all states, irrespective of the level of their social, economic or scientific development. In July 2015, a Joint Statement regarding the Principles of Elaboration of International Instruments on Outer Space Activities was made, supporting the idea of an international instrument on rules of behaviour in outer space. Such instrument should 'actively promote international cooperation in the uses of outer space for peaceful purposes and should not be discriminatory by including provisions that would in fact set up thresholds that would limit the equal right of exploration and use of outer space by developing countries and emerging space-faring nations.'[85] The commitment of BRICS nations to the peaceful use of outer space and the need to strengthen international

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82 Mark Koba, 'BRICS: CNBC Explains' *CNBC* (New Jersey, 11 August 2011) <http://www.cnbc.com/id/44006382> accessed 26 May 2018, points out that this acronym has been attributed to Goldman Sachs chief economist Jim O'Neill in a 2001 paper he wrote titled 'Building Better Global Economic BRICs'.

83 According to Koba id these countries should not be considered a political alliance (like the European Union). They, however, have the potential to become a powerful economic bloc.

84 ibid.

85 See Embassy of the Russian Federation in South Africa 'Joint Statement regarding the Principles of Elaboration of International Instruments on Outer Space Activities' (31 July 2015) <https://russianembassy.org.za/index.php/brics/187-brics-joint-statement-regarding-the-principles-of-elaboration-of-international-instruments-on-outer-spac-activities> accessed 21 September 2018.

cooperation in outer space activities were again stressed at the recent ninth BRICS summit held in Xiamen, China.[86]

The following cursory overview shows that all four of South Africa's BRICS partners are currently also to a lesser or greater degree involved in outer space activities and a number of space co-operation strategies have been formulated between these states.

Brazil may be considered the most active Latin American country in terms of conducting space activities.[87] The establishment of the civilian space agency, *Agênca Espacial Brasileira* in 1994, signalled the end of the tight military control over Brazil's space activities[88] and, similar to the agenda of many other emerging space powers, Brazil's space programme is mainly aimed at its socio-economic development and national security interests.[89] Satellite technology is also applied for environmental purposes, including the protection of the Amazon rainforest.[90] Apart from operating the Alcantara Launch Centre,[91] Brazil has a very successful rocket programme, and it has launched a number of earth-observation satellites, some in cooperation with its BRICS partner China.[92] In addition to its important co-operative efforts with China, Brazil has also concluded a trilateral agreement with South Africa and India for the production of earth observation and weather satellites.[93] It is furthermore partnering with Russia in a project to develop a number of launch vehicles.[94] Apart from the economic advantages, Brazil's aspirations to become an autonomous leading space nation is motivated by its ongoing efforts to become a permanent member of the United Nations Security Council.[95]

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86 See BRICS Leaders Xiamen Declaration (4 September 2017) <https://www.russianembassy.org.za/index.php/brics> accessed 8 September 2017. The BRICS leaders expressed their commitment as follows: 'We adhere to the principle of utilizing outer space for peaceful purposes and emphasize the need to strengthen the international cooperation in space activities in order to use space technologies to respond to global climate change, environmental protection, disaster prevention and relief and other challenges faced by humankind.'

87 Neger and Soucek (n 32) 169; Cheli (n 1) 183.

88 Harding (n 3) 116.

89 Harding id 109. Harding id 110, summarises the objectives of the Brazilian space policy as follows: '(1) to exert sovereignty over its vast, rich, but thinly populated geographical interior; (2) to develop economically and military so as to obtain a presumably deserved regional leadership position; (3) to eventually receive recognition as a world power.'

90 Harding id 118.

91 See further on this Harding id 115–116.

92 Neger and Soucek (n 32) 169; Cheli (n 1) 183. In this regard Harding (n 3) 95–96 notes that '[t]his collaboration resulted in the CBERS satellite series (I and II), produced in cooperation with the Brazilian Space Agency. CBERS and its successors have been used by both Brazil and China to track deforestation and other geographical phenomena.' Also see Harding id 117.

93 Harding id 118.

94 Id 120.

95 Id 121.

Russia and China are the only two BRICS states that have human space flight capabilities—the 'ultimate achievement' for any spacefaring nation.[96] Russia has been at the forefront of space tourism activities,[97] since it began to take private persons to the ISS in 2006.[98] Moreover, Russia is one of only two countries that have successfully landed on the moon.[99] Russia and China signed a Space Cooperation Programme for 2010–2012. Their cooperation included the sharing of earth exploration data, as well as plans to explore the moon and other planets in our solar system.[100]

From its inception more than forty years ago, India's space programme has been focused primarily on socio-economic development,[101] as well as on its military and national security interest, including missile and nuclear technologies.[102] Since establishing the Indian Space Research Organisation in 1972, India has developed into an important space power that focuses especially on the development and operation of launch vehicles, and satellites.[103] India and its two BRICS partners China and Russia, offer their launch systems on a commercial basis.[104] At the end of 2010, India and Russia concluded a co-operation agreement to share high-precision signals from the Global Navigation Satellite System for defence and civilian purposes.[105] These two countries are also co-operating to send probes to the moon to analyse lunar soil.[106] Projects such as its manned space programme and the planned development of a reusable space plane are indicative of India's lofty ambitions to be a major space player.[107] In February 2017,

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96 Neger and Soucek (n 32) 167. Also see on China, Harding (n 3) 98.

97 See further on space tourism, Anél Ferreira-Snyman, 'Legal Challenges Relating to the Commercial Use of Outer Space, with Specific Reference to Space Tourism' (2014) Potchefstroom Electronic LJ 1–50.

98 To date, the following seven space tourists have travelled to the ISS on board the Russian Soyuz spacecraft: Dennis Tito (2001), Mark Shuttleworth (2002), Gregory Olsen (2005), Anousheh Ansari (2006), Charles Simonyi (2007 and 2009), Richard Garriot (2008) and Guy Laliberté (2009). See GC Sgrosso, *International Space Law* (LoGisma Vicchio 2011) 266–267; E Walter, 'The Privatisation and Commercialisation of Outer Space' in Brünner and Soucek (n 1) 500. See further Tanja Masson-Zwaan and Steven Freeland, 'Between Heaven and Earth: Legal Challenges of Human Space Travel' (2010) Acta Astronautica 1598 fn 6; Tanja Masson-Zwaan, 'Article VI of the Outer Space Treaty and Private Human Access to Space' (2008) Proceedings of the International Institute of Space Law: 51st Colloquium on the Law of Outer Space 538–539.

99 In 1966, the Soviet Union's unmanned Luna 9 spacecraft performed the first soft landing on the moon. See Mayer (n 9) 23. The other country to perform a moon landing is the USA. See further Neger and Soucek (n 32) 167.

100 Cheli (n 1) 183.

101 Harding (n 3) 101–102.

102 Id 103.

103 Cheli (n 1) 185.

104 O Koudelka, 'The Technical Dimension of Space' in Brünner and Soucek (eds) (n 1) 53. Also see Harding (n 3) 106.

105 Cheli (n 1) 185.

106 Harding (n 3) 106.

107 Id 107.

India further confirmed its status as a serious space actor, by launching a record-breaking 104 nano-satellites into orbit on board a single rocket from the country's Sriharikota space centre.[108]

China's aspiration to dominate space, was made visible when it independently launched its first astronaut into outer space in 2003,[109] and by becoming the fourth space-faring actor to place a spacecraft in orbit around the moon.[110] Although China's space programme was initially largely military and politically motivated, with the emphasis on national security objectives, it has in recent years also focussed on socio-economic development priorities.[111] China became an independent launch provider in the mid-1980s, and it is currently the third largest national provider of satellite launch services.[112] Together with India, China has become an important emerging space power[113] during the last decade, and it is envisaged that this country will play an important role in space activities in the future,[114] including a possible moon landing.[115] China's ambitions to become a leading space nation is clearly illustrated by its plans to launch an independent space station similar to the ISS, named Tiangon-3, which is expected to be operational around 2022. The Chinese space station, which will be situated approximately 400 kilometres above the Earth, will allow a manned spacecraft and two research modules to attach to the main body of the station. The permanent crew of three astronauts will rotate every six months. In addition to Tiangon-3, the Chinese plan to launch a telescope, similar to NASA's Hubble, into near orbit.[116] China has concluded a number of co-operative project agreements with developed and less developed space actors, ranging from satellite production and launch services to training for

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[108] Michael Safi, 'India Launches Record-breaking 104 Satellites from Single Rocket' *The Guardian* (Delhi, 15 February 2017) <https://www.theguardian.com/science/2017/feb/15/india-launches-record-breaking-104-satellites-from-single-rocket> accessed 26 May 2018.

[109] Harding (n 3) 81. Also see 'China Successfully Completes First Manned Space Flight' *Space Daily* (Beijing, 16 October 2003) <http://www.spacedaily.com/news/china-03zo.html> accessed 26 May 2018.

[110] Harding (n 3) 98.

[111] Id 81.

[112] Id 90. Harding id 93, points out that by October 2000, China had already launched more than 100 of its own satellites. It plans more than sixty more government launches during the period 2010–2020.

[113] Cheli (n 1) 182 points out that India and China have been added to the White House's 'space actors list'.

[114] Id 183. According to Harding (n 3) 81, China is the leader amongst the emerging space actors.

[115] Harding id 100.

[116] 'China Plans to Build Own Space Station Similar to ISS' *Sputnik News* (15 July 2017) <https://sputniknews.com/asia/201607151043067682-china-space-station/> accessed 26 May 2018; 'China's Answer to NASA: National Space Agency to Launch Own "Hubble"' *Sputnik News* (6 June 2016) <https://sputniknews.com/asia/201606061040871028-china-space-observatory/> accessed 26 May 2018. Also see Harding (n 3) 93 for a discussion of the different phases of the Chinese manned space programme.

experts in less developed states.[117] In June 2016, China signed an agreement with the United Nations Office for Outer Space Affairs (UNOOSA) to provide UN member states with the opportunity to conduct experiments on board Tiagnon-3, and to promote international co-operation in the areas of human space flight and other space activities. The China Manned Space Agency envisages that this co-operation will provide developing countries with better accessibility to outer space.[118] The agreement with UNOOSA will thus provide the impetus for further multinational co-operation in conducting space activities and will build the capacity of developing states under the auspices of UNOOSA's Human Space Technology Initiative.[119]

It should be clear from the above short overview, that the space programmes of developing states are not only aimed at addressing their national security concerns, but also to improve their national economies, by enhancing their abilities in the areas of science and technology, and by creating job opportunities.[120] This clearly confirms the argument that space capabilities are no longer a mere luxury for states, but are becoming an increasingly important national development and security tool for developing states.

ISSUES REQUIRING COOPERATION BETWEEN DEVELOPED AND DEVELOPING COUNTRIES[121]

As mentioned earlier, Africa is becoming one of the most important markets for telecommunication development. Sustained development in this area, however, will be dependent on the safety and integrity of space assets. In this regard, outer space co-operation to develop instruments and norms regulating the space domain is imperative.[122] Consequently, more African states (including states not involved in space activities) should become parties to and comply with the space treaties and also increase their representation in the UNCOPUOS, in order to have more bargaining power

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117 Harding id 86. Harding id 95, points out that '[b]y 2006, China had signed 16 agreements with 13 separate countries, and initiated space industry production cooperation with more than 40 countries and agencies, including, Argentina, Brazil, Canada, France, Malaysia, Pakistan, Russia, Ukraine, and the ESA. In addition, China has signed cooperative memoranda with the space agencies of India and the United Kingdom. One of China's most celebrated collaborations had been with Brazil, which is an archetypical model of post-Cold War South-South cooperation.'

118 Tomasz Nowakowski, 'China's Agreement with United Nations to Help Developing Countries get Access to Space' *Space Flight Insider* (28 July 2016) <http://www.spaceflightinsider.com/organizations/china-national-space-administration/china-agreement-with-united-nations-to-help-developing-countries-get-access-to-space/> accessed 26 May 2018.

119 Id 3.

120 Harding (n 3) 8.

121 This section is an updated version based on earlier research by the author in Ferreira-Snyman (n 23).

122 *The Role of Norms Behaviour in African Outer Space Activities* (n 37) 2.

and influence in this committee, by taking a unified African position on space issues.[123]

The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries (1996) determines that:

> All States, particularly those with relevant space capabilities and with programmes for the exploration and use of outer space, should contribute to promoting and fostering international cooperation on an equitable and mutually acceptable basis. In this context, particular attention should be given to the benefit and the interests of developing countries and countries with incipient space programmes stemming from such international cooperation conducted with countries with more advanced space capabilities.

This aspiration is mirrored by the Mombasa Declaration on Space and Africa's Development,[124] which states that the participants in the Fourth African Leadership Conference on Space and Technology for Sustainable Development,[125] held in 2011, are 'convinced that international cooperation is the best manner to promote peaceful uses of outer space' and 'declare their

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[123] Van Wyk (n 28) 93. 'The Mombasa Declaration on Space and Africa's Development, Fourth African Leadership Conference on Space and Technology for Sustainable Development (ALC IV)' (Mombasa 11–28 September 2011) <http://www.unoosa.org/documents/pdf/psa/bsti/ALC2010/Mombasa_Declaration_Final_final_28-10-2011.pdf> accessed 26 May 2018 proposes that the following actions be taken in order to strengthen African participation in the UNCOPUOS and its Scientific and Technical Subcommittee and Legal Subcommittee: 'a. To reaffirm the importance for African member States of COPUOS and its Scientific and Technical Subcommittee and Legal Subcommittee; b. To promote better coordinated African participation in COPUOS and other global space fora to ensure that the agendas in those fora address Africa's needs and to engage in those fora with well developed African positions on key issues; c. To affirm, through statements in COPUOS, the value of the United Nations Programme on Space Applications for Africa and the importance of ensuring the provision of adequate resources for the continuation of this Programme; d. To take note of the outcomes and recommendations of other regional conferences for Asia and the Pacific and Latin America and the Caribbean, that are relevant to efforts to promote cooperation in the peaceful uses of outer space at the regional, inter-regional and global levels.' Of the current eighty-four member states of the UNCOPUOS, seventeen states are African. These states are: Algeria, Benin, Burkina Faso, Cameroon, Chad, Egypt, Kenya, Libya, Morocco, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Sudan, Tunisia and Ghana. See UNOOSA, *United Nations Office for Outer Space Affairs: Members of the Committee on the Peaceful Uses of Outer Space* <http://www.unoosa.org/oosa/en/members/index.html> accessed 26 May 2018.

[124] (n 123).

[125] 'The Mombasa Declaration' reiterates that the African Leadership Conference on Space and Technology for Sustainable Development 'was born out of a need for a regional platform to improve cooperation among African space professionals and to raise awareness among African governments of the important benefits of space science and technology for Africa's sustainable development.'

commitment to harness space science and technology for the betterment of the human condition in Africa.'

Effective co-operation between developed and developing countries is, however, dependent on the negotiation of a number of contentious issues of which the interpretation of the term *common heritage of mankind* in Article 1 of the Outer Space Treaty,[126] the mitigation of space debris and the militarisation of outer space are arguably the most pressing.

Geostationary Orbit (GSO)

Article 1 of the Outer Space Treaty[127] determines that:

> The exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out *for the benefit and in the interest of all countries*, irrespective of their degree of economic or scientific development, and shall be *the province of all mankind*.[128]

The phrase 'for the benefit and in the interest of all countries' refers to the international law concept *common heritage of mankind*[129] and confirms the communitarian view of space 'as a place where humanity works cooperatively to promote exploration and "pure science"'.[130] The concept, *common heritage of mankind*, has been enunciated in a number of UN treaties and refers to the areas of Antarctica, outer space, and the seabed. These areas cannot be monopolised by one state or a group of states, but should be used for the benefit and in the interest of all mankind.[131] The use of outer space is thus not confined to the benefit of space-faring nations only.[132] Also, if states use outer space in such a manner that it excludes other states from using it, for example by producing potentially harmful space debris, it would be contrary to the principle of the free exploration and use of outer space.[133]

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126 See (n 7).
127 ibid.
128 [Author's emphasis].
129 Schmidt (n 35) 696. Schmidt id 697, lists the following five core principles with regard to the concept *common heritage of mankind*: '1. There can be no private or public appropriation, i.e. no one legally owns common heritage spaces; 2. Representatives from all nations must share in the management of the resources contained in such a territorial or conceptual area on behalf of all, because a common area is considered to belong to everyone; 3. All nations must actively share with each other the benefits acquired from exploitation of the resources from the common heritage region regardless of the level of participation; 4. The area must be dedicated to peaceful purposes (no weaponry or military installations established in territorial commons area); and 5. The area must be preserved for the benefit of future generations.'
130 Harding (n 3) 27.
131 Id 696; Nicholas D Welly, 'Enlightened State-interest – A Legal Framework for Protecting the "Common Interest of All Mankind" from Hardinian Tragedy' (2010) J of Space Law 273.
132 Welly id 278.
133 Sgrosso (n 98) 131.

The extent of the international regulation that is needed to ensure the equitable use of the global commons has been a matter of contention between developed and developing countries.[134] Developing states often use the concept *common heritage of mankind* to contend that the freedom to explore and use outer space, legally obliges space-faring nations to share the benefits of their activities with developing countries, and that this even constitutes an enforceable right on the part of the developing countries.[135] Contrary to these assertions, developed countries deny that the Outer Space Treaty or any other international law instruments provide for such an obligation and enforceable right.[136]

The allotment of slots for satellites in the geostationary orbit (GSO)[137] has been a particularly contentious issue between developing and industrialised nations. As the GSO can only host a limited number of satellites (around 180), developing countries for some time have been concerned that, once they are ready to place their own national satellites in the GSO, all the slots will already be occupied by industrialised states and the space powers.[138] In this regard, Harding[139] points out that one of the important incentives behind 'China's rush into space' is the limited number of orbital slots for satellites in the GSO. He cautions that

> [i]n an era of satellite communications, reconnaissance, and information systems, for a state not to have claimed an orbital slot is tantamount to abdicating its national power, perhaps even sovereignty in the long term.[140]

As a result of the limited satellite slots in the GSO, eight Equatorial countries[141] adopted the Bogota Declaration in 1976[142] in which the GSO is considered to be a scarce natural resource. The Declaration states that because of the increasing importance and value of the GSO, coupled with the

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134 Schmidt (n 35) 696.

135 Id 712. Schmidt explains that '[t]he basis for the claims of developing countries is mainly found in the common heritage of mankind concept, in which theoretically all of humanity became the sovereign over the international commons.'

136 ibid.

137 Schmidt id 701 describes the GSO as 'a circular orbit that corresponds to national territorial, sea and insular territory directly above the Earth's equator. A satellite positioned in the GSO appears stationary with respect to a fixed point on the rotating Earth. Commercial communications satellites, broadcast satellites and weather satellites often operate in geostationary orbits, with the intention that the antennas communicating with them do not have to move, but can be pointed at the position in the sky where they stay. The GSO is managed by the Telecommunications Union (ITU) through the ITU's allocation mechanisms.'

138 ibid.

139 See (n 3).

140 ibid.

141 Brazil, Colombia, Ecuador, Indonesia, Congo, Kenya, Uganda and Zaire.

142 Full text at <https://bogotadeclaration.wordpress.com/declaration-of-1976/> accessed 26 May 2018.

development of space technology and the growing need for communication, the equatorial countries have decided to proclaim and defend, on behalf of their peoples, their sovereignty over this natural resource.[143]

In qualifying the GSO as a natural resource, the equatorial states relied on UN General Assembly Resolution 2692 (XXV) entitled Permanent Sovereignty over the Natural Resources of Developing Countries and Expansion of Internal Accumulation for Economic Developments. In addition, they based their argument on Article 2 of the Charter on Economic Rights and Duties of States adopted by the UN General Assembly as Resolution 3281 (XXIV), which provides that all states have permanent sovereignty over their natural resources.

According to the equatorial states, there is 'no valid or satisfactory definition of outer space' to indicate that the GSO is included in outer space.[144] This statement again stresses the need to formulate a clear and binding definition of outer space. However, they, acknowledge that the segments of the orbit corresponding to the open sea are beyond the national jurisdiction of states and will thus be considered as the common heritage of humankind to be used and exploited for the benefit of all humankind.[145]

The Bogota Declaration has been criticised widely for contravening Article II of the Outer Space Treaty, which clearly determines that 'outer space is not subject to the national appropriation by claim of sovereignty', and which (according to the critics) includes the GSO also. Hence, the Declaration did not get much support from non-equatorial states, other developing states and the space powers, and it was largely abandoned.[146] The equatorial states, however, continue to press for special treatment of the GSO. The view has been expressed in the Legal Subcommittee of the UNCOPUOS that there was a need to establish a *sui generis* legal regime with regard to the GSO as a limited natural resource, in order to provide for the equitable use of the orbit by all states, while taking into account the special needs of developing and equatorial countries because of their geographical position.[147]

At the time of the drafting of the outer space treaties, the space environment was regarded as an empty domain. This resulted in the space-faring nations freely creating orbital debris, without any effective system to manage the common interest of humankind.[148] It is, however, increasingly suggested that the global commons, which would include outer space,

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143 Paragraph 1.
144 Paragraph 4.
145 Paragraph 3.
146 Schmidt (n 35) 704.
147 ibid.
148 Welly (n 131) 279.

should be held and managed in a kind of trust for the whole of humankind.[149] Some environmental harm can only be effectively prevented and remedied through a global effort. The mitigation and prevention of space debris is a clear example in this regard.[150]

Space Debris[151]

Despite many space objects re-entering the earth's atmosphere in a carefully guided manner, there have been a number of reports (also in recent years) of objects making unguided return trips to Earth.[152] In March 2016, China announced that its prototype space module Tiangong-1, has come to the end of its two-year lifespan in space and that it will almost certainly at some time return to Earth in an uncontrollable manner. Although the Chinese Manned Space Engineering Office has made assurances that there is little chance of space debris falling on populated areas on Earth, some experts are estimating that the debris will land anywhere between forty-three degrees north and forty-three degrees north/south of the equator, an area where almost 90 per cent of the human population resides. This obviously makes the odds of falling space debris hitting someone, relatively high.[153]

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149 Frances Lyall and Paul B Larsen, *Space Law: A Treatise* (Ashgate 2009) 280–281. Various constructions such as 'trusteeship', 'guardianship', 'custodianship' and 'stewardship' have been suggested with respect to the preservation of certain or all elements of the environment by individual states. See Peter H Sand, 'Sovereignty Bounded: Public Trusteeship for Common Pool Resources' 2004 Global Environmental Politics 53. Kemal Baslar, *The Concept of Common Heritage of Mankind in International Law* (Kluwer Law 1998) 117–155, points out that international spaces and national and cultural resources such as the open sea, Antarctica, the environment, and human rights form part of the common heritage of humankind. He suggests the use of the term *stewardship sovereignty* in order to regulate the inherent tension between the notions of sovereignty and common heritage of humankind. In an analysis of the effect of biodiversity on state sovereignty, Werner Scholtz, 'Animal Culling: A Sustainable Approach or Anthropocentric Atrocity?: Issues of Biodiversity and Custodial Sovereignty' (2005) Macquarie J of Intl and Comp Environmental L 21–25, submits the use of the term *custodial sovereignty* in relation to the issue of biodiversity: 'This notion entails that a state is the trustee of its global environmental resources, and that other states have an expectation that the relevant state will protect these resources. Other states are burdened with the duty to support the custodial state to fulfil its obligations. The custodial state is still entitled to exploit its resources in accordance with its (permanent) sovereignty, but the latter is restricted by the expectations of other states. The sovereignty of the custodial state further enables it to deter unwanted aggression by other states regarding its resources.' According to Lotta Viikari, *The Environmental Element in Space Law – Assessing the Present and Charting the Future* (Martinus Nijhoff 2008) 184, there is no reason why the idea of states as trustees of common resources cannot be applied to the management of space activities as well.

150 Id Lyall and Larson 281.

151 See further Ferreira-Snyman (n 23).

152 For a list of these examples, see id 26–27.

153 Monica Grady, 'Tiangong Falls Out of the Sky, China Must Ask Itself Why' *Asian Scientist* (6 October 2016) <https://www.asianscientist.com/2016/10/features/tiangong-1-crash-2017-chinese-space-agency-cooperation/> accessed 26 May 2018.

The 'prospect of burning debris from Tiangong-1 raining down on Earth'[154] has again highlighted the need for cooperation between space agencies, as collaborative expertise and better communication will assist in solving problems (such as the crashing of Tianong-1) more easily. The mitigation of space debris, however, has proven to be a contentious issue between space-faring and developing states. As developing states, including states in Africa, realise the socio-economic and human security benefits of space applications and they become increasingly involved in space activities, space issues will inevitably also become a greater concern for these states. The consequences of damage[155] as a result of satellites being involved in accidents with space debris will be especially serious for developing states with limited resources.[156] There is also the possibility of environmental damage on the territory of developing states because of falling space debris. One of the issues that will need to be negotiated amongst developing and developed states, is the responsibility for current and future levels of space debris. Since 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 accorded to the space powers that have carried out these launches.[157] This is in accordance with the environmental law principle of 'common but differentiated responsibilities' that a number of

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154 Monica Grady, 'Crashing Space Station Shows Why China Must Start to Collaborate in Orbit' *The Conversation* (Johannesburg, 26 September 2016) <https://theconversation.com/crashing-space-station-shows-why-china-must-start-to-collaborate-in-orbit-66072> accessed 26 May 2018.

155 For a detailed discussion of states' responsibility and liability for damage caused by their outer space activities in terms of the Outer Space Treaty and the Convention on International Liability for Damage caused by Space Objects (1972), see Ferreira-Snyman (n 23) 36–44.

156 M Prasad, 'Common but Differentiated Responsibility – A Principle to Maintain Space Environment with respect to Space Debris' (2007) International Institute of Space Law Proceedings of the 50th Colloquium on the Law of Outer Space 290. 'The Mombasa Declaration' (n 123) recognises that 'the space environment is becoming increasingly crowded and that actions of one actor in outer space hold potential consequences for many other actors, and that emerging space nations do not have the luxury of entering into a pristine environment, but have to take cognisance of the effects of their actions on all other users of outer space'. Also, see Ian Sample, 'Where Will the Out-of-control Chinese Space Station Land?' *The Guardian* (London, 24 September 2016) <https://www.theguardian.com/science/2016/sep/24/where-will-the-out-of-control-chinese-space-station-land-tiangong-1> accessed 26 May 2018.

157 Prasad (n 156) 290.

international environmental law instruments enunciate.[158] According to 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 capacities to respond to environmental problems, and they should, therefore, assist developing countries in accessing relevant resources and technologies to achieve sustainable development.[159] As a result of the difference in social, economic and ecological circumstances of states, the environmental standards applied to industrialised and developing countries cannot be the same, hence the need for differentiated responsibilities.[160]

Also in the context of outer space, non-space-faring nations insist that space-faring nations (thus mainly industrialised countries) that have caused (and continue to cause) the current levels of space pollution should have the main responsibility to improve the situation, in order to also guarantee the possibility of future space activity (including those of developing states). Space-faring nations are obviously in a better position to take the necessary action in this regard.[161]

Although the principle of 'common but differentiate responsibilities' is not included in any of the outer space treaties, Viikari submits that the space sector might be more receptive to the principle in future due to the general process towards creating multilateral accountability.[162] She suggests the

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158 See, for example, principle 7 of the Rio Declaration on Environment and Development of 1992 which determines that '[s]tates shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit to sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.' In terms of Article 3(1) of the United Nations Framework Convention on Climate Change of 1992, '[t]he Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capacities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof.' See further, Utsav Mukherjee and Aravind Mokkapati, 'Determining Liability for Damage Caused due to Debris in Outer Space: Portal to a New Regime' (2009) Proceedings of the International Institute of Space Law – 52nd Colloquium on the Law of Outer Space 294–295.

159 Viikari (n 149) 179.

160 Mukherjee and Mokkapati (n 158) 294; Viikari (n 149) 179.

161 Viikari id 182–183; Mukherjee and Mokkapat id 174, note that the view was also expressed at the UNCOPUOS meeting in February 2007 that the states largely responsible for creating space debris should contribute to space debris mitigation efforts in a more significant manner than other states.

162 Mukherjee and Mokkapati id 295, is similarly of the opinion that the principle of 'common but differentiated responsibilities' can be extended to apply to the environmental problems caused by space debris by drafting a convention on the management and liability of space debris.

creation of a space fund as an expression of the ideals of common but differentiated responsibilities. The fund can be used for the benefit of future generations. Such a fund is in conformity with the notion, referred to earlier, that states are the trustees of the common resources.[163] Sgrosso also refers to suggestions that an international fund should be created to compensate victims who suffered damages caused by unidentified space debris. States would then have to pay an amount of money into the fund before carrying out a space launch. The amount would depend on the size, mass and harmfulness of the space object to be launched. She, however, doubts whether this idea is feasible, as it would be very difficult to determine the amount to be paid. Developing states that would be required to participate in the fund when they commence with space activities, may object to this, as the harmful situation has already been created by industrialised countries carrying out past space launches.[164]

In order to limit the future creation of space debris, Prasad suggests that launch quota caps should be created for space-faring states. These states will then be awarded 'debris credits' if they implement the space debris mitigation guidelines. Nations with advanced space programmes would also be allowed to buy 'debris credits' from other countries. Developing countries that plan to develop future space capabilities can be given fixed quotas that will lapse after a certain period, should they not realise their planned space missions. However, these countries can sell their 'debris credits' to developed countries, thereby acquiring the means to develop their own space capabilities. He also proposes the creation of a trust fund, which will be used to compensate victims of damage as a result of space debris.[165]

It is clear that none of the above suggestions provides an ideal solution to the current and future space-debris problem. Space-faring states are reluctant to participate in space-debris mitigation measures that would have negative financial implications for them. It is, therefore, doubtful whether states would be willing to contribute to the proposed trust fund. There is also the possibility that developing states will merely sell their debris credits to industrialised countries, without really utilising this as a means to develop their own space capabilities.

At the 69th Session of the General Assembly Special Political and Decolonization Committee, South Africa expressed its concern that the increase in space debris posed a risk to space systems and may cause the disruption of essential space-based services. It therefore welcomed the proposed guidelines by the working group on the Long-term Sustainability of Outer Space Activities and called on all nations to work together in preserving outer space for future generations.[166] In the domain of space

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163 Viikari (n 149) 183–184.
164 Sgrosso (n 98) 136.
165 Prasad (n 156) 291.
166 See (n 71).

law, the work of the legal subcommittee of the UNCOPUOS is vital to developing a shared understanding of the legal implications of the rapid development in the space arena.[167]

Militarisation / Weaponisation of Outer Space[168]

The potential use of space for military purposes persisted to be intrinsically linked to the development of space technology[169] and space flight,[170] since the end of the Second World War. The launch of the first artificial satellite, Sputnik 1, by the USSR in 1957 'caused a crisis in Western military thinking'[171] as it indicated that a surprise attack from space is a real possibility. This event was the impetus for the so-called 'space race' between the USA and the USSR, causing these two new world powers to invest huge resources in their respective space programmes.[172] Apart from the development of intercontinental ballistic missiles used for the launching of nuclear warheads,[173] specifically the strategic benefit of earth-observation from outer space (reconnaissance), was and is still seen as an important security tool for states.[174]

In view of the recent emergence of new major space powers, such as China,[175] the focus has again shifted to the military use of outer space and the potential that a state with advanced space technology may use it for military purposes in order to dominate other states.[176] This was already illustrated

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167 ibid.

168 For a detailed discussion of this issue, see Anél Ferreira-Snyman, 'Selected Legal Challenges Relating to the Military Use of Outer Space, with specific reference to Article IV of the Outer Space Treaty' (2015) Potchefstroom Electronic LJ 489–529.

169 Lyall and Larsen (n 149) 499, 508.

170 A Soucek, 'Earth Observation' in Brünner and Soucek (n 1) 116. Neger and Soucek (n 32) 158, point out that 'military aspects were the basis of modern spaceflight'.

171 Lyall and Larsen (n 149) 507.

172 Neger and Soucek (n 32) 157.

173 Id 158.

174 Soucek (n 170) 116–117.

175 See Jackson Nyamuya Maogoto and Steven Freeland, 'From Star Wars to Space Wars – The Next Strategic Frontier: Paradigms to Anchor Space Security' (2008) Air and Space Law 12–15.

176 Lyall and Larsen (n 149) 499, 508. In this regard Soucek (n 170) 318, refers to the *doctrine of space control* as one of the purposes of space capacities identified by the US Space Command. Soucek points out that, although the idea of space superiority is in itself a legitimate goal, the doctrine of space control may be contrary to the provision in Article 1 of the Outer Space Treaty that all states should be free to use and explore outer space. He explains as follows: 'Space control has four key aspects: surveillance, protection, prevention and negation. The problem lies in the last of the four: Space control wants to limit the space freedoms if unilaterally found necessary (applying upon occurrence, i.e. during a military conflict). The doctrine of space control requires capacities and methods; much of it sounds like Star Wars turned true: anti-satellite weapons, space mines, bodyguard satellites, high altitude nuclear detonations, etc. The focus of the doctrines of space superiority and space control is ultimately to achieve national goals through a dominant use of outer space in comparison to adversaries.'

when China, in January 2007, 'shocked the international community'[177] by performing an Anti-Satellite (ASAT) test which generated a vast amount of space debris in the low earth orbit.[178]

The *Outer Space Treaty*[179] prohibits the installation of nuclear weapons and weapons of mass destruction in outer space, and it determines that the moon and other celestial bodies shall be used for peaceful purposes only.[180] Although the installation and testing of military equipment and space weapons in outer space is clearly unlawful, the problem remains that most space assets have the potential to be used for military purposes.[181] For example, while satellite technology in the form of remote sensing can be used to gather meteorological data, it can also be used to gather intelligence in other states. Similarly, Global Navigation Satellite Systems (GNSS) or Global Position Systems (GPS) can be used for civilian purposes, but also to direct bombs or cruise missiles.[182] Telecommunication satellites are not only used to transmit civilian communications, but also military messages.[183] Remote sensing by means of satellite is also used in the civilian as well as military spheres.[184]

It is clear that the distinction between military and non-military uses of space is increasingly becoming blurred.[185] The question therefore remains whether the military use of space equipment is contrary to the provision in the *Outer Space Treaty,* that outer space must be used exclusively for peaceful purposes. Moreover, due to the importance for states to protect

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177 Nina-Louisa Remuss, 'Space and Security' in Brünner and Soucek (eds) (n 1) 519.

178 Fabio Tronchetti, 'A Soft Law Approach to Prevent the Weaponisation of Outer Space' in Irmgard Marboe (ed), *Soft Law in Outer Space: The Function of Non-binding Norms in International Space Law* (Publisher 2012) 365; Maogoto and Freeland (n 175) 15; Harding (n 3) 98. For further examples of recent developments towards space militarisation, see V Gopalakrishnan, KRS Murthi and MYS Prasad, 'Weaponization of Outer Space and Impact on Peaceful Uses' (2008) Proceedings of the International Institute of Space Law 254.

179 (n 7).

180 Article IV.

181 Lyall and Larsen (n 149) 500. Also see TW Goodman, 'To the End of the Earth: A Study of the Boundary between Earth and Space' (2010) Journal of Space Law 108, who confirms that '[i]t is widely known that any object in space can become a space weapon.'

182 Lyall and Larsen id 500, 519. The authors point out that 'the present operation systems, US GPS, Russian GLONASS and the Chinese Beidou are systems designed, operated and owned by the military to which civilians have been granted access.' Also, see Frischauf (n 33) 126–133, on the dual use of satellite navigation systems.

183 Lyall and Larsen (n 149) 500. The use of telecommunications systems is subject to the rules and procedures of the International Telecommunications Union (ITU). See further in this regard, Reaching Critical Will, 'Outer Space: Militarization, Weaponization, and the Prevention of an Arms Race' (*Women's International League for Peace and Freedom*) <http://www.reachingcriticalwill.org/resources/fact-sheets/critical-issues/5448-outer-space> accessed 26 May 2018.

184 Lyall and Larsen (n 149) 521–522. Also see Soucek (n 170) 317; S Ospina, 'Let there be Peace in Space, and on Earth' (2009) Proceedings of the International Institute of Space Law: 52nd Colloquium on the Law of Outer Space 178.

185 Lyall and Larsen id 519; Ospina id 80.

their space assets from possible neutralisation by other states, the potential for conflict is self-evident.[186] This has obvious implications for developing states, with limited resources.

Attempts to conclude a legally binding treaty prohibiting the placement and use of all kinds of weapons in outer space up to present have been very challenging.[187] The most recent attempt to achieve this is the Russia/China *Draft Treaty on the Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects*,[188] submitted to the Conference on Disarmament in 2008 and 2014 respectively. There are, however, some concerns regarding Russia and China's motives with the Draft Treaty, which some observers consider as an attempt to limit their adversaries' military capabilities.[189] Due to the difficulties in creating a binding treaty, the appropriateness of soft law to prevent an arms race in outer space and to protect space assets, is increasingly supported in the area of space security.[190] These soft-law guidelines could be drafted in various forms, for example, guidelines or rules of the road with the purpose of creating transparency in order to avoid 'accidental military engagement in outer space';[191] codes of conduct which provide certain behavioural and operational rules to be followed by states when conducting space activities;[192] or TCBMs[193] with the purpose of sharing information on, amongst others, the location and scope of space launches and activities, or information on domestic space policies programmes in order to improve international relations.[194] In this regard, Tronchetti[195] submits as follows:

> First and utmost soft law provisions, and in particular TCBMs, are being recognised as a useful tool to enhance space security because they contribute to create mutual understanding and to reduce tensions among States. In particular, these measures diminish and even eliminate the cause for mistrust,

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186 Goodman (n 181) 110.

187 Tronchetti (n 178) 368–369.

188 Draft Treaty on the Prevention of the Placement of Weapons in Outer Space and of the Threat or Use of Force against Outer Space Objects (2008) <http://reachingcriticalwill.org/resources/fact-sheets/critical-issues/5448-outer-space> accessed 26 May 2018.

189 See further Timothy Farnsworth, 'Fate of Space Code Remains Unclear' (*Arms Control Association*) <https://www.armscontrol.org/print/6349> accessed 26 May 2018.

190 Tronchetti (n 178) 372.

191 Lyall and Larsen (n 149) 529–530.

192 For a discussion of some of these soft-law codes see Tronchetti (n 178) 376–383.

193 See further on TCBMs, Y Takaya-Umehara, 'TCBMs Over the Military Use of Outer Space' (2009) Proceedings of the International Institute of Space Law: 52nd Colloquium on the Law of Outer Space 123–132; Anatoly Kapustin, 'The Place of TCBMs in Outer Space Security' (2009) Proceedings of the International Institute of Space Law: 52nd Colloquium on the Law of Outer Space 186–190; V Gopalakrishnan, A Bhaskaranarayana and KRS Murthi, 'Peace in Space: A Pragmatic Approach' (2009) Proceedings of the International Institute of Space Law: 52nd Colloquium on the Law of Outer Space 140–142.

194 Tronchetti (n 178) 372.

195 Id 373.

> fear and miscalculation concerning military activities in outer space and intentions of other States, factors which may generate the perception of an impaired security of national space objects and provide justification for the placement and use of weapons in outer space.

The European Union's draft *Code of Conduct for Outer Space Activities*[196] is a good example of an attempt to regulate the military use of outer space by means of a soft-law instrument. The Code, which will not be legally binding, aims to improve safety and security in outer space by means of principles and guidelines, voluntarily agreed upon by states.[197] A number of states, such as Australia, Canada, and Japan, have already indicated their support for the Code. Also, the USA seems to be inclined to accept the Code due to its non-binding nature.[198] However, some countries, including four of the BRICS nations, namely, Brazil, Russia, India and China, have expressed concerns that the Code could be used as a means to constrain their capacity to undertake future space activities, and that the language on self-defence in the Code could encourage an arms race in space. Specifically Brazil and India have expressed their disappointment for not being consulted properly in the development of the Draft Code.[199] This uneasiness expressed by the above-mentioned states, again highlights the need for cooperation (specifically also as a TCBM) between developed and developing states in negotiating matters relating to the use of outer space. Tyson[200] points out that simultaneously with the growth of cooperation in the economic development of outer space, the risk of the weaponisation of outer space is escalating. She therefore aptly cautions as follows:

> Both the nuclear Non-Proliferation Treaty (NPT) as well as the UN Charter are premised on advancing cooperative security through the rule of law. Should one or several countries advance in weaponizing space, the disarmament premises of the NPT will be compromised as well as the underlying foundation of cooperative threat reduction and security. A world with multiple levels of security of radically differing proportions, like a nuclear apartheid world, is unstable. Where some have military security and others feel threatened, what level of cooperation will occur in addressing biodiversity, alleviating poverty, protecting the oceans or the climate?

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196 The fifth revised *International Draft Code of Conduct for Outer Space Activities* was made public by the EU on 31 March 2014. Text available at 'EU proposal for an international Space Code of Conduct, Draft' (31 March 2014) <https://eeas.europa.eu/headquarters/headquarters-homepage/14715/eu-proposal-international-space-code-conduct-draft_en> accessed 26 May 2018.

197 Reaching Critical Will (n 183).

198 ibid.

199 Farnsworth (n 189).

200 Rhianna Tyson, 'Advancing a Cooperative Security Regime in Outer Space' (Global Security Institute: Policy Brief, May 2007).

> Weaponization of space will stimulate asymmetrical military responses, arms racing, amplified distrust, and reduced cooperation. If humanity is to continue to benefit from our growing use of outer space, the prevention of its weaponization is imperative.[201]

CONCLUSION

The rapid development in the realm of outer space and the concomitant problems (such as the overcrowding of the GSO, space debris, and the possible weaponisation of outer space) have highlighted the necessity to ensure the long-term sustainability of outer space. As was discussed above, a number of measures are currently under consideration in this regard. These include binding norms in the form of a treaty and non-binding rules such as TCBMs, codes and guidelines. The formulation and successful application of these measures are, however, reliant on cooperation between developed as well as developing states. This implies that the position of specifically African states on the UNCOPUOS and its sub-committees will have to be strengthened.[202] It may, however, be expected that as African states become more involved in outer space activities, their representation and participation in the UNCOPUOS will also increase.

Out of the current eighty-four members of the UNCOPUOS,[203] seventeen states are African, five states are BRICS nations, with South Africa being a member of both the African Union and BRICS. Therefore, it is submitted that South Africa has an important role to play in this forum. From the preceding discussion, it is clear that South Africa is already playing a leading role in outer space affairs in Africa, and that its aspiration to become the African leader in space technology and space research is much more than a pipe dream. To date, South Africa has made the following meaningful contributions to promote outer space activities on the African continent:

- Through its National Space Agency (the largest in Southern Africa), South Africa has initiated a number of space programmes focused on earth observation for purposes of disaster, agricultural and environmental monitoring and post-disaster management in Africa.
- Especially since the commencement of the new constitutional dispensation, South Africa has been actively involved in space science. Notable achievements in this regard include the launching of its first earth-observation satellite (Sunsat), by the University of Stellenbosch in 2009,

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201 Id 6.

202 Van Wyk (n 28) 93.

203 For the membership of the UNCOPUOS see UNOOSA, 'Members of the Committee on the Peaceful Uses of Outer Space' <http://www.unoosa.org/oosa/en/members/index.html> accessed 26 May 2018.

and the subsequent launching of its first nano-satellite (ZACUBE-1) by the Cape Peninsula University of Technology in 2013.[204]

- South Africa's commitment to extend the benefits of space technology to the African continent as a whole is evident from its active participation in and cooperation with other states in the regional and international space arenas. Specifically South Africa's participation in the Square Kilometre Array project will create the opportunity to develop the space knowledge and capabilities of developing states in Africa.

In addition to its role in Africa, as a member of BRICS, South Africa is co-operating with states that have significant knowledge and experience in the area of outer space activities. Through its cooperation with African and BRICS nations in the realm of outer space, South Africa will not only promote its own national outer space interests, but such cooperation may also serve specifically the socio-economic needs of the African continent as a whole.

Due to states' own military and strategic interests, an element of competition will always be inherent to outer space activities. However, as Cheli[205] points out, this does not necessarily have to be a constraint on inter-state cooperation:

> The (political) art is to balance cooperation and competition such as to maximise the benefits of spaceflight for the largest possible number of people. On the one hand, that will always be national citizens or local economies *first*. But, on the other, the advantages of sharing resources are obvious. If the risks associated with this sharing can be minimised, cooperation will flourish more and more.

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[204] A second nano-satellite (ZACUBE-2) developed by the Cape Peninsula University of Technology and the French South African Institute of Technology was expected to be launched in India early July 2018. See 'WATCH: CPUT Unveils New Nanosatellite to be Launched into Space' *News 24* (Johannesburg, 18 April 2018) <https://www.news24.com/Video/SouthAfrica/News/watch-cput-unveils-new-nanosatellite-to-be-launched-into-space-20180418> accessed 26 May 2018.

[205] Cheli (n 1) 181.