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Content

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The introduction of a regulatory framework for the operation of Unmanned Aircraft Systems (UAS) and aircraft with Vertical Take-Off and Landing (VTOL) capability

Francesca Melega

The protection of the environment in the course of air and space activities: legal dimensions

Aikaterini Vakaki

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*Francesca Melega**

1. Introduction

On the 30th of June 2022, the European Union Aviation Safety Agency (EASA) released a Notice of Proposed Amendment (NPA) establishing a thorough legislative framework to deal with new operational and transportation concepts based on cutting-edge technologies, such as Unmanned Aircraft Systems (UAS) and aircraft with Vertical Take-Off and Landing (VTOL) capability.

In particular, this regulatory proposal1 aims at modifying the following pieces of legislation:

i) Commission Regulation (EU) No 748/2012 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations[2];

ii) Commission Regulation (EU) No 965/2012 laying down technical requirements and administrative procedures related to air operations[3];

iii) Commission Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew[4];

iv) Commission Regulation (EU) No 923/2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation[5];

v) Commission Delegated Regulation (EU) 2019/945 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems[6];

vi) Commission Implementing Regulation (EU) 2019/947 on the rules and procedures for the operation of unmanned aircraft[7].

At the same time, the act proposes the introduction of two new delegated and implementing acts regarding:

i) the continuing airworthiness of certified unmanned aircraft systems and their components, and the approval of organisations and personnel involved in these tasks and

ii) the requirements for competent authorities and administrative procedures for the certification, oversight and enforcement of the continuing airworthiness of unmanned aircraft systems.

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1 NPA 2022-06, Introduction of a regulatory framework for the operation of drones — Enabling innovative air mobility with manned VTOL-capable aircraft, the IAW of UAS subject to certification, and the CAW of those UAS operated in the 'specific' category. Link: https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2022-06.

2 OJ L 224, 21.8.2012, p. 1.

3 OJ L 296, 25.10.2012, p. 1.

4 OJ L 311, 25.11.2011, p. 1.

5 OJ L 281, 13.10.2012, p. 1.

6 OJ L 152, 11.6.2019, p. 1.

7 OJ L 152, 11.6.2019, p. 45.

As a result of the development, during the past few years, of innovative technology like UAS and aircraft with VTOL[8], the industry has been creating new operational concepts. These changes have accelerated the rate for the growth of a wide range of aerial services, as well as many forms of air mobility for the transportation of passengers or cargo over a variety of geographic scales, from urban areas to international routes. In particular, air taxi operations are planned to begin with manned VTOL-capable aircraft in the early stages, before moving to remotely piloted versions in the future.

Therefore, a complete and harmonized regulatory framework across the EU MSs must be established to address the privacy, safety, security and environmental implications of this new form of mobility for people and cargo by air.

Moreover, the new regulatory proposal is required to i) bolster the international competitiveness of EU industries at global level, ii) enable the deployment and implementation of UAM operational concepts in Member States, ensuring a smooth integration of these concepts in the current civil aviation domains and iii) help EU citizens gain confidence in the use cases of UAM operations carried out with UAS and passenger-carrying, manned VTOL-capable aircraft[9].

2. Overview of the proposed amendments

The underlying presumptions and standards used to modify existing regulations or create new one, which will be applicable to the v aviation domains impacted by this NPA, can be divided in i) the initial airworthiness (IAW) of UAS subject to certification; ii) the continuing airworthiness (CAW) of UAS subject to certification which are operated in the specific category of operation; iii) the operational requirements applicable to manned VTOL-capable aircraft.

2.1. Initial Airworthiness (IAW) of UAS subject to certification

Since according to the Basic Regulation, the definition of aircraft includes unmanned aircraft, the terms and procedures for providing licenses for UAS may be based on the same applied to manned aircraft, governed by Commission Regulation (EU) No 748/2012. In this regard, the purpose of the NPA is to amend Commission Regulation (EU) No 748/2012 and its Annex I (Part 21) to include provisions for the certification of UAS and for the command unit (CU)[10] that remotely controls the UAS. These amendments are proposed to be applied to UAS that are subject to certification regardless of the category in which they are operated (specific or certified). In particular:

i) since many different reliability flight tests may be necessary for the most complex and critical applications, such as smaller UAS used for parcel delivery or those falling under the specific category of operation, UAS's specific requirements have been created to address the need to maintain this flexibility[11];

ii) UAS in the specific high-risk category of operation requires an operating authorization instead of a permit to fly. However, if the CofA is not yet issued, the operating authorization cannot be obtained until the flight conditions have been approved[12]. The application for flight conditions approval will be submitted to EASA as well as to the appropriate authority in order to ensure the design's safety and that other factors unrelated to the design (op-

8 According to EASA Study on the societal acceptance of Urban Air Mobility in Europe: "*The estimated market size of innovative air mobility (IAM) in Europe, including research and development (R&D), vehicle manufacturing, operations and infrastructure construction, will be approximately EUR 4.2 billion by 2030, which represents almost one third of the global market and hints at the opportunity that this industry may offer for Europe. The estimated market size may create or sustain approximately 90 000 jobs by 2030, based on labour spending for constructing related infrastructure and operating UAM.*" Link: https://www.easa.europa.eu/sites/default/files/dfu/uam-full-report.pdf.

9 NPA 2022-06, Introduction of a regulatory framework for the operation of drones — Enabling innovative air mobility with manned VTOL-capable aircraft, the IAW of UAS subject to certification, and the CAW of those UAS operated in the 'specific' category, 241-290. Link: https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2022-06.

10 The NPA proposes an improved definition of the term 'command unit (CU)' in comparison to the current definition in Implementing Regulation (EU) 2019/945 and Delegated Regulation (EU) 2019/947, stating that "*any ground-, air-, or space-based equipment that supports aircraft command and control is not considered part of the CU*".

11 New Point 21.A.35(f)(2), Commission Regulation (EU) No 748/2012.

12 New Point 21.A.708, Commission Regulation (EU) No 748/2012.

erational procedures and checklists, remote crew training and multi-crew coordination, external systems, etc.) are properly addressed;

iii) if a separate type certificate is required for the command unit, its certification is carried out through dedicated procedures included in this proposal, i.e. the modification of the CoA form to include further information and the designation of the CU models that can be used to operate the UAS;

iv) manufacturers can modify manned aircraft to create unmanned or optionally piloted versions. The current proposal includes the initial airworthiness of such optionally piloted (hybrid) configurations: these aircraft will be listed on a single type certificate (or restricted type certificate or flight condition) so that individual aircraft can be issued a single certificate of airworthiness (or restricted certificate of airworthiness or permit to fly)[13.]

2.2. Continuing Airworthiness (CAW) of UAS subject to certification operated in the specific category

With regard to the Continuing Airworthiness (CAW), UAS maintenance shall be governed by a delegated act (DA) under Article 58 of the Basic Regulation[14]. EASA proposes to include all aspects of UAS continuing airworthiness (maintenance and continuing airworthiness management) in the new DA to be implemented for a clear regulatory framework. This will make it easier for interested parties to evaluate their compliance with the applicable requirements.

Two Annexes to the DA, dealing with high-risk operations in the specific category, are proposed by the NPA: the first Annex, Part-ML.UAS, specifies the CAW requirements that shall be met by UAS; the second one, Part-CAO.UAS, specifies the organizational requirements (i.e. Part-CAO.UAS organizations) to put CAW requirements into practice. However, these Annexes will become applicable for the operator after obtaining a CofA or a restricted certificate of airworthiness (RCofA).

The main differences between Part-ML.UAS and Part-CAO.UAS and Commission Regulation (EU) No 1321/2014 are the following:

i) Part-ML.UAS and Part-CAO.UAS take into account and handle the unique characteristics of the command unit (CU), absent in manned aviation;

ii) no maintenance licensing for UAS in the specific category is being suggested, instead the UAS maintenance organization must set up a "*company authorisation*" process for the certifying staff;

iii) there are no requirements for approved maintenance training organizations working with UAS operated under the *specific* category.

Moreover, EASA also recommends the adoption of a dedicate implementing act (IA) outlining the provisions for the competent authorities in charge of overseeing and enforcing the DA, in accordance with Article 62 of the Basic Regulation.

The IA includes one annex (Part-AR.UAS), which is divided into two subparts:

i) Subpart GEN, establishing the requirements for general competent authority for the oversight of CAW organizations (management system, record-keeping, oversight principles, and so on);

ii) Subpart CAW, setting up specific requirements for tasks and responsibilities related to competent authority's oversight of the UAS CAW and to the issuance of the Airworthiness Review Certificates (ARCs).

13 NPA 2022-06, Introduction of a regulatory framework for the operation of drones — Enabling innovative air mobility with manned VTOL-capable aircraft, the IAW of UAS subject to certification, and the CAW of those UAS operated in the 'specific' category, 24-28. Link: https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2022-06.

14 Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.

Moreover, in compliance with Article 40(1) of Commission Delegated Regulation (EU) 2019/945 and with the Continuing Airworthiness Regulation, a type certificate is not considered always mandatory for UAS larger than 3 metres, operating over masses of people. This, since the risks posed by UAS in case of crash are quite different, considering that the materials with which they are built are different. In such cases, UAS operators must perform a risk analysis and determine appropriate mitigating strategies and safety objectives in order to operate the specific category. If this is not possible, Article 40, 1(d), will still apply, the UAS operation will be categorized as certified, and a type certificate and adherence to the Continuing Airworthiness Regulation will be required.

In addition, Article 7(2) of Commission Implementing Regulation (EU) 2019/947 is amended to require the UAS operator to get a restricted CofA in cases where the nature of proposed operation necessitates the certification of the UAS. As a result, the UAS operator is not required to get a restricted CofA if the UAS is certified but its certification is not required by the kind of proposed operation. The noise certificate uses the same methodology[15].

2.3. **Operational requirements applicable to manned VTOL-capable aircraft**

2.3.1. **Air Operations (AIR OPS)**

First of all, the regulatory proposal in question provides the definition of VTOL-capable aircraft (i.e. "*a power-driven, heavier-than-air aircraft, other than aeroplane or rotorcraft, capable of performing vertical take-off and landing by means of lift/thrust units used to provide lift during the take-off and landing*") and of "helicopter"[16] (i.e. "*heavier-than-air aircraft supported in flight chiefly by the reaction of the air on up to* two *power-driven rotors on substantially vertical axes*") in order to distinguish between these two typologies of aircraft.

To simplify the future integration of VTOL-capable aircraft into EU Member States' transportation systems, the NPA uses the current regulatory infrastructure for airplanes and helicopters with the necessary modifications to account for novel aircraft designs, propulsion systems, and concepts of operation. In fact, aircraft and helicopter operations are now governed by Commission Regulation (EU) No 965/2012, however that Regulation lacks the necessary rules for the safe operation of VTOL-capable aircraft, UAS and for the certification of their operators.

In this regard, the NPA establishes a new Annex IX (Part-IAM[17]) to Commission Regulation (EU) No 965/2012, which rules manned configuration of VTOL-capable aircraft and is divided into four subparts i) GENERAL (GEN) ii) OPERATING PROCEDURES (OP) iii) AIRCRAFT PERFORMANCE AND OPERATING LIMITATIONS (POL) and iv) INSTRUMENTS, DATA AND EQUIPMENT (IDE). The last three are in turn divided into two modules: operations in congested urban areas (Module-UAM) and operations in non-congested areas (Module-NAM).

Before beginning commercial or non-commercial air operations, the operator of a UAS/ VTOL-capable aircraft shall go through a certification procedure and receive an air operator certificate (AOC). The AOC for a VTOL-capable aircraft operator is valid as long as the operator complies with all applicable requirements. Moreover, the VTOL-capable aircraft must be certified, and the operator must indicate the aircraft it plans to utilize in the operational requirements submitted with the AOC. A VTOL-capable aircraft must also have the required navigation, communication, surveillance, detect, and avoid equipment.

The main duties of the AOC holder, detailed in the aforementioned Annex IX (Part-IAM) to Commission Regulation (EU) No 965/2012, are to i) establish proper procedures for operational control of its aircraft ii) make sure pilots are

15 NPA 2022-06, Introduction of a regulatory framework for the operation of drones — Enabling innovative air mobility with manned VTOL-capable aircraft, the IAW of UAS subject to certification, and the CAW of those UAS operated in the 'specific' category, 28-34. Link: https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2022-06.

16 Therefore, the NPA modifies the current definition of helicopter in Commission Regulation (EU) No 965/2012, in Commission Implementing Regulation (EU) No 923/2012 and in Commission Regulation (EU) No 1178/2011.

17 According to the NPA, Innovative air mobility (IAM) means "*the safe, secure and sustainable air mobility of passengers and cargo enabled by new-generation technologies integrated into a multimodal transportation system*".

licensed and maintain competence iii) make sure the operation of VTOL-capable aircraft complies with the applicable EU regulations and with the airspace requirements of the Member State where the operation is conducted.[18]

2.3.2. **Flight crew licensing (FCL)**

Before the creation of thorough flight crew license requirements (ab initio training) for manned VTOL-capable aircraft, some manufacturers and operators of manned VTOL-capable aircraft will already be prepared to begin operations. Therefore, this NPA proposes to introduce provisions (a new Article 4f in Commission Regulation (EU) No 1178/2011) that will permit holders of commercial pilot licences for airplanes or helicopters (CPL(A) and CPL(H)) to be issued with a VTOL-capable aircraft type rating. In this way, CPL(A) or CPL(H) holders choose to continue flying VTOL-capable aircraft, can add a VTOL-capable aircraft type rating to their current license instead of getting a separate pilot's license for manned VTOLs. This will guarantee that there will be a sufficient number of adequately qualified and licensed flight crews available for the start of operations with manned VTOL-capable aircraft in the near future, although only pilots who already possess a license for a conventional aircraft can operate manned VTOL-capable aircraft.[19]

3. **Standardised European rules of the air (SERA)**[20]

The key objective of the SERA requirements is to ensure safe, efficient, orderly air traffic management and prevent mid-air collisions. Currently, aircraft operations in urban areas are limited to a very specific purpose (e.g. police helicopters, helicopter emergency medical services (HEMS) operations); however depending on the acceptable level of safety, societal acceptance and noise tolerance, VTOL-capable aircraft offers a new paradigm for more operations in urban environments.

The first type of manned VTOL-capable aircraft operations in urban environments are expected to stick to a specific set of predetermined routes or areas/corridors for which the relevant competent authorities have received confirmation that the air and ground risks are appropriately mitigated and, as a result, the objectives of point SERA.3105[21] on minimum heights shall be met. Moreover, there will be a certain number of vertiports and operating sites in each city, thus it is important to ensure that air traffic taking off from and landing at those area, the already existing air operations, and other urban air traffic are all carried out safely.[22]

18 NPA 2022-06, Introduction of a regulatory framework for the operation of drones — Enabling innovative air mobility with manned VTOL-capable aircraft, the IAW of UAS subject to certification, and the CAW of those UAS operated in the 'specific' category, 35-39. Link: https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2022-06.

19 Ibid, 40.

20 Commission Implementing Regulation (EU) No 923/2012 of 26 September 2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Implementing Regulation (EU) No 1035/2011 and Regulations (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010 (OJ L 281, 13.10.2012, p. 1). Link: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32012R0923&qid=1655032371589.

21 In particular, point SERA.3105 establishes "The permission from the competent authority to fly at lower levels than those stipulated in SERA.5005(f) and SERA.5015(b) may be granted either as a general exception for unlimited number of cases or for a specific flight upon specific request. The competent authority is responsible for ensuring that the level of safety resulting from such permission is acceptable." Link: https://www.easa.europa.eu/document-library/easy-access-rules/online-publications/easy-access-rules-standardised-european?page=7#_Toc256000063.

22 NPA 2022-06, Introduction of a regulatory framework for the operation of drones — Enabling innovative air mobility with manned VTOL-capable aircraft, the IAW of UAS subject to certification, and the CAW of those UAS operated in the 'specific' category, 41. Link: https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2022-06.

4. **Conclusions**

In the light of the above, by reducing potential safety risks and promoting an operation-centric, proportionate, risk and performance based regulatory framework, standardized across the EU Member States, this regulatory proposal aids in ensuring a high and uniform level of safety with regard to operations with UAS and manned VTOL-capable aircraft. Additionally, it provides an effective and well-designed regulatory framework that is devoid of onerous rules, enhances market development in the IAM sector and makes it possible for new aviation actors to be safely integrated into Union airspace. A clear example of the advantages that can be obtained through this NPA is given by the previously mentioned establishment of predefined routes for manned VTOL-capable aircraft operations in urban environments, which would allow to automatically avoid mid-air collisions and flying over 'sensible' places (i.e. places and structures that need, for any reasons, to be protected from noise), reducing potential safety risk, preserving the environment and increasing public acceptance[23].

23 Ibid, 45-47.

The protection of the environment in the course of air and space activities: legal dimensions

*Aikaterini Vakaki**

1. Introduction

The development of trade in air transport and air activities, as well as the increasing commercialization of space activities, resulted in the proliferation of environmental risks and threats. Although economic interests and environmental protection were historically mutually exclusive, this view has now changed, highlighting the current need to achieve a balance between i) the benefits arising from civil aviation and space exploitation for the global community and ii) the environmental risks associated with their progressive development.

Interests in the prevention and protection of the environment in air and space transcend national borders and are not static in time, since the environment belongs not only to the present but also to future generations. Nevertheless, the need to protect the environment was not envisaged at the first stage of the development of international air law, since sustainability was regarded only as incidental to mainly economic concerns[1]. Although the major space law Treaties contain some general principles and rules regarding the prevention of environmental hazards, they do not provide for adequate protection[2]. For this reason, recent efforts have been made to address the evolving sustainability concerns associated with activities both sectors.

Could the response of the international community be considered adequate and sufficient to deal with both the current and future environmental risks, associated with the increasing development of aerospace activities? This dissertation examines the environmental threats posed by activities in the air and in space sectors and the response of the international community with respect to environmental protection. In particular, Part I analyses the environmental threats posed in the aviation sector by aircraft noise, emissions and, in particular, carbon dioxide emissions; while, for the space sector, it addresses the risks posed by space debris, nuclear power sources, organic and biological contamination and resource exploitation. Part II summarizes the current regulatory framework for environmental protection, in particular, by evaluating ICAO's activities under Annex 16 of the Chicago Convention in relation and the UN space Treaties and other and other relevant regulatory acts. Lastly, Part III focuses on the comparative aspects of the existing legal framework for environmental protection applying to the continuum of aerospace activities.

2. PART I: environmental threats with respect to air and space activities

The main environmental impacts of international air transport relate to the noise and the emissions generated by aircraft engines, raising questions about sustainable development, since air transport, like any other form of mass public transport, relies on finite planetary resources that cannot be regenerated and, therefore, that cannot be considered sustainable in the long term. For this reason, it is essential to achieve the sustainability of air transport and improve its environmental footprint, both at the policy and industrial levels. With regard to the sustainable space exploration and development, history shows that without environmental protection policies, there's the tendency to explore and exploit the environment with insufficient regard to the long-term impact[3]. That being said, the environmental hazards posed

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The opinions and positions argued in this paper only express the author and should not be considered as representing official positions.

1 Tanveer Ahmad, "Evaluating the Effectiveness of the European Union Emissions Trading System to Reduce Emissions from International Civil Aviation", *McGill International Journal of Sustainable Development Law and Policy*, Volume II, Issue I, 2015, p. 137.

2 He Qizhi, "Environmental Impact of Space Activities and Measures for International Protection", 16 *Journal of Space Law* 2, 1988.

3 Mark Williamson "Space: The Fragile Frontier", Space News, 2006, available at: https://spacenews.com/space-fragile-frontier/ (last visited: 20.07.2022).

by space exploration and exploitation activities affect not only the space environment *per se*, but also the atmosphere and the Earth. Often, they do not remain limited in the specific context that causes them, but indiscriminately endanger other space and even terrestrial activities[4]. This is a manifestation of the *"tragedy of the commons"* issue[5], implying that the benefits of individual space missions primarily accrue to the entities that undertake them, while the detrimental effects of space exploitation can hamper all stakeholders in the sector[6].

2.1. Air activities

Aircraft noise was the first major environmental issue raised by civil aviation and it is considered one, if not the most, detrimental effect of aviation on the environment[7]. Noise, or unwanted sound, is generated when the passage of air over the aircraft causes fluctuating pressure disturbances[8]. The main sources of noise in aviation are the aircraft engine noise, from propeller aircraft engines and jet engines, the airframe noise by an aircraft in flight and the airport noise generated on the ground[9]. Most of the noise generated from aircraft engines typically occurs from the high velocity exhaust gases and the airflow in the fan system[10]. Another element of an aircraft that generates noise is the airframe, causing the non-propulsive noise in flight (while parts of the airframe, such as wings, flaps and landing gear produce noise when deployed). Part of aviation noise is also generated on the ground, both from aircraft and other elements involved in airport operations.

Apart from that, aviation emissions mainly concern transboundary air pollution, ozone layer depletion and climate changes caused by emissions of smoke and gaseous pollutants from aircraft engines. Carbon dioxide is considered the most harmful greenhouse gas, which has no definite lifetime because it is constantly circulating between the atmosphere, the oceans and the land biosphere[11]. Aircraft emitted gases (and other elements affecting the air quality) have deleterious impacts on both human health and the environment. Aircraft emissions alter at different flight stages. While major emissions from aircraft occur at higher altitudes, approximately 10% of all aircraft emissions, except hydrocarbons and carbon monoxide, occur during airport ground level operations and at landing and takeoff[12]. These emissions, directly into the upper troposphere and lower stratosphere, pollute the environment and contribute to climate change and global warming.

2.2. Space activities

Before evaluating to the contamination of space itself, it is worth specifying that contamination of the surface and atmosphere of the Earth can occur during/because of a launch (in particularly failed launches[13]). Looking outward from the Earth, space and celestial objects can be contaminated. The contamination of the Earth from returning space objects might also occur due to organic-constituent and biological molecules. In particular, forward contamination is the contamination of space or celestial bodies by terrestrial micro-organisms transferred through the conduct of space ac-

4 Lotta Vittari, "Environmental Aspects of Space Activities", in Frans von der Dunk, Fabio Tronchetti (eds.), *Handbook of Space Law*, Edward Elgar Publishing, 2015, p. 718.

5 Garrett Hardin, "The tragedy of the Commons", 162 *Science*, 1968, pp. 1243-1248.

6 Lotta Vittari, supra note 4.

7 Matthias Basner et al., 'White Paper on Aircraft Noise, Aviation noise impacts, State of science', in *ICAO Environmental Report, Aviation and Climate Change*, 2016, p. 35.

8 Michael Smith, 'Aircraft Noise', *Cambridge University Press*, 1989, p. 41.

9 Yaw Nyampong, "Aircraft and Airport Noise", in Paul S. Dempsey and Ram S. Jakhu, *Routledge Handbook of Public Aviation Law*, Routledge, 2017, pp. 182-183.

10 PSU Noise Quest, "Sources of Aviation Noise", available at https://www.noisequest.psu.edu/sourcesofnoise-overview.html (last visited: 20.07.2022).

11 Ibid, p. 200.

12 Travis Norton, "Aircraft Greenhouse Gas Emissions during the Landing and Takeoff Cycle at Bay Area Airports", *University of San Francisco*, 2014, p. 11.

13 He Qizhi, *supra* note 2, p. 118.

tivities, while backward contamination is the contamination of Earth from space, caused by the return of astronauts or space objects that might potentially carry extraterrestrial forms of life into the Earth environment[14].

Most current space activities take place in the Earth orbit, where the environment may be potentially affected by other forms of contamination including space debris and nuclear devices. The potential damage by debris particles, circulating in outer space derives, from the fact that impact velocities in orbits are enormous and even a smallest particle can easily incapacitate an entire functional satellite or trigger a fatal reaction[15]. Apart from that, due to the "*Kessler syndrome*", there is a risk that one collision will produce many fragments that could, in turn, trigger others in a cascading effect leading to more and more collisions and debris. It should be noted that in 2009 the collision between the Russian satellite Cosmos-2251 and the active US satellite Iridium-33 led to the creation of a space debris cloud of 2000 pieces of debris larger than 10 cm and thousands of smaller pieces which might remain in orbit for years[16]. The space debris issue is closely linked to the use of nuclear power for space activities. Moreover, the collisions and explosions of satellites with NPS on board are sources of nuclear contamination in outer space. Besides, one of the most severe risks posed by the use of NPS is the possibility of radioactively contaminated objects returning to Earth, as clearly demonstrated by the un-programmed re-entry in 1978 of the Soviet satellite Cosmos-954.

The degradation of the space environment has become a serious problem that could threaten not only the exploration and use of space by the current generation, but also the ability of future generations to do so. In this respect, the Earth's orbital space environment constitutes an finite resource that is being used by an increasing number of States, international intergovernmental organizations and non-governmental entities, while the proliferation of space debris, the increasing complexity of space operations, the emergence of large constellations and the increased risks of collision and interference with the operation of space objects may affect the long-term sustainability of space activities[17].

The outer space environment can also be affected by direct use during resource exploitation. Those related to space resources constitute ultra-hazardous activities, harmful to both the outer space and the Earth environment due to the number of debris, hazardous waste (which might be chemically or physically dangerous), radioactive waste and biological material (transferred from Earth to a planetary body by space probes or during human space missions)[18]. Due to the low gravity environment of asteroids, mining activities are prone to create clouds of dust materials that after the excavation or mining activity will drift into space at a slightly different speed than the asteroid[19]. The amount of unused excavated materials can exceed the combined mass of existing space debris by orders of magnitude and result to hampering the sustainable access to space[20].

In light of the above, it is clear that due to the different environmental conditions prevailing in air and space, the issues present in the two domains are different and pose a variety of environmental concerns. This, even though both sectors affect not only their respective domains, but also the Earth's environment and raise sustainability issues.

14 Gerardine M. Goh, B. Kazeminejad "Mars through the looking glass: an interdisciplinary analysis of forward and backward contamination", *Space Policy*, 2004, p. 221.
15 Lotta Vikari, *supra* note 4, pp. 721-722.
16 Rada Popova, Volker Schaus, "The Legal Framework for Space Debris Remediation as a Tool for Sustainability in Outer Space", 5 *Aerospace* 2, 2018, p. 55.
17 UN Report of the Committee on the Peaceful Uses of Outer Space, Sixty-second session, 2019, p. 50.
18 Fengna Xu, "The approach to sustainable space mining: issues, challenges, and solutions", I*OP Publishing Conference Series*: *Materials Science and Engineering*, 2020, p. 5.
19 Stephan Kaiser, "Legal Protection against Contamination from Space Resource Mining", *66 German Journal of Air and Space Law*, 2017, p. 282.
20 Lotta Viikari, *The Environmental Element in Space Law*, Martinus Nijhoff Publishers, 2008, p. 31.

3. PART II: responses to the environmental threats with respect to air and space activities

3.1. ICAO's activities for environmental protection

In 1971, the ICAO Assembly adopted Resolution A18-11 which recognized the adverse environmental impact that may be related to aircraft activities and stated that the development of international civil aviation, which, according to the Chicago Convention Preamble, is a fundamental objective of ICAO, must be ensured so as to be fully compatible with the protection of the environment[21]. According to Resolution A35-5 (2004) of the ICAO Assembly, the involvement and engagement of the Organization with the environment is based on the Preamble and Article 44 of the Chicago Convention[22]. The Convention, however, was signed during the first stage of the development of international environmental law, when environmental regulation was regarded only as incidental to primary economic regulations[23]. The need to protect the environment was not envisaged at the time of negotiation and drafting of the Convention. Hence, no explicit provisions on environmental protection have been incorporated therein[24].Nevertheless, the Convention tacitly confers on ICAO the responsibility to address aviation environmental issues. This, since, according to Article 44 of the Convention, one of the aims and objectives of ICAO is "*to develop the principles and techniques of international air navigation and to foster the planning and development of international air transport so as to promote generally the development of all aspects of international civil aeronautics*". Moreover, since reducing the impacts of aviation to ensure the protection of the environment is one of the major objectives of international civil aeronautics, ICAO has the duty to regulate emissions from international civil aviation[25]. The fundamental text regarding the ICAO actions with respect to the environment is Annex 16 of the Chicago Convention on the Protection of the Environment. The Annex is divided into four volumes. Volume I deals exclusively with the protection of the environment from aircraft noise, Volume II addresses the issue of aircraft engine emissions, Volume III evaluates carbon dioxide emissions and Volume IV deals with the Carbon Offsetting and Reduction Scheme (CORSIA).

3.2. Aircraft noise

The relevant SARPs for aircraft noise were first adopted by the ICAO Council in 1971 and were included in Annex 16, dealing with the measurement of the level of aircraft noise and the noise certification. Volume I of the Annex provides for the measurement of the level of aircraft noise for the various types of aircrafts and helicopters. For each type of aircraft, a specific noise assessment measure was standardized[26]. Accordingly, it provides that noise certification shall be granted or validated by the State of Registry of the aircraft, on the basis of sufficient evidence that the aircraft complies with the noise Standards provided in the Annex. In 2010, to promote an harmonized implementation of the technical procedures of Annex 16, Volume I, among signing States, ICAO published the Environmental Technical Manual on the Use of Procedures in the Noise Certification of Aircraft[27] providing guidance to certificating authorities and applicants regarding the standards of the Annex.

The main ICAO's general policy on aircraft noise is the Balanced Approach to Aircraft Noise Management, adopted by the ICAO Assembly in the Resolution A33-7 (2011) and reaffirmed in all the subsequent Assembly Sessions[28]. The concept

21 George D. Kyriakopoulos, "Legal Aspects of the ICAO's Recent Work on Environmental Protection", in *Protecting the Environment from Human Intervention: Legal and Criminological Aspects*, Ant. Sakkoulas, 2018.

22 Convention on International Civil Aviation, signed on 7.12.1944 (Chicago), entered into force on 14.4.1947, 15/U.N.T.S./295 (hereinafter: "The Chicago Convention").

23 Catherine Redgwell, "International Environmental Law" in Malcolm D. Evans, *International Law*, 3rd ed, New York: Oxford University Press, 2010, p. 690.

24 Tanveer Ahmad, "Global Civil Aviation Emissions Standards- from Noise to Greener Fuels", *McGill Occasional Paper Series*, No. XI, 2016, p. 2.

25 Tanveer Ahmad, "Environmental law emissions", in Paul S. Dempsey and Ram S. Jakhu, *Routledge Handbook of Public Aviation Law*, Routledge, 2017, pp. 222-223.

26 ICAO, Annex 16 to the Convention of Civil Aviation 'Environmental Protection: Volume I: Aircraft Noise', Part II, Chapter 4, Eighth Edition, 2017.

27 ICAO, "Environmental Technical Manual on the use of Procedures in the Noise Certification of Aircraft", Volume I, ICAO Doc. 9501.

28 ICAO, "Balanced Approach to Aircraft Noise Management", available at: https://www.icao.int/environmental-protection/Pages/noise.aspx. (last visited: 20.07.2022).

is that aircraft noise can be reduced by making changes to various aspects of aircraft operations, thereby reducing the overall impact of aircraft noise on the community and surrounding environment. In particular, the balanced approach to noise management consists in identifying the noise problem at an airport and then analyzing the various measures available to reduce noise through the exploration of four principal elements. Namely: i) reduction at source, ii) land-use planning and management, iii) noise abatement operational procedures and iv) operating restrictions[29]. ICAO encourages signing States not to apply operating restrictions as a first resort, but only after careful consideration of the benefits to be gained from the other principal elements of the Balanced Approach[30]. The overall goal of the Balanced Approach concept is to address noise problems on an individual airport basis and to identify the noise-related measures that achieve maximum environmental benefit most cost-effectively, using objective and measurable criteria[31]. The ICAO Assembly Resolution A40-17 re-emphasized the importance of the Balanced Approach concept to aircraft noise management and recognized that the adverse environmental effects of civil aviation activities can be reduced by the application of comprehensive measures. In particular, measures embracing technological improvements, more efficient air traffic management and operational procedures, aircraft recycling, the use of clean, renewable and sustainable energy sources, the appropriate use of airport planning, land-use planning and management, community engagement and market-based measures[32].

3.3. Aviation emissions

The Kyoto Protocol recognizes ICAO as the primary body responsible for the regulation of aviation related environmental issues on aircraft engine emissions and calls upon developed Countries to pursue limitation or reduction of greenhouse gases from «*aviation bunker fuels*” working through ICAO[33]. ICAO's regulatory provisions in aircraft engine emissions is enshrined in Volume II of Annex 16[34]. Specifically, Part II of Volume II of Annex 16 contains regulations on the vented fuel of turbine-powered aircraft-intended to operate in international airspace and manufactured after 1982-and prohibits the intentional discharge of clean fuel into the atmosphere. Part III provides standards for emission certification, which shall be issued on the basis of satisfactory evidence that the engine complies with the minimum requirements set by the provisions of the Annex. In order to achieve the highest degree of harmonization and to promote uniformity in the implementation of the Annex, general information and guidance material on the application of the emissions Standards of Annex 16 is provided by the Environmental Technical Manual, Volume II[35]. It should be noted that, with respect to emissions, ICAO's focus has changed. While the initial focus was on air quality in adjacent aerodrome regions, in the 1990s ICAO's overall approach gradually broadened to include global atmospheric issues, such as the question of climate change, and in 2010 a historical step was taken in this direction, when the 37th Assembly[36] resolved that ICAO should work to strive to achieve “*a collective medium term global aspirational goal of keeping the global net carbon emissions from international aviation from 2020 at the same level”*[37].

29 ICAO, Annex 16 *supra note* 27, Part V: “Balanced Approach to Noise Management”, p. V-1.
30 ICAO Document 9829, ‘Guidance on the Balanced Approach to Air Noise Management’, 2008, pp. I-2-1 - I-7-3.
31 *Ibid*, p. I-1-2.
32 ICAO, General Assembly Resolution A40-17, ‘Consolidated statement of continuing ICAO policies and practices related to environmental protection-General provisions, noise and local air quality”, adopted by the 40th session in 2019.
33 Ruwantissa Abeyratne, “Some Recent Developments in Aviation and Environmental Protection Regulation”, 32 Environmental Policy and Law 1, 2002, pp. 32 – 40.
34 ICAO, Annex 16 to the Convention of Civil Aviation ‘Environmental Protection: Volume II: Aircraft Engine Emissions”, Fourth Edition, 2017.
35 ICAO, “Environmental Technical Manual on the Procedures for the Emissions Certification of Aircraft Engines”, Volume II, ICAO Doc. 9501, Second Edition, 2014.
36 ICAO Assembly Resolution A37-18: “Consolidated statement of continuing ICAO policies and practices related to environmental protection - General provisions, noise and local air quality”, adopted by the 73rd session in 2010.
37 George Kyriakopoulos, supra note 22.

3.4. Aeroplane CO_2 emissions

In 2016 ICAO adopted the first ever CO_2 standard for aircraft and a third volume was added in Annex 16 to deal with CO_2 emissions. Part II of Volume III of Annex 16 contains SARPs for certification of airplane CO_2 emissions based on the consumption of fuel applicable to the classification of airplanes specified in the Annex (subsonic jet airplanes over 5700kg and propeller-driven airplanes over 8618 kg), where such airplanes are engaged in international air navigation. CO_2 emissions certification shall be granted or validated by the State of Registry of the airplane on the basis of satisfactory evidence that the airplane complies with requirements at least equal to the applicable Standards specified in the Annex. Guidance material on the provisions of the Annex is contained in the Environmental Technical Manual Volume III - Procedures for the CO_2 Emissions Certification of Airplanes.

3.5. Carbon Offsetting and Reduction Scheme (CORSIA)

The implementation by ICAO of a global MBM scheme, to compensate the CO_2 emissions and to achieve - from 2020 onwards - a "*carbon neutral growth*" in the form of a Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), was the first agreement to tackle CO_2 emissions in a globalized sector of the economy. The system adopted by ICAO is based on offsetting, whereby global aviation offsets its emissions by reducing them elsewhere and purchasing credits from a "carbon market" (driven by supply and demand) generated by projects that reduce carbon emissions around the world[38]. Participation in CORSIA is voluntary, but from 2027 onward, all States with an individual share of international aviation activities greater than 0.5% or whose cumulative share reaches 90% of the total shall participate in the system. Part II of Volume IV of Annex 16, in Chapter 2, includes SARPs and guidelines for monitoring, reporting and verification of an airplane operator's annual CO_2 emissions. The airplane operator shall submit an Emissions Monitoring Plan to the State for the approval. Part II, in Chapter 3, includes SARPs and guidelines on an airplane operator's CO_2 offsetting requirements that can be reconciled using Emissions Units generated by eligible programmes under Chapter 4. The relevant applicability requirements to an airplane operator, engaged in international air navigation, are specified in the individual Chapters of Volume IV of Annex 16. In order to promote uniformity of implementation of the technical procedures of Volume IV of Annex 16, the Environmental Technical Manual (Doc 9501), Volume IV - Procedures for demonstrating compliance with the Carbon Offsetting and Reduction Scheme (CORSIA) - provides general guidelines for the interpretation of Annex 16 (for the monitoring, reporting and verification processes) and for the calculation of CO_2 offsetting requirements. It also refers to equivalent procedures to the provisions of the Annex. Although carbon trading reduces emissions in one place, it allows them to continue somewhere else and, for this reason, compelling arguments have emerged supporting the alternative of a carbon tax on aircraft engine emissions[39]. Apart from that, the 2009 ICAO Conference on Aviation and Alternative Fuels endorsed the use of sustainable alternative fuels for aviation, particularly the use of drop-in fuels in the short to mid-term, as an important means of reducing aviation emissions[40].

3.6. Space law on environmental protection

3.6.1. UN Space Treaties

International space law, which consists of five Treaties, has relatively little to say about environmental issues, since at the time of their implementation (in the 1960s and 1970s) such considerations were not crucial and later it has proved very

38 Ronald Bartsch, *International Aviation Law*, A practical Guide, Second Edition, Routledge, 2018, p. 344.
39 Ruwantissa Abeyratne, *Legal Priorities in Air Transport,* Springer, 2019, p. 138.
40 ICAO Conference on Aviation and Alternative Fuels, Declaration and Recommendations Working Paper, November 2009, Rio De Janeiro, (CAAF/09- WP/24).

difficult for space actors to agree on new legally binding international rules[41]. Article 1 of the 1969 Outer Space Treaty[42] provides 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*". This provision is seemingly a departure from the traditional "*national interest*" approach of international law and has represented a moral obligation to some[43], and a *jus cogens* or mandatory legal principle to others[44]. Article 4 of the Treaty forbids the stationing of "*any objects carrying nuclear weapons or any other kinds of weapons of mass destruction*" in outer space. Furthermore, Article 9 requires States parties to conduct their activities in outer space, including the moon and other celestial bodies, "*so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, to adopt appropriate measures for this purpose*". Furthermore, the same Article includes an obligation to conduct space activities "*with due regard to the corresponding interests of all other States Parties*", thus referring to an obligation to avoid creating hazards that could adversely affect the safe conduct of space activities by other States. Moreover, the Article provides for a dual consultation regime.

The Moon Agreement[45] lays down stricter obligations. It explicitly provides for the protection of the celestial environment, and it is considered the most progressive of the space Treaties with respect to the environment. Article 7 of the Moon Agreement clarifies the general obligations expressed in Article 9 of the Outer Space Treaty, by providing specific standards that must be followed. For example, the Moon Agreement requires that States prevent disruption of the natural lunar environment and that they have an affirmative obligation to act to prevent disruption. Hence, it does not recognize States as much discretion when conducting potentially harmful space activities. The agreement also clarifies that such disturbance may occur through the introduction of adverse changes into that environment by harmful contamination or by other unspecified means and does not limit the concept of harmful contamination to the introduction of extra-environmental matter, but it provides that harmful contamination is only one form of environmental disturbance. Article 7(1) of the Moon Agreement also addresses the issue of back contamination, by requiring States to avoid harmful interference with the Earth's environment through the introduction of extraterrestrial material or otherwise.

3.6.2. Other regulatory developments

The UN Treaties on space law do not have much to offer when it comes to considering the environmental impacts of space activities. Fortunately, there are current and plausible efforts to mitigate the environmental problems associated with space activities.

3.6.3. Space Debris

International efforts specifically targeting the problem of space debris were initiated by the Inter-Agency Space Debris Coordination Committee (IADC), which first adopted a set of guidelines in 2002 to curb the growth of space debris. The IADC Guidelines have formed the base for the UNCOPUOS to adopt its Space Debris Mitigation Guidelines in 2007, which have been endorsed by the UN in 2008. The IADC Guidelines cover the overall environmental impact of the space missions focused on limitation of debris released during normal operations, minimization of the potential for on-orbit break-ups, post-mission disposal and prevention of on-orbit collisions. Operators of existing spacecraft and orbital stages are encouraged to apply the guidelines to the greatest possible extent.

41 Ranbir Singh, Sanat Kaul, Srikrishna Rao, *Current developments in Air and Space Law*, National Law University, 2012, p. 315.
42 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 610 U.N.T.S. 205, *entered into force* Oct. 10, 1967.
43 Bin Cheng, "The 1967 Space Treaty", 95 *Journal du Droit International*, 1968, p. 578.
44 Carl Q. Christol, "The Jus Cogens Principle and International Space Law", in *Proceedings of the 26th Colloquium on the Law of Outer Space*, 1983.
45 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, adopted on December 1979, 1363 UNTS 3.

The UN COPUOS Guidelines are the leading international arrangement to mitigate space debris and are overall similar to the IADC Guidelines. They provide for the i) limitation of debris during normal operations, ii) minimization of the potential for break-ups during operational phases, ii) limitation of the probability of accidental collision in orbit, iv) avoidance of intentional destruction and other harmful activities, v) minimization of the potential for post-mission break-ups resulting from stored energy, vi) limitation of the long-term presence of spacecraft and launch vehicle orbital stages in the low-earth orbit region after the end of their missions, and vii) limitation of the long-term interference of spacecraft with the geosynchronous earth orbit region after the end of their mission. The Guidelines are to be considered for mission planning, design, manufacture and operational phases of spacecraft and launch vehicle orbital stages and they apply both to planning and operation of new missions, as well as to operation of existing one if possible. It should be noted that all space systems should be designed primarily to avoid the release of debris during normal operations, and if this is not feasible, at least the impact of debris on the space environment should be minimized. One of the very few differences between the Guidelines is that IADC Guidelines recommend a 25-year post-mission orbital lifetime limitation, whereas the UNCOPUOS Guidelines do not. Ever since the adoption of the IADC and UNCOPUOS Guidelines, a growing number of space-faring nations and international organizations have voluntarily made their own orbital debris mitigation guidelines pursuant thereto and in some States, the requirements have been incorporated into their licensing procedure. UNGA Resolution 62/217 recognized that the 2007 Guidelines reflected the current state practice and although voluntary, they have been adopted by states and implemented in national regulations as *de facto* international standards[46].

Apart from the above, in recent years, there have been many proposals for solutions to the space debris issue, either based on active debris removal or for on-orbit capabilities that carry out a variety of tasks, such as satellite servicing[47]. Also, a recent study conducted by the McGill University and IAASS, proposes the establishment of an intergovernmental organization to procure the development and commercialization of satellites for space debris removal and the concurrent commitment through a separate legal instrument to remove on commercial basis existing big debris[48]. Besides, it proposes that States committed to collecting their own space debris may impose a national/domestic "*space garbage collection"* tax and that they may introduce an assured removal clause into their national licensing rules as prerequisite to obtain a launching/operating license for a satellite by means of a national or foreign launcher.

3.6.4. Nuclear Power Sources

Although the use of NPS in outer space activities attracts the application of the outer space Treaties *ipso facto*, they do not adequately address the use of NPS. The landmark document of the Nuclear Test Ban Treaty[49] which regulates the protection of the environment from radioactivity caused by nuclear waste, provides in Article 1 that States Parties to the treaty undertake to prohibit, prevent, and refrain from carrying out any nuclear weapons test explosion or any other nuclear explosion at a site under their jurisdiction or control or, inter alia, in space or in any other environment, if such explosion causes radioactive debris outside the territorial limits of the State under whose jurisdiction or control the explosion is carried out. A step towards more advanced environmental protection by legal means in the space sector are the Principles Relevant to the Use of Nuclear Power Sources in Outer Space[50] which restated many principles already well-accepted in international space law. Genuflecting to Article 3 of the OST, Principle 1 provides that the use of NPS is governed by existing international law thus, the general principles of international environmental law are applicable to the use of NPS in outer space[51]. It follows, *inter alia*, that, when using NPS in space activities, States must have due regard to the environment of other States and that of areas beyond national jurisdiction. In addition, due to the higher potential

46 Francis Lyall, Paul Larsen, *Space Law, A Treatise*, Second Edition, Routledge, 2018, p. 276.
47 Ram Jakhu, Joseph Pelton (eds.), *Global Space Governance: An international Study*, Springer, 2017, p. 331.
48 McGill, IAASS Proposal for an Operational and Regulatory Framework to Ensure Space Debris Removal, 2020.
49 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Over Water, Aug. 5, 1963,480 U.N.TS. 45.
50 Principles Relevant to the Use of Nuclear Power Sources in Outer Space, 14 December 1992, UNGA Res. 47/68, 1993.
51 Francis Lyall, Paul Larsen, *supra* note 47, p. 257.

risks associated with NPS, the Principles also developed further the existing rules of space law. In particular, Principle 4 requires that a state launching a space object must ensure that *"a comprehensive safety assessment*" is conducted prior to the launch. The assessment is to cover "*all relevant phases of the mission and shall deal with all systems involved, including the means of launching, the space platform, the nuclear power source and its equipment and the means of control and communication between ground and space*". The results of the assessment "*shall be made publicly available prior to each launch, and the UN Secretary-General shall be informed on how States may obtain such results of the safety assessment as soon as possible prior to each launch*". Principle 6 reiterates the obligation of consultation established under Article 9 of the Outer Space Treaty.

Apart from that, in 2009 the UNCOPUOS Sub-Committee's Working Group on Nuclear Power Sources in Space has prepared in cooperation with the International Atomic Energy Agency (IAEA) a voluntary Safety Framework for Nuclear Power Source Applications in Outer Space, consisting of recommendations for governments and management of NPS applications in space and general technical guidance, providing high-level guidance in the form of a model safety framework for national and international use[52]. The Safety Framework is applicable to the use of NPS not only for electricity generation, but for propulsion and heating purposes too, since it applies to all space NPS applications "*without prejudice"*.

3.6.5. Planetary protection

Planetary protection is defined by NASA as "*the practice of protecting solar system bodies from contamination by Earth life and protecting Earth from possible life forms that may be returned from other solar system bodies*"[53]. It covers not only outward contamination, but also backward contamination. The issue of planetary protection is addressed in Article 9 of the Outer Space Treaty and Article 7 of the Moon Agreement, as previously elaborated, while general international law is also applicable, especially the precautionary principle, which is of particular importance in the avoidance of backward contamination.

In 2002 the Committee on Space Research (COSPAR) adopted a revised and consolidated Planetary Protection Policy which was amended in 2011 to include Principles and Guidelines for Human Missions to Mars, while the recent shift in focus of astro-biological exploration from just Mars to the icy moons of the outer solar system, necessitates review and expansion of the planetary protection protocols.[54] The COSPAR Planetary Protection Policy is being maintained as a reference for space-faring nations, both as an international standard on procedures to avoid organic-constituent and biological contamination in space exploration, and to provide accepted guidelines to guide compliance with the wording of the OST and other relevant international agreements[55]. There is considered to be international consensus on standards for biological contamination under the OST, particularly in the interpretation of Article 9. The Policy makes a distinction between five categories of target body/mission type combinations and proposes different requirement ranges for each category. Members are encouraged to inform COSPAR of the planetary protection requirements they have established for planetary missions and to provide information on the planetary protection procedures and calculations for each flight and on the areas of targets that may have been contaminated. The Policy focuses on contamination with organic constituents and biological agents during space exploration, as well as protection of the terrestrial biosphere from possible contamination by extraterrestrial material.

52 Safety Framework for Nuclear Power Source Applications in Outer Space, 2009, A/AC.105/934, www.iaea.org/Publications/Booklets/Safety/safety framework1009.pdf.

53 Nasa, "Planetary Protection" available at: https://sma.nasa.gov/sma-disciplines/planetary-protection. (Last visited 20.07.2022)

54 European Commission, *The International Planetary Protection Handbook*, *Planetary Protection of Outer Solar System*, 2018, p. 17.

55 Jinyuan Su, "Control over activities harmful to the environment", in Ram S. Jakhu, Paul S. Dempsey (eds.) *Routledge Handbook of Space Law*, Routledge, 2017, p. 82.

3.6.6. Long Term Sustainability Guidelines

The long-term sustainability of space activities is defined as the ability to sustain the conduct of space activities indefinitely into the future in a manner that realizes the goals of equitable access to the benefits of the exploration and use of space for peaceful purposes to meet the needs of present generations while preserving the environment of space for future generations[56]. In 2019, the Committee on the Peaceful Uses of Outer Space Activities adopted the Guidelines for the Long-term Sustainability of Outer Space promoting the conduct of space activities in a manner that supports the safety and long-term sustainability of space activities[57]. The LTS Guidelines provide for a legal framework for space activities with respect to monitoring national space activities and improving the practice of space object registration and the safety of space operations by providing up-to-date contact and shared information on space objects and orbital events, and shared operational space weather data and forecasts. They also provide for international cooperation, capacity and awareness building, and scientific and technical research and development to consider new measures to address the space debris population. The guidelines were developed to fit within the existing international legal framework for space activities, including the various UN Treaties and principles on outer space. In their development, consideration was given to the practices of States, including their policies, operating procedures, technical standards, and experience gained in space activities[58]. In this regard, the adopted Guidelines already reflected widespread government and commercial practice and, as such, imposed minimal regulatory burden in terms of compliance or enforcement[59].

3.6.7. Space mining

Even though space resources may be considered abundant, Article 1 OST draws a red line when sustainable access to space and the ability for Earth and space observation is at stake[60]. In addition, the protection of the environment is of great importance in relation to the Moon and its natural resources, which are "*common heritage of mankind",* as stated in Article 11 of the Moon Agreement. In this Article, the States Parties to the Agreement undertake to establish an international regime, including appropriate procedures, to regulate the exploitation of the Moon's natural resources as soon as such exploitation becomes possible[61]. Existing technical standards for preventing space debris apply only to debris originating from man-made space objects, and not to natural substances that enter space as a result of human intervention. The unregulated mining of the vast quantum of resources can be prevented by implementing the principle of sustainable use[62]. Even though the risk of overexploiting asteroid resources is not a main concern at the time, it must be highlighted that any mining activity is bound to contaminate outer space's pristine environment[63]. Thus, space mining raises the issue of planetary protection, which has already been addressed in the COSPAR safeguards. Apart from this, the Hague Space Resources Governance Working Group's (HSRGWG) Draft Building Blocks (DBB) for the Development of An International Framework on Space Resource Activities proposes conducting a pre-approval review of space resource activities, developing technical standards, assessing compliance to avoid adverse impacts, and implementing response measures in the event of adverse impacts[64]. It proposes that States shall adopt appropriate measures with the aim of avoiding and mitigating potentially harmful impacts including risks and damage to the environment, adverse changes in

56 Committee on the Peaceful Uses of Outer Space, Guidelines for the Long-term Sustainability of Outer Space Activities, Conference room paper by the Chair of the Working Group on the Long-term Sustainability of Outer Space Activities, Document A/AC.105/2018/ CRP.20, paragraph 5, 2018.

57 Committee on the Peaceful Uses of Outer Space, Guidelines for the Long-term Sustainability of Outer Space Activities, Working paper by the Chair of the Working Group on the Long-term Sustainability of Outer Space Activities, Document A/AC.105/C.1/L, 2019.

58 Delgado López, et al., "The Importance of the United Nations Guidelines for the Long-Term Sustainability of Space Activities and Other International Initiatives to Promote Space Sustainability", *Oasis,* 2014.

59 Larry Martinez, "Legal regime sustainability in outer space: theory and practice", *Cambridge University Press*, 2019.

60 Stefan A. Kaiser, *supra* note 20, p. 282.

61 Isabella Diederiks-Verschoor, "Environmental Protection in Outer Space", in 30 *German Yearbook of International Law*, 1987, p. 144.

62 Sandeepa Bhat, "Application of Environmental Law Principles for the Protection of the Outer Space Environment: A Feasibility Study", *39 Annals Air & Space Law*, 2014, p. 323.

63 Francis Lyall, "Planetary Protection from a Legal Perspective - General Issues", in IAA Cosmic Study 'Protecting the environment of celestial bodies", 2010.

64 Fengna Xu, *supra* note 19.

the environment of the Earth, harmful contamination of celestial bodies and outer space as well as harmful effects of the creation of space debris. Another proposal refers to the conduct environmental impact assessments prior to the start of each mining mission, as it is done by ISA for exploration and exploitation regimes, in order to prevent, to the best of their capacity, polluting outer space[65].

In the light of the above, the ICAO response to environmental threats posed by air activities has been progressively addressed in Annex 16 of the 1944 Chicago Convention covering aircraft noise, aviation emissions, carbon dioxide emissions and the most recent Carbon Offsetting and Reduction Scheme. On the other hand, environmental protection with respect to space activities is primarily addressed in the Outer Space Treaty and the Moon Agreement, the provisions of which are supplemented by more recent regulatory developments referring to the issues of space debris, the use of nuclear power sources, planetary protection, long term sustainability and space resources exploitation.

4. Part III: assessment of the environmental response by air and space law

As regards the regulation of aviation related issues, ICAO has provided a strong legal regime with respect to air activities and the overall ICAO system is considered quite successful. The Chicago Convention under Article 37 and Article 54 facilitates the adoption of international Standards and Recommended Practices (SARPs) which are designated as Annexes to the Convention by the ICAO Council[66]. Under the requirements of Articles 37 and 38 of the Chicago Convention, States have an affirmative duty to harmonize their domestic law with the SARPs since the provisions of the Annexes are regulatory in nature and the Standards contained are binding, except when States opt out according to the procedure of Article 38 of the Chicago Convention[67]. Thus, in the absence of such a notification to the ICAO Council, the international standards are binding upon member States. In particular, Article 38 provides ground for deviation since it explicitly states that any State which finds it impracticable to comply with any international standard or procedure, or to bring its own regulations or practices into full accord with any international standard or procedure after amendment of the latter, or which deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, is required to give immediate notification to ICAO of the differences between its own practice and that established by the international standard. Although Article 37 invites all Contracting States "*to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organization*", any State can refrain from doing everything possible by it since the phrase "*highest practicable degree of uniformity*" has not been defined[68].

For this reason, while the overall framework of ICAO as regards the environmental impacts of aviation is solid, from a legal context the Annex is criticized by some on the basis that it does not reflect sufficient compulsion for compliance and because it contains mainly technical specifications with no Standards suggesting action for non-compliance. It is acknowledged that while the vast law-making work of the Council in the drafting of the SARPs represents the most visible and monumental achievement of ICAO during its existence, the real and effective level of their implementation by the contracting States is a matter of grave concern and doubt[69]. For this reason, ensuring strict adherence of the measures on environmental protection that reduce the pollution levels of aircraft and airports is crucial instead of imposing strict restrictions on aviation[70].

In any case however, the Annexes carry with them a moral imperative with an inarticulate premise that the Annexes suggest "*the right thing to do"* and when provisions of law are generally reflective of widely accepted norms of conduct,

65 Gabrielle Leterre, "Providing a legal framework for sustainable space mining activities", *University of Luxembourg*, 2017, pp. 74-75.
66 ICAO Document 10055 AN/518, Manual on Notification and Publication of Differences, 2018, p. 1-1.
67 Ruwantissa Abeyratne, *Rulemaking in Air Transport, A deconstructive Analysis*, Springer, 2016, pp. 102-105.
68 Tanveer Ahmad, "Achieving Global Safety in Civil Aviation: A Critical Analysis of Contemporary Safety Oversight Mechanisms", *37 Annals of Air & Space Law*, 2012, p. 86.
69 Michael Milde, "The Chicago Convention - Are Major Amendments Necessary Or Desirable 50 Years Later?", 19 *Annals of Air & Space Law*, 1994, pp. 425-426
70 Ranbir Singh, Sanat Kaul, Srikrishna Rao, *supra* note 42, p. 66.

they receive more universal acceptance due to "*social conscience*" as a theory of compliance[71]. Thus, although the Standards adopted by this process of ICAO, or subsequent amendments thereto, "*are not to be given compulsive force"*, this has not been deemed a serious impediment to their general application[72]. Therefore, ultimately whatever *de jure* "*soft law*" attributes SARPs may have, they appear to have corresponding *de facto* "hard law" attributes as well[73]. It is widely accepted that the technical Annexes to the Chicago Convention are one reason why ICAO has been so successful in international law making, since through the use of these Annexes, the Organization has been able to separate the political and technical facets of international civil aviation and to a large degree uniformity in all technical and navigational aspects of international civil aviation has been achieved[74].

As regards space activities, on the other hand, most of the environmental threats were not even foreseen during the period that the space Treaties were negotiated and for this reason, the space Treaties incorporated very limited provisions on environmental protection. Environmental issues in outer space are primarily discussed under Article 9 of the Outer Space Treaty, but unfortunately this most important provision for protecting the environment in outer space falls short of providing the necessary protection, while the theoretically stronger provisions of the Moon Agreement have little practical significance, since its provisions apply only to the Moon and other celestial bodies, and it is the least accepted space agreement, with only fifteen ratifications and four signatures[75]. On the other hand, non-binding guidelines and policies to protect the space and planetary environment have remained in the realm of morality, rather than been transformed into legally binding norms. While guidelines provide a suitable mechanism for establishing approved behavior within a specific community of practice, they are ultimately non-binding and not designed to be enforced when actors refuse to adhere[76]. For instance, the IADC Guidelines and the UNCOPUOS Guidelines although they are considered an important step towards reducing risks related to space debris, are voluntary in nature and they express at most political, not legal commitment to mitigating the space debris problem. Besides, they are not sufficient in the long term, since they remain quite general in nature and do not provide a comprehensive approach to the problem as they only state what is to be achieved regarding debris mitigation, without specifying how to achieve those goals. Apart from that, neither the NPS Principles nor the Safety Framework for Nuclear Power Source Applications constitutes legally binding instruments under international law. As regards COSPAR's Planetary Protection Policy, it may be persuasive to many nations, but it binds none, since it constitutes only "*soft law"* imposing only "*a moral kind of obligation*" on spacefaring nations[77]. Nevertheless, it must be recognized that the COSPAR Policy is followed by some major space agencies such as NASA, ESA, and JAXA, and are therefore considered respected, technically oriented international guidelines because of their wide acceptance and general adherence[78].

Furthermore, the LTS Guidelines are only intended to "*supplement guidance available in existing standards and regulatory requirements*" and are also not legally binding under international law. The prevalence of soft law instruments clearly creates uncertainties in the protection of the space environment. Only if voluntarily adopted by States and subsequently implemented through national legislation or licensing requirements could such provisions be binding. The absence of conventional regulation and the shift to more creative international mechanisms that are voluntary to address space issues could be explained by the fact that the political element was not as strong with respect to air activities, but space

71 Jutta Brunnée, "Enforcement Mechanisms in International Law and International Environmental Law", in Ulrich Beyerlin et al, (eds.), *Ensuring Compliance with Multilateral Environmental Agreements: A Dialogue Between Practitioners and Academia,* 2005, p. 5.
72 Helen Jones, "Amending the Chicago Convention and Its Technical Standards - Can Consent of All Member States Be Eliminated", 16 *Journal of Air Law and Commerce 2*, 1949.
73 Paul S. Dempsey, *Public International Air Law, McGill Universit*y, *Institute and Center for Research in Air & Space Law*, 2008, pp. 79-80. See also: Herbert Morais, "The Quest for International Standards: Global Governance vs. Sovereignty", 50 *Kansas Law Review*, 2002, p. 779.
74 Nandasiri Jasentuliyana, "Celebrating Fifty Years of the Chicago Convention Twenty-Five Years after the Moon Landing: Lessons for Space Law", 19 *Annals of Air & Space Law*, 1994, p. 429.
75 Sandeepa Bhat, supra note 63, pp. 332-335.
76 Gerardine Goh, "Softly, Softly Catchee Monkey: informalism and the quiet development of international space law", 87 *Nebraska Law Review*, 2008, p. 725.
77 Jeb Butler, "Unearthly Microbes and the Laws Designed to Resist Them", 41 *Georgia Law Review,* 2007, p. 1355.
78 Thomas Cheney et al, "Planetary Protection in the New Space Era: Science and Governance", *Frontiers in Astronomy and Space Sciences*, 2020.

is an area of competition that is primarily political as started by the two superpowers at the time and therefore evolved with a soft law approach. Nonetheless, non-binding instruments embody a certain degree of political commitment and therefore still raise expectations for future behavior.

As mentioned earlier, the protection of the aviation environment is envisaged under the auspices of an international body and has been so successful precisely because an international organization has achieved the broad and safe development of international aviation through international rules. ICAO has provided a strong and systematic legal system because the rules in the Annexes are legally binding on member States, which is considered an exception in the international scheme. The peculiarity and originality of the process of drafting international legal rules by ICAO is that the rules are planned by an international organization and are binding on States, as they are obliged to adapt their national legislation accordingly[79]. This is the main reason why the ICAO system is considered so successful and widely respected by States.

On the other hand, with respect to outer space, there is no international body with broad powers, as only subsidiary organs of the UN deal with outer space activities, and while they produce significant work, their status is insufficient to meet the current and future needs of outer space law. International law relating to outer space has not evolved significantly, with no binding rules adopted after the adoption of the main corpus of space law by the set of the five UN Treaties. Even in the bipolar political context of the Cold War that dominated the space race in the 20th century, there was a willingness between the two superpowers to reach internationally binding agreements on the early governance of space activities, but as the world is no longer bipolar but multipolar, there are many more States and now non-State actors actively engaged in space activities[80]. Thus, as competing interests have become more diverse, States have become less willing to submit to new binding norms. In particular, States have expressed very different approaches to regulating space activities, while some even dream of unilateral action, and since UN COPUOS decides by consensus, adopting new Treaties is quite difficult in the current political climate. Therefore, although space is an area beyond national jurisdiction regulated by international law, and space activities take place in a fragile environment under adverse conditions, there are practically no binding rules for environmental protection.

Many suggestions have been made to fill this gap, including the argument in favor of an analogy of the ICAO framework in civil aviation matters to outer space activities. Jasentuliyana recommends that, to this end, the United Nations should develop a treaty with comprehensive and general guidelines and leave it to an international technical body to establish standards and recommended practices to which states can adhere[81]. Within this framework, mandatory standards could be adopted to be followed by all States except those having reservations, while recommended practices would serve to encourage States to use their best efforts to follow them in the interest of protecting the space environment[82]. ICAO indeed provides the best example of treaty development. The ICAO SARPs have bestowed on the ICAO Council at least a quasi-legislative function and are highly authoritative in practice since they ensure safety and efficiency in air travel and are widely respected by States[83]. Apart from this, referring to the ICAO CORSIA scheme for mitigating aviation emissions as an example of reducing space debris, there is a suggestion for the introduction of launch quota caps for spacefaring states, which would be granted 'debris credits' if they implement space debris mitigation guidelines. In such a space debris market, developing countries could sell their "*debris credits*" to industrialized countries thereby acquiring the funds to develop their own space capabilities[84]. For this reason, the analogy of the ICAO framework to the perceived gap in the regulation of environmental protection in space exploration may well be seen as a suitable starting point for more extensive protection of the space environment.

79 Aggelos Yokaris, George D. Kyriakopoulos, *International Air Law*, Nomiki Bibliothiki, 2013, p. 21.
80 Ram S. Jakhu, Joseph Pelton, *supra* notę 48, p. 51
81 Nandasiri Jasentuliyana, "A Survey of Space Law as Developed by the United Nations", in *Perspectives on International Law*, The Hague: Kluwer Law International, 1995, p. 378.
82 He Qizhi, "Environmental Impact of Space Activities and Measures for International Protection", 16 *Journal of Space Law*, 1988, p. 117.
83 Ruwantissa Abeyratne, "The Use of Nuclear Power Sources in Outer Space and Its Effect on Environmental Protection", *25 Journal of Space Law 17*, 1997.
84 M. Prasad, 'Common but differentiated responsibility - a principle to maintain space environment with respect to space debris', *International Institute of Space Law Proceedings of the 5th Colloquium on the Law of Outer Space*, 2007, p. 291.

5. Conclusions

In light of the above, it is more than clear that the increasing development and proliferation of air and space activities have demonstrably harmful effects on the environment, and the risks are even more serious due to the ongoing commercialization of aerospace applications and technological advances, as these activities are far from being environmentally friendly. Thus, the increasing use of airspace and outer space means increasing environmental threats.

From a regulatory perspective, ICAO has systematically responded to environmental threats with legal and technical regulations. Annex 16 of the Chicago Convention provides a compact and robust framework for environmental protection that is constantly being supplemented over time to keep pace with environmental issues and respond to new challenges. Although it could be argued that the provision of Article 38 limits the compulsion for compliance, the reality in international aviation is that the contracting States generally consider themselves bound by ICAO policy, and because of this acquiescence by States, ICAO is in a position to fundamentally influence environmental law and policy in aviation[85].

On the other hand, with respect to space activities, six decades ago, international "*hard law*" Treaties created governance for space that was intended for the few government space programmes, while today non-governmental commercial enterprises operate under voluntary "*soft law*" rules that expose the inadequacies of the original Treaties to provide regulatory oversight of the expanding commercial orbital presence[86]. The existing Outer Space Treaties contain only a very limited number of provisions for the protection of the environment in outer space, while the regulations and mechanisms that have emerged in UN bodies and other alternative forums fall under the heading of soft law, which means that they are voluntary measures that States are only encouraged to comply with by implementing their own national standards. In view of this fact and the lack of consensus on the development of new rules to protect the space environment with mandatory effect, the existing space law, although containing some general principles, does not provide adequate protection. Consequently, there is no solid legal framework in space for environmental protection and effective management of environmental threats, as all current efforts remain at the level of principles.

Environmental degradation in the air and in space is already a serious problem with the potential to threaten not only the activities of the present generation, but also the possibilities of future generations. Therefore, the protection of the environment is not only a legal obligation, but also a moral and ethical one. Activities in this field are becoming increasingly commercialized, and the number of actors and stakeholders, whether governmental or private, is growing rapidly. For this reason, ensuring the continuation of the pristine environment is a shared responsibility of all States, populations, and generations. As Judge Manfred Lachs noted, international cooperation is essential if all activities are to be carried out for the benefit of all and to the detriment of none, and if all opportunities opened up are to be used responsibly, the conduct of States must be subject to the rule of law[87]. In any case, a radical reconceptualization of man's relationship to the rest of nature would not only be a step towards solving the material planetary problems, but there are strong reasons for such a changed consciousness from the point of making us far better humans in terms of, if not our current values, at least newer and stronger ones[88].

85 Ronald Bartschp, *International Aviation Law*, *A Practical Guide*, Routledge, 2018, p. 342.
86 Larry Martinez, "Legal regime sustainability in outer space : theory and practice", *Global Sustainability*, Volume 2, Cambridge University Press, 2019.
87 Manfred Lachs, *The law of outer space, an experience in contemporary law making*, Sijthoff Leiden, 1972, pp. 6-7.
88 Christopher D. Stone, "Should trees have standing: Toward legal rights for natural objects", *Southern California Law Review* 45, 1972.

Space

The NewSpace role in the insurance market: profitability goals and its regulatory framework challenges
Sara Dalledonne and Maria Vittoria Prest

ESA accelerators: challenges and opportunities
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Space to Africa
Luisa Santoro

The NewSpace role in the insurance market: profitability goals and its regulatory framework challenges*

*Sara Dalledonne** and Maria Vittoria Prest****

1. **Introduction**

Space activities are characterised by an inherently high level of risk, both because space is per se a risk environment (several circumstances such as technical failures of the launch vehicle, failure to reach a proper orbit, operational failure of the satellite itself, as well as delays can be mentioned) and in relation to damages that can be caused to third parties as a consequence of those operations. The intrinsic nature of these operations, frequently dealing with the use of unproven technologies, can indeed lead to significant losses in revenue.

In this sense, the insurance market can offset hazardous activities by reducing the magnitude of exposure of the actors involved (mainly satellite operators and lunch operators) and providing reliable protection against the risk of financial loss. As a consequence, the predictable and reliable manner of dealing with risks (responsible operations) incrementally gains the interest of investors.

This insurance market is experiencing several challenges, with claims exceeding premiums for three consequent years (from 2018 to 2020). In this sense, an encouragement to revert to profitability might be provided by the continuing growth of NewSpace. Even though there is **not a common definition of this concept**, NewSpace Global has defended NewSpace as "*A global industry of private companies and entrepreneurs who primarily target commercial customers, are backed by risk capital seeking a return, and seek to profit from innovative products or services developed in or for space*"[1].

The upswing of private, commercial space activities undertaken with a different approach from the traditional direct involvement and oversight by government or intergovernmental organisations is relatively recent. In a comparison with traditional space (or OldSpace), where the space domain was only reserved to governments, which invested in public programmes through public funds, operating under a traditional procurement system, what identifies this NewSpace ecosystem?

It is significant to mention features such as[2]:

- the increasing participation of private firms, start-ups, and new business ventures in satellite and launch operations;
- extensive range of services (including finance for manufacturing and data analysis) that are used or offered, usually in correlation with new technologies (e.g., Big Data, AI applications and so on), and new space markets;
- proposition of disruptive market solutions (e.g., integrated service, higher performance, lower price) An increasing number of launch of satellites, usually smallsats, and the rise in number of satellite constellations;
- enough large demand for smallsats to provide a commercial basis for the potential viability of small launchers market;
- new industrial and procurement approaches, mainly based on PPP or service procurement approach;

* Source: 72nd International Astronautical Congress (IAC) – n, 25-29 October 2021. IAC-21,E7,7,7,x66863.
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*** Space expert, Manager at IARI - Istituto Analisi Relazioni Internazionali, Rome, Italy.
1 *NewSpace Global*, "LLOYD´S Emerging risk report 2019 – New Space bringing the new frontier close to home", 2019, at 9.
2 *A. Vernile*, "The rise of private actors in the space sector", 2018, at 12.

- amaller budget in comparison to traditional space industry;
- massive private investment provided through different funding mechanisms: venture capital or high net worth (HNW) individuals;
- market demand, access, and distribution of data worldwide; and
- Increasing contribution in space-related matters by several space-faring nations.

This change in paradigm in the way of conducting space activities is leading to a new space sector dimension, in particular in the sense of democratisation of outer space. However, NewSpace also requires a new dimension for old issues and concerns, among them the need for sustainable and responsible behaviour in space operations.

NewSpace might represent the trigger to bring the space insurance market to the next level, taking advantage of the complementary between insurance and mission assurance. Novel insurance formulas, embedding a new level of flexibility on defining terms of the products and services, as well as on conducting the evaluation risk phase, would create additional opportunities for the market. Finally, this change in paradigm will also result in series of legal challenges, the necessity for standardisation and best practices in the field for instance.

2. Current regulatory framework

The insurance market comprises two types of insurance: **Asset & Property insurance** (or property damage insurance) and **third-party liability insurance**. While third-party liability insurance is typically offered by the aviation insurance industry, Asset & Property insurance is usually offered by space insurers.

2.1. Asset & Property Insurance

Asset & Property insurance protects the owner or operator of a space object from the loss or damage of that space object. There are three kinds of Asset & Property insurance: pre-launch insurance, launch insurance, and in-orbit insurance. As they follow in a consequential order, it is important that one ceases to produce effects when the other begins in order to avoid overlapping or lack of guarantees. Particularly:

- The pre-launch insurance phase begins with "*the signing of the satellite procurement contract and ends when the launch of the launcher becomes irreversible*"[3]. This phase covers three periods of time: the assembling, integration and testing phase; the transportation of the payloads and launcher to the launch site; and the launch campaign. It is usually offered by **maritime cargo insurers**.
- The launch insurance phase starts when the launch becomes irreversible (based on the launch services agreement and depending on technical aspects specific for that type of launcher), and it can end a few days or more often one year after the launch. Some insurers have multi-annual policies. It is usually offered by **space insurers**, and it covers the payloads but not the launcher *per se,* which can be included as an additional cost factor. Different solutions will have to be shaped due to the increased interest in reusable launchers.
- The in-orbit insurance (spacecraft or individual transponders) phase starts whenever the launch insurance ends and could potentially last until the end of the life of the satellite in space. It is usually offered by **space insurers.**

The decision to contract insurance for a space object is free. No insurance obligation is placed on the manufacturer, the operator, their clients or financial institutions. Institutional satellites are for the large majority not insured, especially due

3 *C. Gaubert*, "Insurance in the context of space activities", in: F. von der Dunk, F. Tronchetti (Eds.), Handbook of Space Law, Edward Elgar Publishing Limited, Cheltenham, 2015, at 910–948.

to the fact that government turns to the private sector for satellite services and launch. Besides, only 30% of commercial satellites are usually insured **for Asset & Property** insurance[4].

2.2. Asset & Property insurance Policy

Insurance policies have their own specific set of terms, conditions, and exclusions.

Asset & Property insurance (for lunch and in-orbit services) is the result of a risk mapping analysis of launch service providers or satellite operators. It covers the loss or damage suffered by the insured to its space object regardless of the cause ("*all risks policies except*"[5]) unless it is specifically excluded by the policy. As a result, if the insurer does not want to cover the damage or loss, they will need to prove the applicability of an exclusion, while the insureds will only have to prove they suffered damage or loss[6]. Asset & Property insurance usually covers external causes of damage (e.g., falls, collisions, etc.), internal causes of damage (e.g., electrical short-circuit, fire, etc.) and human error, unlike a conscious misconduct "*of directors or officers of the insured*"[7]. It excludes any future revenue losses.

Regarding the insurance amount (insurance premium), the insurance policy usually mentions an "*agreed value*" as a predetermined value that cannot be modified after the inception of the policy. The amount changes on the basis of the policy, the insurance phase, and the insured's selections. It is indeed the insured who decides the amount of the insurance based on the satellite's value, on its replacement costs, or – when the space object is financed by financial institutions - on the amount of the loan. Insured usually ask for the possible "*maximum amount*" (insurance coverage limit) which is measured on the space object's manufacturing costs, the launch services costs (unless the launch services agreement includes a "*launch risk guarantee*" -LRG), the insurance premium, or the in-orbit positioning costs. The contractual operations aiming to determine the terms of the insurance contract are conducted by brokers who act as moderator and impartial party. Space insurers have no or limited direct contact with the client.

Asset & Property insurance is usually purchased by the owner or operator of the satellite (insured). Insured purchase Asset & Property insurance to protect their investment against launch failures, but not on-orbit insurance, while other purchase launch insurance in conjunction with in-orbit insurance as a combined policy.

The period of insurance is variable but today the most common insurance offered by the insurance market is of one year and then renewed on an annual-based or extended under specific requirements. Longer period insurance can also be acquired, even though are less common. For instance, larger satellite operators usually purchase for one year following the successful flight (self-insure the in-orbit phase), while longer insurances are usually contracted with for space debris collision concerns in mind. Indeed, while the insurance market has usually considered the debris risk low in terms of profitability of collision between satellite and piece of debris, SSA has reversed this underestimation by reassessing this part of the coverage.

In the case of longer insurance, the insured usually needs to provide space insurers "*with a health status report of the insured satellite*" on which basis the insurers will decide whether they want to renew the insurance policy and under which terms and conditions[8]. The amount of the insurance usually decreases as the years of life of the satellite increase or towards the end of the financial agreement.

The insurance can claim damages for:

- "*Total loss*" of the space object allows the insured to obtain the total value of the insurance amount[9].
- "*Constructive total loss*" which also allows for the full insurance coverage, but "*upon receipt of the full indemni-*

4 *Space Foundation*, "The Space Report 2020 (Q3)", October 2020.
5 *L. de Gouyon Matignon*, "Space Insurance & Space Law", August 2019. Link: https://www.spacelegalissues.com/space-insurance-space-law/.
6 *Supra* note 5.
7 The insurance that only covers damages or losses due to specific causes listed in the insurance policy is named "named perils". *Supra* note 3.
8 *Supra* note 3.
9 *Supra* note 3.

fication of its loss, the insured undertakes to use its best efforts to save the satellite" and "*the insurers will then be entitled to have the sole right to the maximum benefit of salvage*" (best effort clause)[10].

- "*Partial loss*" of the space object allows the insured to obtain coverage calculated on the "*actual loss of capacity or lifetime*" of the space object[11].

Finally, a "*salvage clause*" can be added to the insurance policy stating that "*after a claim payment, the insured agrees to do all things reasonably practicable to maximise salvage opportunities for the affected part of the satellite*" and "*in such a case, the amount of salvage received by the insurers shall be limited to the indemnification paid by the insurers*"[12].

2.3. Third-party liability insurance

Third-party liability insurance is insurance against damage caused to a third-party, and addresses "*a launching agency, a satellite operator or owner whose launcher, satellite or part thereof is considered accountable for damages caused to third parties during the space operation*"[13]. It covers the indemnification of all sums that the insured shall become legally obligated to pay for bodily injury and/or property damage to third parties. It can be divided into two subcategories:

- Liability insurance for space operators, which covers the damage caused to third parties during insured launches and in-orbit operations of spacecraft.

- Space product liability insurance, which covers manufacturers, subcontractors, and service providers when damage to a third or contractual party is caused "*due to a defect of the product after its delivery*" or due to a service default[14]. These individuals may also be liable on the basis of the general rules applicable to product liability beyond space activities[15]. It usually provides financial coverage for 1 year. Space risks in case of damages caused by satellites' failures are addressed in Europe under the European Space Products Liability Scheme (ESPLS)[16].

In contrast with Asset & Property insurance, the 1969 Outer Space Treaty (OST) and the 1972 Liability Convention (LB) outlined a particular legal regime governing space-related liabilities of States party to the Treaty at the international level. Particularly:

- governance of national activities carried out by governmental and non-governmental entities (authorisation and supervision) (Article VI OST);

- liability for damage to other states party to the Treaty caused by launch or procurement of the launching of an object in space (Article VII OST).

Subsequently, the Liability convention expands on the liability rules of the OST to elaborate on efficient liability regimes, rules, and procedures for prompt and equitable compensation in case of liability. On the other hand, the third-party liability insurance's regulatory framework consists mainly of national disciplines (e.g., US Commercial Space Launch Act) since neither the OST nor the Liability Convention imposes an insurance obligation. In any case, liability insurance policies have legal consequences both under international and national laws[17].

10 *D. Philippe*, "Best Efforts Clauses: Common Law and Civil Law", November 2017. Link: http://www.interleges.com/wp-content/uploads/2018/01/Best-Efforts-Clauses-Common-Law-and-Civil-Law.pdf.

11 The "partial loss" corresponds to "a partial reduction of the lifetime or operational capacity of the satellite below the threshold used for the determination of the constructive total loss". The same concept of "loss quantum" used for the latter will also be employed in this case. Supra note 3.

12 *Supra* note 3.

13 *Supra* note 3.

14 *Supra* note 5.

15 *Supra* note 3, at 29–126.

16 *Supra* note 3, at 29–126.

17 *Supra* note 5.

Furthermore, it is common for participants to space operations to try to mitigate - or eliminate whether possible - their liability with clauses in the respective contracts (including manufacturing and launch service contracts), aware of the high risks connected to space activities[18]. In terms of insurance, these limitations or exemptions may benefit the insurers if they are stipulated in favour of the insured or penalise them if they are stipulated in favour of the other parties by limiting or eliminating altogether the insured's right to recourse in the event of damage for which they are not responsible. The validity of these clauses however is subjected to national disciplines, provided that the state is responsible at the international level.

2.4. National regulatory framework

Approximately forty countries have laws regulating space activities to a certain extent. National space law includes clarification regarding the risk-sharing between the State and the private entities: in particular, tools to provide indemnification to governments, a ceiling of liability for limiting the exposure of private entities, and licensing control of national space activities. A specified (minimum) amount of insurance is different based on the prescribed applicable legal regime. These frameworks usually aim to facilitate compliance with international obligations.

The majority of national space legislations require the possession of a license or permission to conduct space operations for both their nationals regardless of their location and foreigner conducting space activities within the country on the matter. Many spacefaring nations also require an adequate financial guarantee or insurance. The insurance obligations vary widely, but only a few national laws explicitly require the purchase of insurance coverage. Some national regimes also impose a compulsory requirement upon launch services providers to contract third-party liability insurance as a condition for obtaining a licence. Space liability insurance for in-orbit services is less common as a requirement in national regulations. In other cases, legal requirements of insurance coverage for private participants in space activities might be the result of bilateral agreements in the context of specific planned activities (e.g., common carriage or spacecraft operations) involving the nationals of the relevant states or between different countries.

National space laws and related insurance requirements are represented in the following figure:

Table 1 - *Compulsory Indemnification and Insurance Requirements per National Space Law*[19]

	Indemnification of State	Third-Party Liability
Insurance Requirement at the discretion of governments	Austria, Belgium, Denmark, Kazakhstan, Norway, Sweden, South Arica, Ukraine	Denmark, Finland, New Zealand, Portugal, South Africa, Ukraine
Greater of Maximum amount **Or** **Maximum probable loss**	Australia, China, Hong Kong, Indonesia, Netherlands, South Korea, New Zealand, the U.K.	Australia, Indonesia, Luxemburg, Netherland, the U.K., Japan, Russian Federation
Up to probable maximum probable loss with cap	France, Finland, Portugal, the U.K., the U.S.	France, the U.S.

18 Such clauses are the "limitations of liability or waiver of recourse" clause, and the "hold-harmless" clause. Also, a cap on damage type can be used. *Supra* note 3.

19 *J. Suchodolski*, "An Overview and Comparison of Aviation and Space Insurance", J. Bus. & Tech. 14, 2019.

In 60-plus years of space activities, launch and on-orbit liability claims have not occurred, so there is no direct precedent for such circumstances. A third-party liability claim could be challenging and even catastrophic for the satellite operators at fault, as well as for the space insurance market[20].

Going into details, the approaches taken by the national space law can be grouped into three main systems:

1) No maximum amount of liability cap (an only requirement for indemnification)

   In some cases, namely Norway and Sweden, requirement, and type (insurance or financial guarantee) are under the discretion of the agency on a case-by-case basis, or not required at all as in the case of Kazakhstan. Reimbursement from the entity to whom the law applies to the government for the amounts disbursed in accordance with a claim for damages is envisioned. In addition, there is no limit to liability[21].

2) Maximum amount

   In other countries, such as China, the Netherlands, and South Korea the insurance operates under a maximum available insurance market amount (or capacity), usually diversified based on type and phase of risks (launch or in-orbit). It means space actors are required to acquire a cover-up to the maximum allowable amount which can be obtained on the market[22].

3) Maximum probable loss (MPL)

   Other counties, such as the U.K. (for certain operations) and Australia provide more specific requirements in regard to the type of indemnification and set up the amount of the maximum probable loss anticipated by the space operation. In 1986, the U.K. released the Outer Space Act requiring a minimum acceptable level of cover per satellite. In 2018, the U.K. passed the Space Industry Act, in which at Section 38 requires holders of on-orbit operations licenses to have third-party liability insurance.

4) Liability cap for indemnification requirement

   Finally, the U.S., as well as France and the U.K. (in certain circumstances) require licensees to demonstrate they hold sufficient third-party liability insurance for the activities undertaken. In particular, France and the U.K. set up a limit amount above which the government is responsible to cover the costs instead of the operator.

The U.S. was the first country to enact a national space law expressly governing space launches and liabilities, in compliance with international discipline. Indeed, the **US Commercial Space Launch Act** provides a third-party liability insurance obligation – or financial guarantee in the alternative – on the launch licensee as well as mandatory additional insurance coverage on the U.S. nationals and any other participant in the launch operation. The U.S. set up three Tiers of potential losses which divide the costs between the private stakeholder and the government. Under the first limit amount, the operator is bounded (Tier I), while the country commits itself to pay the amount in case of higher damage top to the third level (Tier II). The operator is again responsible above the third tier (Tier III)[23]. In terms of liability limitations, the U.S. has

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20 *V.A. Samson, J.D. Wolny, I. Christensen*, "Can the Space Insurance Industry Help Incentivize the Responsible Use of Space?", IAC-18-E3.4.2, 69th International Astronautical Congress, October 2018.

21 *UNOOSA*, "National Space Law, Space Law: National Space Law Database". Link: https://www.unoosa.org/oosa/en/ourwork/spacelaw/nationalspacelaw/index.html.

22 *Kongjian Wuti Dengji Guanli Banfa* ([illegible]), "Measures for the Administration of Registration Space Objects", promulgated by PRC Nat'l Def. Sci. & Tech. Indus. Comm. and PRC Ministry of Foreign Affairs, Feb. 8, 2001, effective immediately. "Interim Measures on the Administration of Permits for Civil Space Launch Projects", promulgated by PRC Nat'l Def. Sci. & Tech. Indus. Comm., November 2001, effective December 2002. See also "Interim measures on Administration of Mitigation of and Protection against Space Debris", promulgated by PRC Nat'l Def. Sci. & Tech. Indus. Comm., effective January 2010.
See also, "Minebob [Civil Act], Act on Compensation for Damage Caused by Space Objects", Act. No. 8714, Dec. 21, 2007, amended by Act No. 8852, Feb. 29, 2008, art. 4 (S. Kor.), translated in Korea Legislation Research Institute online database, http://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=17043&type =sogan&key=2.

23 *T.J. Brennan, C. Kousky, M. Macauley*, "More than a Wing and a Prayer: Government Indemnification of the Commercial Space Launch Industry", September 2009. Link: https://economics.umbc.edu/files/2014/09/wp_09_112.pdf.

been the first country to impose an indemnification cross-waivers of claims between the licensee or transferee and the participant in the launch or re-entry operation, including the customer[24]. As a result, the parties waive their right to seek recourse for the damage suffered. In turn, the same does the Secretary of Transportation regarding damages sustained by the government or executive agency due to an activity of the licensee or whether a licensee or transferee are facing exclusion from insurance contained in the relative insurance contract[25].

Under the **French Law on Space Operations (FSOA)**, adopted in 2008, private space operators can either insure for third-party liability or prove they are able to compensate the eventual victim (Article 6)[26]. The FSOA set up a limit amount under which the operator is bounded, while the French government commit itself to pay the remained amount in case of higher damage.

The insurance or financial guarantee must cover the French government and public bodies (including CNES), ESA and all the participants in the production of the space object or the space operation, which all benefit from the insurance policy "*subscribed by the launch operator*" (Article 6.3)[27]. The 2008 French Space Law also regulates waivers of recourse and "*hold-harmless*" clauses for space operations (Article 4). Whenever said law is not applicable though, liability's limitations or exemptions clauses are invalid "*for professionals that do not have the same business speciality*" and can be rescinded by a judge[28].

To conclude, national regulatory frameworks have the potential to be one of the elements under which competition in the space sector is based. The balance of shared risks between private and public actors is indeed a way to attract private companies, including a large number of emerging start-ups.

3. Space-related insurance market

As previously mentioned, insurance coverage for space operations is usually differentiated between the kind of space activity and the type of insurance sectorial companies:

- manufacturing (usually insured by the ground market);
- transit and pre-launch (usually insured by the marine market);
- launch and Commissioning (usually insured by the aviation market or space market);
- in-orbit life (usually insured by the aviation market or space market);
- de-orbit operations (usually insured by the aviation market).

The **global insurance market** represents more than €4.2 trillion per year. The space insurance market on the other hand is quite recent, as it emerged in the early 1980s due to increased demand for such insurance. In 2020, it comprised a market between approximately €500 million and €850 million per year.

Insurance requirements represent a significant additional cost for space companies. Indeed, property insurance is typically the third-largest expenditure behind launch and manufacture, with an average of 10% of the overall cost for private space entities. The vast majority of satellite ventures carry property insurance, and especially launch insurance, which covers the riskiest phase of the satellite's life cycle (approximately 34% of GEO satellite losses since 2000 occurred during launch.). The market into question has been mainly the one of large satellites in GEO (45% of GEO satellites holding insurance in 2019). However, this market is currently experiencing a downturn, and the focus is switching to large con-

24 *Supra* note 3.
25 *Supra* note 21.
26 *Supra* note 21.
27 *Supra* note 21.
28 *Cour de cassation, civile*, Chambre commerciale, March 2013, 11-26.566. Link: https://www.legifrance.gouv.fr/juri/id/JURITEXT000027209798

stellations in LEO (3% of LEO satellite holding insurance in 2019)[29]. In any case, the cost is substantially contingent on the kind of activity performed (launch activities, satellite operations) and the financial robustness of operators.

The space insurance industry's goal is to receive in premiums more than what it pays out in claims. Meanwhile the economics of space insurance has broadly been successful over the past 20 years, it has been experienced a persistent loss space insurance sector in the last three years (2018, 2019, and 2020) with claims larger than premiums[30]. While in 2005, the ratio between the premiums received by insurers and the maximum exposure by insurers (for all potential claims of that year) was 3.4., it had reduced to 0.7 by 2018, meaning premiums would not cover the total insured value of space assets in the case of failure[31], 2018 saw five major failures, resulting in estimated claims of over $515 million. In 2019, insurance claims were over $800 million against premiums of $502 million (two major failures). In 2020, insurance claims were $500.3 million against premiums of $460.5 million[32]. At the same time, the total number of launches has marginally increased.

The current challenge the space insurance market is experiencing is the result of a **confluence of factors.** Among them, an oversupply of (offered) capacity has concurred with changes in demand, resulting in reducing premiums over the past couple of decades. Indeed, space insurers operate in a highly competitive industry, with limited demand for insurance. The competition between them is sometimes based on coverage terms and capacity, but more frequently on premium prices (premium rate), which are the consequence of multiple factors (market conditions, risk assessment, sum insured).

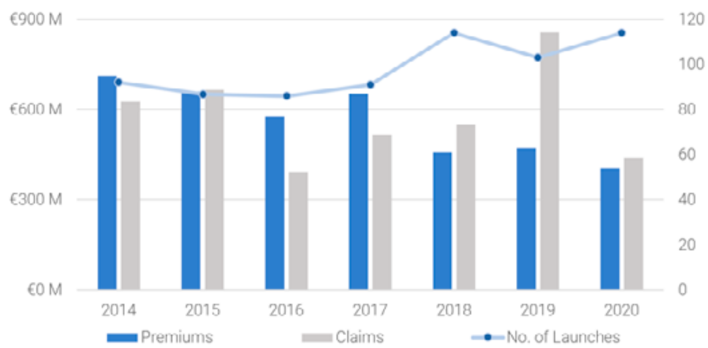
Table 2 - *Major insurance claims in the space sector 2018-2020* (Source: ESPI)[33]

2018	Reported claims	Cause
WorldView-4	$183 million	In-orbit failure
Angosat-1	$121 million	In-orbit failure
Al Yah 3	$115 million	Partial launch failure
Soyuz MS-10	$71 million	Launch failure
Turksat-4b	$25 to $60 million	Partial launch failure
2019	**Reported claims**	**Cause**
Falcon Eye-1	$415 million	Launch failure
ChinaSat-18	$250 million	Post-launch anomaly
Eutelsat 5 West B	$192 million	Partial failure
2020	**Reported claims**	**Cause**
Thaicom 5	$26 million	On-orbit anomaly
Express AM-6	$39 million	Payload failure
Palapa-N1	$252 million	Launch failure

29 *Supra* note 4.
30 *European Space Policy Institute (ESPI)*, "ESPI Yearbook 2020 Space policies, issues and trends", June 2021. Link: https://espi.or.at/news/espi-yearbook-2020-is-now-available.
31 *P.B. De Selding*, "Space insurers book 3rd straight money-losing year. Market volatility may mean 100% premium hike in 2019 is not enough", December 2020. Link: https://www.spaceintelreport.com/space-insurers-book-3rd-straight-money-losing-year-market-volatility-may-mean-100-premium-hike-in-2019-is-not-enough/.
32 *R. Schenone*, "Space Insurance Update", June 2019. Link: file:///Users/mariavittoriaprest/Downloads/2019_Space_Insurance_Update.pdf
33 *Supra* note 30.

This prolonged unprofitability and unsustainable premiums have led different companies to take some steps back in the area. In 2019, Swiss Re (represented about 5% of the space insurance industry) announced it would no longer offer space insurance, citing poor financial results and unsustainable premiums[34]. Furthermore, in 2020, American International Group (AIG) also withdrew from the space insurance class industry due to prolonged unprofitability[35]. Boutique space insurance firm such as Assure Space has decided to minimize its exposure, ceasing to offer policies to LEO satellite operators covering collisions due to the increased risk of such events in March 2020[36]. Factual factors to consider are the marginal increase of the total number of launches if to even decreased in GEO, the lowering cost of satellites and the proliferation of small satellites. 52% of all launches were uninsured in 2020 (e.g., SpaceX launches of its Starlink low-orbiting broadband satellites)[37].

Figure 1 - *Insurance Premium and Claim 2014-2020* (Source: Seradata, AXA XL, ESPI)[38]



Insurance companies are mainly concerned by the volatility of the line of business and the changes in demand. Underwriters and brokers may benefit from the experienced loss of underwriting capacity, as it would likely result in an increase of premium rates in the near term, bringing back the sector to profitability. On the other hand, since spacecraft insurance is not compulsory, competitiveness in the industry will not decrease and an excessive rise in premium may lead additional insurers to go out of the market.

The insurance market of property damage insurance needs to mainly be addressed at the international level considering the elevated costs linked to this type of insurance due to the high risks space objects are submitted to. Space insurance companies are mainly located in the U.S., U.K., Germany, France, Switzerland, Japan and the UAE. Approximately 30 insurers (e.g., Lloyd's, AIG, AXA XL and Allianz, Aesir Space, elseco, Marsh, Munich Re) are the space insurers offering Asset & Property insurance today.

4. **How can insurance benefit from NewSpace?**

In recent years, NewSpace has changed the way we "do" space, also consequently leading to a paradigm shift which is heavily affecting the space-related insurance market in different ways. It is not only impacting insurance premiums and policies, but it is also affecting it at the provider and customer levels.

34 *J. Foust*, "Space insurers hoping to break even after recent losses", November 2020. Link: https://spacenews.com/space-insurers-hoping-to-break-even-after-recent-losses/.
See also, C. Henry, "Big claims, record-low rates: Reshaping the space insurance game", September 2019. Link: https://spacenews.com/big-claims-record-low-rates-reshaping-the-space-insurance-game/.

35 *Supra* note 34, *C. Henry. See also, A. McNestrie, J.H. Jones*, "AIG withdraws from loss-hit space insurance market", November 2020. Link: https://www.insuranceinsider.com/article/2876nupqiql67n4bf7r40/aig-withdraws-from-loss-hit-space-insurance-market.

36 *Supra* note 35, *A. McNestrie, J.H. Jones*.

37 *D. Werner*, "Assure Space won't cover collision risk in low Earth orbit", March 2020. Link: https://spacenews.com/assure-space-leaves-leo/.

38 *Supra* note 30.

The first point of discussion regards the **necessity for NewSpace to contract insurance**. From this perspective, and in particular, as a consequence of multiple factors such as the ongoing democratisation of outer space opening the market to start-ups, the speedier development of new technologies, the high severity of loss, higher launch rates, new architectures for satellite, and increasing orbit hazard, NewSpace companies need the insurance market to absorb their risks and attract investment. Indeed, they have smaller and more unique businesses, backed by a reduced and more vulnerable financial commitment, and loss might likely lead to the end of their business. Furthermore, contracting insurance represents an added value for investors who are then more incentivised to take the risk of getting into NewSpace. Under this perspective, NewSpace might represent a new class of insurance industry participants, to which the space insurance market should find a way to adjust while remaining viable and benefitting from. Nevertheless, the development costs of small satellites are lower than those for traditional satellites. As a result, it is more advantageous for NewSpace companies to manufacture or buy a backup satellite to launch in case of a failure rather than insure one. Even though privates still need to ensure their launches, it is possible that the increasing volume of spacecraft will decrease the amount of in-orbit satellite insurances. It is thus still unclear whether underwriters will benefit from NewSpace as new customers.[39]

4.1. Market perspectives: how can the insurance companies adapt their policies to the very different needs and characteristics the NewSpace market has?

In a highly technological age like the one we are currently living in, innovation moves fast. As a result, the insurance market policies should continuously be adapted in order to be up-to-date and meet the quick-changing sectors' requirements. No difference should there be for the space sector. As previously mentioned, fast evolutions characterising the space sector - further boosted by the advent of the private sector – is mostly a consequence of NewSpace. NewSpace's phenomena are both challenging and beneficial for the space-related insurance market under different perspectives. In comparison with traditional risks that insurers are usually underpinning, space insurers dealing with NewSpace are mostly challenged by the necessity to build new reliable rating models for the assessment of new risks. The development of parameters for a new module based on trustworthy risk analysis is difficult, especially because new players not always have experience in dealing with high-risk space environment. This demanded new approach shall deal with novel emerging risks (e.g., untested space technologies, increased space debris-related concerns) as well as new specific needs of the space sector (e.g., insurance of large satellites constellations, reusable launchers).

Among them, the advent of **small satellites** has been a game-changer in many ways. Smallsats - and even more CubeSats - production costs are lower than bigger satellites, they are starting to be mass-produced, and as previously mentioned the insurance costs occupy the third place on the "*cost podium*". As a result, those few times when smallsats are insured, the insurance premium is minimal. This phenomenon is one of the contributing causes to the exit of big insurance companies from the market. A market which, if it is to survive the advent of NewSpace, must necessarily create the conditions for its companies to attract clients as well as be competitive and efficient. Space insurance companies are facing new concerns in this regard. For instance, the low economic value of small satellites does not allow insurance companies to individually study them to offer specific product-based policies; while another issue is connected to the large number of small satellites and the resulting high number of policies and, potentially, claims if they were to be all singularly insured. Space insurance companies might thus develop new formulas and programmes, and to do so they can get inspired by programmes coming from similar insurance models in other fields. Among them, the Unmanned Aircraft Systems (UAS) or drone industry.

Large satellite constellation also represents an example of this phenomenon. On the one hand, they require new forms of insurance since there are several problems with the current insurance framework. For instance, in terms of property

39 *P.B. De Selding*, "Space insurers book 3rd straight money-losing year. Market volatility may mean 100% premium hike in 2019 is not enough", December 2020. Link: https://www.spaceintelreport.com/space-insurers-book-3rd-straight-money-losing-year-market-volatility-may-mean-100-premium-hike-in-2019-is-not-enough/.

damage insurance, it is difficult to imagine that every single satellite would fall under a different insurance policy. One of the insurance renewability conditions for in-orbit insurance requires the provision of "*a health status report of the insured satellite*" to the space insurer, which makes it infeasible in the presence of an entire constellation of satellites.[40] Since these factors affect the insurance market in several ways, not necessarily with positive results, solutions must be found. For instance, designing joint multiclass insurance policies for an entire constellation, or lowering insurance premiums for deorbit operators working before the 25 years mark. On the other side, they further increase the risks of an already very dangerous environment by creating orbits overcrowding, increasing collision risks and potentially worsening the issue of space debris. If the cons outweigh the pros, these factors could push insurance companies out of the market as they consider it to be unattractive and insufficiently secure, leaving many uninsured. Although the space and insurance markets have always had a complicated relationship, there have been cases where insurance companies can really contribute to achieving predetermined targets.

Another dimension concerns the **launch sector**. While launches and payloads are usually covered by space and aviation insurers, launchers are commonly not insured. The reasoning behind this relies on two factors. Firstly, launchers are destroyed after their use therefore their cost is covered by the "*launch services costs*". Secondly, the launch service is usually considered by the launch services agreements to be terminated after the ignition of the launcher. One of the latest developments of NewSpace, however, could lead to an interesting innovation in the insurance market. The re-usability of launchers combined with an adaptation of insurance policies to the new needs, could push companies to start insuring their launchers and this could give a new boost to the space-related insurance market.

The common thread linking all these reflections is that space is a continuously evolving and highly complex environment with special characteristics that require specific knowledge and expertise and NewSpace further affects this reality. On the other hand, the insurance industry, in general, is no stranger to high-risk sectors - such as nuclear - and has always found formulas to meet their necessities. Therefore, now more than ever it is fundamental that insurers drew from their pool of knowledge acquired in other high-risk sectors and partner with experts in the space sector aware of the elements characterising NewSpace and its underlying dynamics to offer new insurance solutions to customers. Down this road, **new forms of involvement** concerning the insurance sector operating in space-related activities might be sought.

Firstly, if space-related insurance companies wish to survive these changes in paradigm, they will have to **comply with partially renovated duties and responsibilities.** For a start, they will need to switch from a passive role to a more active one, being involved since the outset of the value chain. Time and degree of involvement would clearly change depending on the object and type of insurance. This would include investigating clients' needs, opening communication channels with experts in the sector, and potentially being integrated into the value chain. This approach could lead to an eased identification of coverage needs, potential coverage of insurance gaps based on actual customer needs as well as balancing some of the risks insurers face in the presence of untested technologies and less experienced operators through a continuous and informed exchange. In particular, while brokers play a huge role in getting the space insurance market closer to NewSpace, space insurance and customers should interconnect at earlier stages, for instance for consultations during the development of the product to insure. Secondly, this should be combined with optimisation and modernisation in terms of distribution of the insurance value chain (how they organize the process internally).

In addition, some companies today, such as SpaceX, or Kineis, tend to house all steps of the production chain (mainly, manufacturing, launching, and in-orbit services). These steps of the value chain are often covered by different insurance markets (ground, marine, space and aviation insurers). In this circumstance and excluding other issues, it is difficult to imagine an inclination for companies to insure when each step falls under the competence of different insurance companies. Therefore, insurance companies should more commonly offer **packages which cover the different phases of the space value chain** under one single contract, covering the entire lifetime of the product and if necessary, also for multiple missions and projects.

40 *Supra* note 3.

The insurance industry targeting the space sector should also adapt to NewSpace's changing landscape in terms of **developing new ways to employ current insurance instruments and new flexible formulas** (for instance focusing on ensuring the service instead of the asset, as in the case of the large constellation). Hence doing both offering adequate financial coverages to their insured and optimising profits in order to survive the NewSpace market. For instance, designing insurance packages not based on general areas (e.g., macro risks) but detailed on specific risks and characteristics for that type of product, by employing an "*intelligent set of underwriting tools and a reliable rating model*".[41] This would create competition on the product offered and not only on the price, as it currently happens in the market.

Furthermore, these "intelligent tools" make it possible to focus on higher-risk insurances as well and having a portfolio of contracts targeting both high and low risks activities allows the mutualisation of losses (the "*big pool*" principle). NewSpace forces the insurance sector to make this step forward. In fact, large companies have a low-risk count but are more volatile, while NewSpace companies have a higher risk count but are less volatile and as mentioned, their risk can be mitigated with intelligent tools.

Finally, the space insurance market (including several classes of insurance e.g., Asset & Property or third-party liability insurance) would have to collaborate on the goal to **educate NewSpace companies about the importance and necessity to insure**. The outcome would be allowing the insurance market to adapt its rules and policies to the NewSpace market demand in order to avoid spikes in premiums and disincentive self- insurances. Nonetheless, the study of risks comports a significant amount of time and resources. On NewSpace's side, these companies should embed proactive behaviour, incentivizing the creation of relations with the insurance market, and proving the value of their business.

4.2. Legal perspectives: Does insurance in the NewSpace sector need to be regulated?

The other face of the coin concerns **regulatory challenges.** From the legal perspective, it is then relevant to mention that no uniform framework can be outlined in terms of insurance constraints.

Discipline on the matter is usually the result of either:

- **Bilateral agreements** concerning predetermined activities and binding the nationals of the signatory states; or
- **National space laws** imposing licences or permission requirements on nationals and/or any other stakeholder carry on space activities in the territory of the country in which the national space law imposing licences or permission requirements is in force.

Hence, the issue of insurance regulations for commercial satellites is often linked to the enactment of national space laws, which many states still lack. Regulation is an important tool, but it needs to be flexible enough to be adapted to the market's needs in general and even more to the rapid changes and challenges characterizing NewSpace. In particular, insurance requirements are a **component of attractiveness** and **proof of seriousness** for space nations. In this sense, regulators should need to formulate their laws trying to find the **right balance between remaining worldwide "competitive"** (regarding the benefit of the discipline for private actors), but **also protecting themselves** from the liability for damages incurred by operators they licence. In this context, many governments are reluctant to impose restrictions on the private sector or to impose insurance or licensing obligations of any kind. Otherwise, the risk would be to have strong migration of private capital to countries where such stringent insurance obligations or limits are not imposed, with relevant consequences for the country of origin not only economically speaking but also in terms of technological development, know-how, security, and so forth. In the absence of a clear international or supranational legal framework, competitive national legislations are invaluable and irreplaceable.

In addition, governments should continue to **develop best practices, and standards, and promote responsible behaviours among** relevant stakeholders in the field. This would make the national and international legal framework more certain. Countries might also start requiring insurance fulfilments for specific operations or phases of a mission or

41 *Volante Global*, New Space deserves New Insurance, March 2021. Link: https://volanteglobal.com/news/newspace-deserves-new-insurance/.

of a satellite lifetime.

They should also **play a much more active role and work alongside with the industry (**insurers, private space companies, satellite operators) and providers to incentivize responsible behaviour and best practices among satellite operators, as well as support the coordination and collaboration in the insurance industry.

The achievement of responsible behaviours would require a high level of collaboration between space insurers, and the antitrust regime might limit the realisation of such a scenario. Space insurers have already expressed their concern in this regard. A partial exemption of space insurers from antitrust laws might be required to implement this approach.[42]

Furthermore, a strategic instrument is represented by the effort of ensuring compliance with these standards and best practices. Countries might also provide **incentives for companies complying with the settled obligations** or displaying appropriate/responsible behaviours (the so-called "good steward" companies).

Moreover, governments can **raise awareness about the complementary role of insurance to mission assurance**, especially targeting NewSpace insurance.

Although, for the space insurance market to be financially equitable, and to achieve a suitable scenario, it would be crucial for spacefaring nations - if not all at least a vast majority of them – to **implement concurrent insurance requirements** targeting all space actors operating in the same operational fields.

To conclude, as a general statement there is a significant role placed by the public sector on taking responsibility and be aware of the challenges the space sector is facing today, also in terms of financial guarantee and insurance.

5. Challenges ahead and conclusions

Insurance is a **key enabler of space commercialisation and new innovative projects**, minimizing the financial impact on insureds in case of loss or damage, letting them focus on innovation and technology development.

The increased interest in new space assets and activities, such as commercial space travel, space tourism, suborbital flights, and on-orbit servicing will likely have an impact on the space insurance sector. New strategies of space-assets insurance should be required to deal with concerns on Space Traffic Management (STM), damage sustained by astronauts while on a mission, with new cybersecurity concerns. This will create new opportunities for the market, but also legal concerns. For instance, a new legal framework will likely have to be developed in relation to the insurance of crew members, and commercial passengers.

To conclude, space insurers would have to find a way to adjust their tools to the changing landscape and continue to support the industry going forward with flexible and intelligent insurance tools.

42 *Secure World Foundation*, "STIMSON". Link: https://swfound.org/media/206112/2018_stimson_swf_insurance_event_report.pdf.

ESA accelerators: challenges and opportunities

*Maria Vittoria Prest**

1. Why the Accelerators?

Over the last years, ESA Agenda 2025 sets out a vision for how Europe could seize the opportunity of the current revolution in space activities to help make a green, digital, safe, and inclusive world.[1] Central to this vision is a reinforced and more effective cooperation between ESA, its Member States, and the EU through existing and future programmes and initiatives. In October 2021, an ESA DG-appointed High-Level Advisory Group made recommendations on the main societal challenges representing priorities for this reinforced cooperation and highlighted the importance of accelerating the use of Space in Europe, identifying three main thematic areas of action:

- Space for a Green Future: the S4GF Accelerator "*will provide actionable information, helping form the baseline for effective European adaptation strategies to support the green transition, enabling the EU to reach its goal of becoming carbon neutral by 2050, and supporting its Green Deal*"[2];
- Rapid and Resilient Crisis Response: through a crisis information management system the R3 Accelerator "*will increase Europe's lead in Earth observation systems, establish Europe as a global leader in humanitarian action and support European autonomy in energy and water supply. It will enhance Europe's digital sovereignty in information handling and communication across the whole of the economy*"[3];
- Protection of Space Assets: the PROTECT Accelerator aims to ensure resilient availability and functioning of space infrastructure by bringing together all European players to secure European autonomy, technological and commercial leadership for safe and independent access to and use of space and safety of the critical ground-based infrastructure[4].

2. A response to critical upcoming challenges of the European space sector

The High-Level Advisory Group outlined the potential of the Accelerators in fostering Europe's private investment in space in the framework of a dramatic growth of commercial space activities. Such new opportunities will pave the way to a more prominent role of private actors alongside ESA, the EU and other partners to further develop and foster coordination of space-related activities and services. Beyond the technical relevance of the issues tackled by the Accelerators, they aim to stimulate innovation and the emergence of new business models contributing to shift the focus from system to services and from programmes to the market in a closely coordinated manner between institutional and commercial players. Accelerating the use of space requires a user-driven approach. Therefore, the High-Level Advisory Group advised ESA to find ways to ensure end-users engagement from inception in order to secure the demand for new space-based services as reliable, resilient and tailored solutions to their needs. Additionally, the Accelerators open new perspectives to Member States to contribute to ESA's activities in a framework in which they can pursue their national priorities, while ESA operates as an integrator, federating national initiatives and incorporating various concepts into the Accelerators. Member States and European stakeholders have expressed their interest in further exploring the new mechanism of the Accelerators. The principles have been endorsed by European leaders with the "*Matosinhos Mani-*

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1 European Space Agency, Agenda 2025, March 2021. Link: https://www.esa.int/About_Us/ESA_Publications/Agenda_2025.

2 European Space Agency, *Accelerate the use of space. Space for a green future*. Link: https://vision.esa.int/space-for-a-green-future/-

3 European Space Agency, *Accelerate the use of space. Rapid and resilient crisis response*. Link: https://vision.esa.int/rapid-and-resilient-crisis-response/.

4 European Space Agency, *Accelerate the use of space. Protection of space assets*. Link: https://vision.esa.int/protection-of-space-assets/

festo", three workshops addressing the Accelerators' thematic areas held in January, and at the 2022 European Space Summit[5]. Additionally, ministers approved seed funding for the Accelerators at the next ESA Council of Ministers and called on ESA to identify other sources of funding[6]. After such positive and promising initial steps, it is now time to set concrete roadmaps and milestones for programmatic implementation, including the definition of S.M.A.R.T. (Specific, Measurable, Achievable, Relevant and Time-bound) objectives in a user-driven approach.

3. ESA's new role as solution architect

Beyond traditional technical and programmatic challenges, the concept of the Accelerators raises unprecedented questions regarding the relation between ESA on the one hand, and Member States, users, and the European Commission on the other hand. With the Accelerators approach, ESA is called to broaden its responsibilities as programme manager to encompass a new role as solution architect for the development and deployment of Europe-wide operational space infrastructure and service. This is not unknown territory though, since there are obvious similarities with the way ESA currently interacts with its Member States and with the scientific community in the framework of the Science Programme. In these matters the Agency relies on the Member States to provide the mission instruments and to implement part of the programmes beyond their financial contribution. Additionally, its scientific activities are based on a user engagement approach to reach out to the European scientific community effectively and efficiently, either in a direct relationship with them or through Member States representation. In this respect, the Science Programme provides relevant best practices and hindsight to build on for the further elaboration of the Accelerators model. However, the incomparable breadth and diversity of the users' community in an operational context, the necessity to ensure effective complementarity with EU Galileo- and Copernicus- related downstream activities, as well as reservations from some Member States to further rely on ESA for security-related applications are poised to raise issues that call for appropriate innovative governance schemes.

4. The way forward

The technical and political relevance of the Accelerators was firmly and consensually confirmed. In the framework of their preparation, ESA has undertaken multiple consultations with Member States, stakeholders, and final users. The three issues identified by the High-Level Advisory Board need to be urgently addressed and space is poised to play a major role in any innovative solution that will be deployed at European level to better anticipate the consequences of climate change, ensure a rapid response in crisis management, or foster the in-orbit security of European assets. Nevertheless, it is also true that the concrete implementation of the Accelerators implies addressing several fundamental issues that the European space sector must or will have to face shortly.

Firstly, the topics of the Accelerators just confirm that security at large has become a pervasive concept that impacts and has implications for almost all the space-related activities currently under consideration. Secondly, the Accelerators highlight the need to ensure users engagement throughout Europe and the development and exploitation processes of future operational space systems addressing public needs. This goes way further the formal and single "*users' consultation*" currently implemented.

Thirdly, it is clear that Europe has not yet adapted its institutional setup to fully take advantage of the greater ability of private actors to propose innovative solutions and ensure faster development and deployment. The Accelerators might be the proper framework to progress in this direction.

5 European Space Agency, *The Matosinhos Manifesto: Accelerating the Use of Space in Europe*, November 2021. Link: https://vision.esa.int/the-matosinhos-manifesto-accelerating-the-use-of-space-in-europe/.

6 European Space Agency, *N° 4–2022: Decisions from the 2022 Space Summit*, February 2022. Link: https://www.esa.int/Newsroom/Press_Releases/Decisions_from_the_2022_Space_Summit.

Last but not least, the recent and ongoing multiplication of national initiatives clearly shows that there are well identified priorities in space and national actors want to contribute to their implementation. In this respect, a framework needs to be set to maximize the return of any European investment in space and reap the benefits at European level of any national public or private initiative. Again, the Accelerators are probably the ideal test-case to initiate a joint reflection in terms of space infrastructure architecture bringing together a variety of otherwise uncoordinated initiatives

To tackle these issues, ESA has a strong background and is probably the most appropriate organisation to assess various options with all stakeholders and present concrete proposals to its Member States. However, this entails that they are ready and open to consider a new role for the Agency in security- related matters and to accept to rely on its technical expertise to devise overarching European space solutions to address some of their critical needs.

Space to Africa

*Luisa Santoro**

1. Introduction

In his speech at the 14th EU Space Conference[1] held in Brussels on 25 January 2022 and in his concluding remarks at the high-level Space Summit in Toulouse on 16 February 2022, EU Commissioner Thierry Breton[2] mentioned Africa as the extra-European country that will benefit from the future EU space-based connectivity infrastructure, adding that a legislative proposal would be presented to EU Member States and the European Parliament.

In the first 15 years of the new millennium, the African continent grew at yearly average rates of 5%, thanks to the "*super-cycle*" of raw materials, even though it was a "*multi-speed growth*"[3].

According to recent statistic data[4], "*in 2020, the population of Africa grew by 2.49 percent compared to the previous year. The population growth rate in the continent has been constantly over 2.45 percent from 2000 onwards* […] *Despite a slowdown in the growth rate, the continent's population would continue to increase significantly in the coming years, reaching nearly 2.5 billion people by 2050*". This is why Africa needs to create at least between 10 and 15 million jobs a year through an average economic growth of the continent between 6% and 7%, which is very difficult to achieve.

Based on those projections and on their longstanding relationship with Africa, EU Member States have been launching concrete initiatives aimed at creating investments and jobs in the African continent, in multiple domains. Space is one of them.

2. Africa in space

Africa belongs to the group of countries that are trying to develop autonomous capacities to access and operate in space in order to benefit from space technologies, applications and activities for political, economic and social purposes, or, as stated in the African Union's[5] vision, for "*an Integrated, Prosperous and Peaceful Africa, driven by its own citizens and representing a dynamic force in the global arena*.". To this end, in October 2017 the African Space Policy[6] was defined – in collaboration with South American[7], Arabian[8] and Southeastern Asia[9] countries – for the development of services and products required to respond effectively to the socio-economic needs of the continent; achieve an indigenous capacity to operate and maintain core space capabilities; put in place industrial capabilities able to turn innovative ideas from

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1 https://ec.europa.eu/commission/presscorner/detail/en/speech_22_561.

2 Thierry Breton is, among others, responsible for "improving the crucial link between space and defence and security… supported … by a new Directorate-General for Defence Industry and Space." (President von der Leyen's mission letter to Thierry Breton, https://ec.europa.eu/commission/commissioners/2019-2024/breton_en).

3 In 2015 African countries such as Nigeria, South Africa and Angola suffered the strong impact of the drop in the cost of raw materials, whereas countries such as the Ivory Coast, Ghana, Ethiopia, Kenya, Senegal and Rwanda, which had diversified resources, could count on greater resistance (see https://www.esteri.it/it/politica-estera-e-cooperazione-allo-sviluppo/aree_geografiche/africa/il-partenariato-con-l-africa/).

4 https://www.statista.com/statistics/1224179/population-growth-in-africa/.

5 Announced in the Sirte Declaration concluded in Sirte, Libya, on 9 September 1999, the African Union is a continental union consisting of 55 African Member States. It was officially launched in 2002 as a successor to the Organisation of African Unity (OAU, 1963-1999).

6 https://au.int/sites/default/files/newsevents/workingdocuments/33178-wd-african_space_policy_-_st20444_e_original.pdf.

7 Chile, Peru, Paraguay, Uruguay and Ecuador.

8 Bahrain, Oman, Kuwait, Katar and Saudi Arabia.

9 Vietnam, Indonesia and Philippines.

research and development into public and commercial sectors; implement coordination across Member States and regions to minimize duplication, as well as on a national, continental and international basis.

In October 2021 the African Union Executive Council – with the support of the African Development Bank (AfDB) and the African Development Fund – approved the structure of the African Space Agency (AfSA), the regional agency that will be domiciled in Egypt and – as proposed in the African Union Agenda 2063 – is expected to become operational in 2023.

AfSA will add up to the space agencies/entities that are already present in the following African countries:

I) ALGERIA

Established in January 2002 in Algiers, the Algerian Space Agency (ASAL) is in charge of the Algerian space programme and to date has flown five different Earth observation (EO) satellites - AlSat 1 (2002); AlSat 2 (2010); AlSat 1B (2016); AlSat 2B (2016); AlSat 1N (2016) - designed for disaster monitoring and other thematic remote-sensing applications. One communications satellite, AlcomSat-1, followed in 2017, in the framework of the first National Space Programme (NSP), that had been adopted in 2006. The 2020-2040 edition of the NSP is mainly focused on developing the use of space tools to ensure food security and environmental protection by studying and taking action against climate change; ensuring continuity of high and medium-resolution imaging coverage service, so as to acquire better knowledge of the Algerian territory; covering the North Africa telecommunications subregion via the development and launch of Alcomsat-2; strengthening space engineering development infrastructures and upgrading existing facilities, in order to develop an autonomous national space system; creating a national industrial space-related ecosystem; contributing to sustainable development and the peaceful use of outer space. In addition, since 2009 Algeria has also been involved – with Kenya, Nigeria and South Africa – in the ARMS C (African Resource Management Satellite) project, a constellation of identical EO satellites providing data for disaster monitoring across Africa, to which Algeria will contribute by developing the very high-resolution EO satellite 'AlSat-3'.

II) ANGOLA

In 2010 the Angola government established the National Space Program Management Office (Gabinete de Gestão do Programa Espacial Nacional - GGPEN), the agency responsible for the country's space activities at the national and international level. With the Ministry of Telecommunications and Information and Communications Technologies responsible for regulating the affairs of GGPEN, in May 2017 Angola adopted its National Space Strategy plan for 2016-2025, which is focused on the development of a space infrastructure composed of communications satellites and ground stations, EO, navigation and positioning satellites and orbital slots; capacity building programmes, such as the national space capacity building and certification programme 'Centro Angolano de Estudos Espaciais' (Angolan Centre for Space Studies); activities for the promotion of space applications in both the public and private sectors. In 2017 GGPEN launched its first (geostationary) communications satellite, AngoSAT-1, which was built by Russian company 'RKK Energia' and is operated by Angosat. AngoSat-1 will be replaced by AngoSAT-2, which is expected to be launched in the first half of 2022[10]. In addition, in 2019 the Angolan National Space Program Management signed a contract with Airbus to manufacture AngoSAT-3, an EO satellite that will be used for military reconnaissance activities.

Angola is also playing an active role in the Southern Africa Development Community (SADC) shared satellite network project and has signed partnership agreements with University Space Engineering Consortium UNISEC, Airbus, Thales Alenia Space and the European Space Agency (ESA).

10 https://africanews.space/angosat-2-will-be-launched-in-the-first-half-of-2022-reiterates-minister-manuel-homem/.

III) **EGYPT**

The Egyptian space programme can be said to date back to the 1950's, even if it was formally launched after the establishment, in 1991, of the National Authority of Remote Sensing and Space Sciences (NARSS), "*the pioneering Egyptian institute in the field of space technology and earth observation*"[11] for remote sensing and space science and technology purposes. The NARSS programme was aimed at developing a robust GIS environment for the sustainable development of the country through investments in scientific research, cooperation with both national academia and industry, promoting international cooperation, scientific research culture among students and capacity building.

NARSS was followed by the formation of the Egyptian Space Council in 1998, which gave birth to the Egyptian space programme. In January 2018 the Egyptian government passed Law No. 3/2018 for the creation of the Egypt Space Agency (EgSa), the national space institution aimed at developing national space technology and satellite launching capabilities and at implementing the National Sustainable Development Strategy "*Egypt-SDS 2030*"; it became fully operational with the transition/upgrade of NARSS to EgSa.

Having launched nine satellites to date - from Nilesat 101, in 1998, for communications services, to Nilesat 102, a geosynchronous communications satellite launched in 2000 and retired in June 2018; EgyptSat 1, a remote sensing satellite put into orbit in 2007; Nilesat 201, a communications satellite launched in 2010; EgyptSat 2, also called MisrSat 2, another remote sensing EO satellite, launched in 2014 and now no longer active; EgyptSat-A or MisrSat A, an EO satellite sent into space in February 2019 and soon followed by two 1U Cubesats, NARSSCube-2 and NARSSCube-1, in July and September 2019 respectively, "*both indigenously developed by Egyptian engineers at NARSS*"[12]; and TIBA-1, a communications satellite for internet services, put into orbit in November 2019 - Egypt boasts one of the most robust space programmes in Africa. In September 2019 EgSa also signed a contract with the China National Space Administration for the development of the remote sensing MisrSat-II satellite. In addition, in February 2022 the Agency announced that in May it will launch its first fully designed satellite, EgSAcube-3, and EgSAcube-4, in cooperation with Benha University.

In 2019 the African Union (AU) endorsed Egypt as the host of the African Space Agency, a recognition that will boost "*Egypt's ascension as the capital of AU's continent-wide space programme*"[13], while, last but not least, Egypt is also building a new city dedicated to manufacturing satellites and conducting space research and education, consisting of 23 buildings located on a 123-acre area on the Central Ring Road towards Suez.

IV) **ETHIOPIA**

Ethiopia has been dealing with space since the early 1950's, when the Ethiopian Mapping and Geography Institute was formed under the Ministry of Education in order to support the country's national development by resorting to geospatial datasets. In 1998 the Institute was renamed to Ethiopian Mapping Agency (EMA) and moved under the Ministry of Finance and Cooperation, whereas in 2018, after a new phase of restructuring and re-organisation, its name was changed into Ethiopian Geospatial Information Institute (EGII)[14]. More recently, in November 2021, consistently with the government's 10-year strategic plan, the Ethiopian House of People's Representatives enacted proclamation 1263/2021, that merged EGII with the Ethiopian Space Science and Technology Institute (ESSTI) – the Ethiopian institute for research, infrastructure development and training in space science created in 2016 under regulation No. 916/2015; the two entities will form the Space Technology and

11 http://www.narss.sci.eg/about.
12 https://africanews.space/peek-into-egypts-growing-capacity-in-space-proposed-10-year-national-space-program/.
13 Ib.
14 EGII cooperated with a number of African and international institutions and participated in the Global Monitoring of the Environment and Security and Africa (GMES & Africa) project, and in the implementation of the United Nations Integrated Geospatial Information Framework.

Geospatial Institute (STGI), that is tasked with a more competitive national space and geospatial programme and is expected to become operational in 2022.

To date Ethiopia has launched two satellites through ESSTI: ETRSS-1, a 72 kg remote-sensing microsatellite, co-designed by Ethiopian and Chinese engineers and launched in December 2019 for weather forecast, environment, and crop monitoring; and ET-SMART-RSS, an 8.9 kg communications nanosatellite, also resulting from an Ethiopian–Chinese collaboration, that was launched in December 2020. In addition, on the short and medium term, the Ethiopian government "*is hoping to construct a satellite manufacturing, assembly and integration testing centre, and a communications satellite, a high-resolution earth observation satellite, as well as advance in the development of the geospatial industry*"[15].

V) GABON

AGEOS (Agence Gabonaise d'Études et d'Observations Spatiales), the Gabonese Agency for Space Studies and Observation, was created in 2010 by the President of the Gabon Republic, in order to implement Earth observation programmes on a national scale and help addressing its socio-economic problems. It is situated in Nkok, in the Special Economic Zone 27 km from Libreville and, as a "*youn"* agency, it is now still working on a draft space policy and on the implementation of its first satellite project the GABON-SAT project – in cooperation with Japan Space System.

In 2015, as part of the "*Satellite-Assisted Environmental Monitoring*" (SEAS) Gabon project with the French Development Agency (AFD) and the Research Institute for Development (IRD), AGEOS endowed itself with a Satellite Data Receiving Station that can directly receive and process optical (Landsat 7 & 8, NOAA, NPP) and radar (Cosmo-SkyMed) satellite data covering a radius of 2,800 km, that is 24 countries of Central and West Africa as well as the entire Gulf of Guinea, in order to tackle issues concerning forests, water resources, the coastline, agriculture and urbanization.

AGEOS is leading the Central Africa consortia facilitating the production of relevant baseline data and indicators, organizing, and disseminating data as well as products and services based on the use of earth observation data; and it is one of the institutions implementing:

- the 30 million Euros Global Monitoring of the Environment and Security (GMES & Africa) project;
- RARS (Regional Advanced Retransmission System), a project led by the ACMAD (the African Centre of Meteorological Application for Development, based in Niamey, Niger), in which four African countries (Gabon, Niger, South Africa and Kenya) will receive Low Earth Orbiting Satellite data to generate products that can be used for Disaster Risk Reduction modelling and weather resilience in Africa;
- CAFI, the Central African Forest Initiative, whose objective is "*to fight climate change, protect forests, reduce poverty and contribute to sustainable development*"[16].

VI) KENYA

Kenya boasts one of the best economies in the entire African continent. In the pre-Covid era, the public services sector was heading towards an increasing marked improvement and the private sector was very vital and in expansion. Thanks to this trend, Kenya aimed to play a leading role both in the East African region and in the rest of the continent.

15 https://africanews.space/ethiopian-government-to-merge-the-ethiopian-space-science-and-technology-institute-and-ethiopian-geospatial-information-institute/.

16 https://africanews.space/ageos-is-driving-the-development-of-gabons-national-space-policy-and-its-first-satellite/.

Kenya started its space activities by collaborating with Italy, thanks to a 1500-ton triangular offshore oil rig that, early in 1964, was dragged from the harbor of Taranto, in Italy, to Mombasa, in Kenya. The rig was named "*Saint Rita*", after the patroness of impossible causes, and in 1966 was followed by a second one, which had been provided by the US Army to Italy, named "*Saint Mark*"[17]. Both platforms were then dragged to Ungwana Bay, off the coast of Malindi, and, with the ground station that was then built in Ras Ngomeni (Kilifi County, Kenya), they formed the initial space base that later on was named "*Broglio Space Center"* (BSC)[18] after Prof. Luigi Broglio (University of Rome, La Sapienza), the originator of the "*impossible cause*".

Located south of the Equator – thus, representing an ideal site for space launching and ground-based satellite monitoring activities – the BSC was the first satellite station for Italy, that from there performed 27 launches between 1967 and 1988, with a total of 9 (4 Italian, 4 American and 1 UK) satellites.

In 2009 Kenya established its National Space Secretariat, which in 2017 was incorporated into the newly-formed Kenya Space Agency (KSA). The Agency will stimulate Kenya's competitiveness and positioning in the regional and global space agenda by promoting, coordinating and regulating space-related activities in the country through research and innovation in space science, technology and applications.

In May 2018 Kenya deployed into orbit, from the International Space Station (ISS), 1KUNS-PF (1st Kenyan University NanoSatellite-Precursor Flight), an experimental cubesat aimed at raising awareness in Kenya about the benefits of space applications and technologies. In March 2021 1KUNS-PF was followed by IKUN3-SIMBA (System for Improving Monitoring the Behavior of Animals), a 1U CubeSat developed by students and researchers at the S5Lab-Space Systems and Space Surveillance Laboratory of Sapienza University of Rome, in collaboration with Machakos University and the University of Nairobi, in order to monitor wildlife in Kenya's national parks and study animal behavior.

Figure 1 - "*Luigi Broglio*" Space Center, Malindi (Kenya) – Photo credits: Italian Space Agency

17 For additional details see: https://owaahh.com/space-center-kenya-doesnt/.
18 For more information about the Broglio Space Centre in Malindi, see: https://www.asi.it/en/the-agency/the-space-centers/luigi-broglio-space-center/

VII) LYBIA

Established in 1989, the Libyan Center for Remote Sensing and Space Science (LCRSSS) is a governmental research organization headquartered in Tripoli and dedicated to remote sensing, space, and earthquake sciences, currently with three centres: the main one, the Astronomy and the Seismology centres. LCRSSS is one of the 22 centres forming the Centre for Scientific Research, which – overseen by the Libyan Authority – is under the Ministry of Higher Education. The Libyan Authority used to be allocated funds by the government and to distribute them to the 22 centres, depending on submitted projects. However, due to the financial crisis that resulted from the uprising in 2011, the government almost eliminated the funding in the last few years and – as clearly stated in December 2021 by the Director-General of LCRSSS, Dr Akram Al Kaseh[19] – apart from some capacity building activities, "*no solid project has kicked off yet*", due to persisting political issues and instability, so that, at the moment, they can carry out some research activities based on satellite data and some additional small projects – all of them "*also without budgets*"[20]. In addition, by partnering with some institutions (Authority of Water in Libya, Sahara and Sahel Observatory consortia on the GMES and Africa project, etc.) LCRSSS gets paid to implement projects for them.

VIII) MOROCCO

Established by decree in December 1989, the Centre Royal de Télédétection Spatiale (CRTS) is Morocco's space institution, operating under the Ministry of Defence, along with the Royal Centre for Space Research and Studies (CRERS). Its mandate foresees the promotion of the exploitation and development of remote sensing applications in Morocco, in collaboration with government departments, private operators and national universities. In 2001 Morocco launched its first (remote sensing) satellite, Maroc-TUBSAT which had been developed in collaboration with the Technical University of Berlin. It was followed by two more remote sensing satellites: Mohammed VI-A, in 2017, and Mohammed VI-B, in 2018, both manufactured by a Franco-Tunisian consortium including Thales Alenia Space and Airbus and aimed "*primarily to surveillance and control of* [...] *borders with Spain, Algeria*"[21]. Both satellites are operated by CRTS.

Thanks to low-cost, labor-force, political stability, proximity to Europe and qualified subcontractors, over 120 aeronautics companies have settled in Morocco in the last 20 years – Safran, Bombardier, Boeing, and some Airbus subcompanies among them – so that "*Boeing aims to create an ecosystem of suppliers that would double the aerospace sector of the kingdom*"[22].

In September 2021 Morocco ratified the Basic Charter of the Arab Group for Space Cooperation, an informal regional organisation founded in November 2019 upon decision of Sheikh Mohammed bin Rashid al-Maktoum, Vice-President and Prime Minister of the Emirates of Dubai[23]; the Charter is aimed at promoting scientific research and innovation, launching joint initiatives, harmonising satellite communications legislation and regulations, and adopting a shared position in regional and international fora.

19 https://africanews.space/we-have-always-wondered-what-the-space-program-in-libya-looked-like/.
20 Ib.
21 https://atalayar.com/en/content/morocco-looks-emirates-model-its-own-space-agency.
22 Oyedamola A. et al., An Analytical Outlook of the Commercial Space Industry for the Last Frontier: Potential Entrepreneurial Evaluation of the African Space Sector (IAC 2019).
23 Composed of 14 Member States under the chairmanship of the Emirates Space Agency, the purpose of the Arab Group for Space Cooperation is to promote and coordinate cooperation in the space sector between Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Mauritania, Oman, Saudi Arabia, Sudan, Tunisia and Saudi Arabia by sharing experiences and information.

IX) NIGERIA

Nigeria's ambition towards space was openly declared in 1976, during an intergovernmental meeting in Addis Ababa. In 1999, when Nigeria became a democratic government, the National Space Research and Development Agency (NASRDA) was formed, so that the government started a long process aimed at formalising a national space programme, that, however, was only approved in May 2001, along with the National Space Policy and Programme. In August 2010 the National Space Research and Development Agency (NASRDA) Act was passed[24], which makes Nigeria one of the few African countries with a space-related national legislation and policy[25]. The Act formally turned NASRDA into a government space agency, empowering the Space Council as the regulatory authority for space science and technology activities in Nigeria.

To date NASRDA has been able to perform satellite launches and to manage space operations for: Nigeriasat 1, a LEO micro satellite for disaster monitoring launched in 2003 under a seven-nation constellation handled by Russian firm Cosmos; NigComsat-1, a communications satellite put into orbit in 2007; Nigeriasat 2, a minisatellite launched in 2011 for the provision of high-resolution, Pan and MS imagery; Nigeriasat x, a multi-spectral (R, G, NIR) sensor launched in 2011 in cooperation with China and the UK, and "*the first ever African-built satellite into orbit*"[26]; Nigcomsat-1R, a telecommunications satellite put into orbit in 2011; and Edusat-1, a nanosatellite built for education purposes by the Federal University of Technology Akure, in cooperation with Japan, launched in 2017. In addition, in 2018, Nigeria gave a $550 million equity stake in the government satellite operator NigComSat to China Great Wall, a Chinese satellite enterprise, in order to manufacture two communications satellites (NigComSat-2 to be launched in 2023, and NigComSat-3 in 2025) to be launched by China after the conclusion of the final agreement.

Finally, NASRDA centres include: a Center for Basic Space Science (CBSS), a National Center for Remote Sensing (NRCS), a Center for Space Science and Technology Education (CSSTE), a Center for Space Transport and Propulsion (CSTP), a Center for Satellite Technology Development (CSTD); a Center for Geodesy and Geodynamic (CGG) and a Center for Atmospheric Research (CARS).

X) RWANDA

Rwanda's space journey started thanks to a partnership between the Rwandan government and UK communications company OneWeb, that enabled Rwanda to launch, in February 2019, Icyerekezo ('*vision*', in English), a satellite aimed at providing remote schools across the country with internet connection. Rwandan engineers also had the opportunity to participate with the Japanese Aerospace Exploration Agency (JAXA) in the mission design, assembly and integration of Rwasat-1, a (3U) CubeSat launched to the ISS in September 2019 with a payload consisting of two cameras for monitoring the status of agriculture and a receiver for data collection by ground-based sensors.

In March 2021, Rwanda's Chamber of Deputies voted on the law establishing the Rwanda Space Agency (RSA), that will coordinate Rwanda's space activities for communication, intelligence, surveillance and reconnaissance purposes, as well as for the provision of geospatial services in domains such as agriculture, urban planning, education, emergency response & weather forecasts. The necessary ground station will be developed by Rwandan Ngali Holding and American satellite communications company GlobalStar.

24 http://nasrda.gov.ng/nasrda-act/.
25 https://africanews.space/the-national-space-research-and-development-agency-act-beyond-a-domestic-implementation-of-international-space-obligations/.
26 https://aerospace.csis.org/challenges-and-opportunities-of-nigerias-space-program/.

In October 2021 RSA filed a request with the International Telecommunication Union (ITU) to put 327,320[27] satellites in space.

In February 2022, the Rwanda Ministry of Education transferred to RSA the Rwanda Climate Observatory Project, that had been launched in 2011 in collaboration with the Massachusetts Institute of Technology (MIT) in order to establish a climate observatory on Mt. Karisimbi, so as to measure meteorological parameters, aerosols and greenhouse gases.

XI) SOUTH AFRICA

Involved in the sector since the 1950's, South Africa has a long history in space, which started with the exploration of outer space. Between the 1950's and 1970's, satellites were tracked to determine the effects of the upper atmosphere on their orbits, and Lunar and interplanetary missions were supported from a tracking station at Hartebeesthoek (about 50 km northwest of Johannesburg). Since then, South African ground-based facilities have continued to support various space missions, providing telemetry, tracking and command (TT&C) services for polar orbiting and geostationary satellites to space agencies and/or aerospace companies globally, including NASA, CNES, Boeing, Intelsat and many others.

Space activities in South Africa are regulated by Space Affairs Act n. 84 of 1993, which established the South African Council for Space Affairs (SACSA), "*responsible for representing South Africa in international intergovernmental fora dealing with space affairs and for the authorisation, licencing and supervision of space activities in South Africa*"[28].

With the South African National Space Agency Act of 2008, the South African National Space Agency (SANSA) was established, even though it started operating in December 2010. SANSA falls under the Department of Science and Technology, whereas the South African National Space Policy provides the objectives and guidelines for the development and implementation of space activities, which are to be carried out consistently with national priorities such as poverty reduction, economic expansion, scientific and technological empowerment and improved quality of life. In addition, SANSA is guiding the Africa Resource Management Satellite Constellation (ARMS C) project involving Nigeria, Algeria and Kenya and aimed at protecting indigenous resources like vegetation, farmland and water. Finally, SANSA also hosts the only Space Weather Regional Warning Centre (SWRWC) in Africa, which provides an important service to the region by monitoring the sun and its activity to provide information, early warnings and forecasts; SWRWC is part of the International Space Environment Service (ISES).

South Africa's first satellite, Sunsat-1, was launched in 1999. It was a microsatellite built by the University of Stellenbosch and was launched on a United States launcher. In 2005 the South African Department of Science and Technology launched a three-year satellite programme focusing on capacity building in all aspects of a typical space mission. The programme was managed by the University of Stellenbosch and resulted in the first satellite – named Sumbandila (meaning pathfinder) – designed, built and tested in South Africa; it was launched in 2009, proving also the ability of the South African industry to support a national space programme.

In December 2012, as South Africa's contribution to the African Resource and Environmental Management satellite constellation (ARMS C), SANSA and the Department of Science and Technology awarded Denel Spaceteq a contract to develop an earth observation satellite, EO-SAT1, in collaboration with the local space industry and the Department of Trade and Industry. The programme started in March 2015 and was expected to be completed in March 2021[29], but, due to funding challenges, it has again been delayed.

27 https://spacewatch.global/2021/10/rwanda-files-at-itu-for-nearly-330000-satellites/.
28 http://www.spacelab.uct.ac.za/space-south-africa-0.
29 https://africanews.space/newspaceafrica-column-denel-spaceteq/.

In 2013 ZACube-1 – a South African CubeSat carrying a high frequency beacon transmitter for space weather research – was launched from Yasny, Russia, followed, in 2018, by ZACube-2, that was launched as a technology demonstrator for the first South-African constellation which was put into orbit from the USA in January 2022 by South Africa's Cape Peninsula University of Technology. The constellation consists of three locally-produced nanosatellites that are part of South Africa's new Maritime Domain Awareness Satellite constellation (MDASat) and designed to collect critical data to enhance the security and protection of South African marine resources. In 2014 Russia launched for South Africa Kondor-E, a satellite that had been built by NPO Mashinostroenia in Reutov (Moscow) and that provides all-weather, day-and-night radar imagery for the South-African military. In April 2017 ZA-AeroSat nano-satellite developed by Stellenbosch University was launched to the International Space Station (ISS), as part of QB50, a European Union project dedicated to the construction, launch and destruction of cubesats by universities. In that launch South African company Space Commercial Services sent to the ISS nSight-1, a low-orbit demonstration nanosatellite with three payloads (a modular designed SCS Gecko imaging payload, a FIPEX atmospheric science instrument and a Radiation mitigation VHDL coding experiment) that was deployed one month later. Finally, mini-satellite XinaBox Thinsat was built by South African High School students as part of a STEM programme designed to attract students (from middle school to the university level) and launched in April 2019.

Western Cape – a province of South Africa located on the south-western coast of the country – can be regarded as the hub of space activities in South Africa; the region hosts facilities, a number of space-related universities, government research laboratories and many high-tech companies.

XII) TUNISIA

Tunisia's involvement in space dates back to 1957, when the first satellite was launched, leading to the creation of Tunisia's main space entity in 1984, i.e. the National Commission of Outer Space (CNEEA) by Decree n° 84-1125; and of the National Centre of cartography and remote sensing in 1988 (Law 88-83) – officially known as National Centre for Cartography and Remote Sensing since 2009. Even the Tunisian Space Agency – a scientific association – was created in June 2012 with the objective to promote the aerospace field in the country.

So far, a number of space projects have been conducted by students, who have been able to manufacture mini rockets and cubesats from design to launch. Worth mentioning are mini rockets Almaz 01, Star01 and Taparoura 01, as well as Carthage Sat 01, a picosatellite and a graduation project accomplished by the president of Tunisian Space Agency, Karim Hamid[30].

In March 2021 Tunisia's first satellite, Challenge ONE, was successfully launched onboard a Soyuz-2 rocket from the Baikonur Cosmodrome in Kazakhistan. It had been announced in 2019 by Tunisian aerospace and telecommunications company TELNET following the conclusion of an agreement with Russian operator of commercial launches GK Launch Services. Challenge ONE represents a precursor for a constellation of 30 satellites to be launched by 2023. The agreement also involved Russian private company SPUTNIX, which manufactures high-tech microsatellite components and technologies. The cooperation with Russia is expected to facilitate the development of satellites and R&D services for satellite components in Tunisia, which is the first country in Maghreb and the sixth in the continent capable of manufacturing satellites.

In 2013 the development of the ERPSat-1 CubeSat was started, whose status is currently unknown.

Since 2016, Tunisia has been hosting a BeiDou centre and in August 2021, through Telnet Telnet company, it signed an agreement with Roscosmos to train a female Tunisian cosmonaut for an expedition to the ISS.

30 https://tunispacedays.com/category/projects/.

XIII) **ZIMBABWE**

Run by the Zimbabwe Ministry of Higher and Tertiary Education, the Zimbabwe National Geospatial and Space Agency (ZINGSA) was formed in 2018 in order to enable the country's economic and social development and growth by promoting advances in geospatial science and earth observation, space engineering, aerospace engineering, space science, satellite communication and global navigation systems. To date ZINGSA has completed projects like a typical demonstration of how the nation's agro-ecological areas can be improved based on accurate and recent satellite data; or like the Zimbabwe Wetlands Master Plan, aimed at mapping national wetlands, and at providing every stakeholder with the necessary data to respond to local needs. In the framework of the Joint Global Multi-nation Birds Satellite (BIRDS) project, a multilateral programme supporting countries to build their first satellite, Zimbabwe is assembling ZIMSAT-1, a nanosatellite which is expected to be launched from Japan in 2022. The CubeSat will host a multispectral camera and image classification device, as well as a transmit-receive tool that will allow stakeholders to assess data related to ground cover and drought.

In addition to countries with space agencies/entities established and regulated by national laws, most of the African continent is also dotted with research centres and/or institutions that conduct space activities in Botswana, Burkina Faso, Ghana, Ivory Coast, Rwanda, Sudan, Uganda and Mauritius. The continent also has a Regional Centre for Remote Sensing of North Africa States (CRTEAN) – whose members (Algeria, Mauritania, Morocco, Tunisia, Libya, Egypt, and Sudan) promote the use of remote sensing techniques and upstream systems for sustainable development and scientific research – and a Regional African Satellite Communication Organization (RASCO), for the provision of telecommunication services, direct TV broadcast services and Internet access in rural areas of Africa.

3. Space to Africa

After SunSat-1, the first satellite designed, manufactured and launched by (South) Africa in 1999, as of November 2021 the African continent's satellites in space are 45, put into orbit by Algeria, Angola, Egypt, Ethiopia, Ghana, Kenya, Mauritius, Morocco, Nigeria, Rwanda, South Africa, Sudan and Tunisia and out of which 28 were launched in the last 10 years, while only 3 (QAF 1, QAF 1R and Newdawn) resulted from of a multi-lateral project[31], which confirms that today the African countries represent the fastest growing group of emerging economies in the world.

According to the 2021 edition of the NewSpace Africa Industry Report published by media and consulting company Space in Africa, "*over 283 private and public companies in 31 African countries operate in the African space and satellite industry*", employing over 44,670 people. In addition, 84% of the 283 NewSpace companies belong to the downstream sector, with activities ranging from component manufacturing and equipment services to earth observation and geospatial services, satellite communications services and astronomy services. Most downstream companies are located in Egypt, Kenya, Nigeria, and South Africa, whereas the majority of the upstream ones are based in South Africa. About 44% of the surveyed downstream companies are still in a developmental phase, while 47% are more mature.

As to the revenues of the African space industry, according to the Report they equaled USD 7.37 billion in 2019 and are expected to generate over USD 10.24 billion by 2024, with main growth rates in the sectors of earth observation and geospatial services, satellite communications services, satellite navigation, and component manufacturing and equipment services.

As underlined by observers and experts, however, despite those results and projections, the African New Space political, economic, and security opportunities and growth potential will turn into stable reality only provided that they can rely

31 https://africanews.space/wp-content/uploads/2020/01/banner-4-scaled.jpg. The diagram doesn't include the Kenyan satellite IKUN3-SIMBA.

on increasing government budget and investment, specific ecosystem development and digital opportunities. Comparisons with space-faring nations, indeed, not only highlight significant underinvestment but also non-optimal approaches in terms of formal governance and operating activities in the space field – due, very probably, to the need for Africa to concentrate on more pressing socio-economic (and often even humanitarian) priorities. Those same conclusions were expressed by the speakers and key stakeholders from African Space Agencies and local and international space communities who last April, from 25 to 27, attended the 2022 NewSpace Africa Conference in Nairobi "*Making Africa the New Hotspot for Space Business*", aimed to "*foster more collaboration among African countries and commercial companies, academia and other stakeholders in the African space industry*"[32], in addition to spurring governments to allocate proper incentives as well as, more in general, to implement an appropriate regulatory, legal and financial framework, so as to boost Africa's space ecosystem.

So, this seems to be the (complex) context in which the EU will have to strengthen and adapt its longstanding partnership with Africa.

On 17 and 18 February 2022 the AU and the EU met for the sixth European Union-African Union summit[33], held in Brussels to revitalize their special partnership. The summit resulted in a common attempt at revamping (old) common goals such as solidarity, peace, prosperity, sustainable and sustained economic development and security for their citizens, trying to bring together people, organisations and regions. The participating leaders - the President of the European Council, Charles Michel, and the Chairperson of the AU, Macky Sall, among them - announced an Africa-Europe Investment Package of € 150 billion, that is expected to boost public and private investments in energy, transport and digital infrastructure; energy and green transition, security and cyber-security; sustainable growth and decent job creation; transport networks; employability of students, young graduates and skilled workers; inclusive and equitable quality education and training; health security and equitable access to essential health services; strengthened border management and enhanced migration dialogues; promotion of international cooperation and effective multilateralism. In that regard, commentators from both sides once again unanimously stress the fact that, after six attempts, it is now (more than ever) time for Africa and Europe to effectively re-launch their deep-rooted partnership, in the spirit of such values as equality, respect, cooperation and reliability, overcoming any donor/beneficiary or paternalistic approach for the benefit of an enduring future of peace and prosperity for all.

32 https://africanews.space/excerpts-from-the-2022-newspace-africa-conference-day-one/.
33 The first Africa-EU summit took place in Cairo in 2001, culminating in the adoption of the Cairo Declaration, aimed at recasting the strategic partnership between them.

Events

International Academy of Comparative Law (IACL)
General Congress, Asunción,
23-28 October 2022

International Bar Association (IBA)
Aviation Law Committee
Annual Conference, Miami,
30 October - 4 November 2022

European Air Law Association (EALA)
32nd Annual Conference, Athens,
3-4 November 2022

International Academy of Comparative Law (IACL)

General Congress, Asunción, 23-28 October 2022

Anna Masutti has been appointed General Rapporteur for Topic XII, ***The Legal Regulation of Drones***, for the International Academy of Comparative Law (IACL) General Congress, that will be held in Asunción (Paraguay) from the 23rd to the 28th of October 2022.

The list of General Rapporteurs and topics is available HERE.

The National Committees have appointed their Special National Rapporteurs for each of the topics.

More detailed information on the IACL General Congress is available HERE.

International Bar Association (IBA) Aviation Law Committee

Annual Conference,
Miami,
30 October- 4 November 2022

International Bar Association
the global voice of the legal profession

The Aviation Law Committee (ALC) of the International Bar Association (IBA) counts among its members attorneys and legal experts, providing the members a unique opportunity not only to contribute to the development of aviation law but also to make useful contacts and increase the professional networking.

The Committee addresses issues relating to aircraft transactions and financing, dispute resolution (tort and contract), insurance, liability and passengers' safety and compensation. In doing so, the ALC publishes a variety of interesting articles and other content of relevance to the practice area.
The ALC is active in promoting events and in following the developments of the aviation sector from a legal perspective.

During the next IBA Annual Conference, that will be held in Miami (Florida) from the 30th of October to the 4th of November 2022, the ALC session "*Aviation roundtable: global trends, upheavals, black swans and the Russia fallout*", **will be held on the 31st of October (09:30 – 10:45)**.

09.30 10.45	Monday **31 October**	Aviation roundtable: global trends, upheavals, black swans and the Russia fallout
16.15 17.30	Tuesday **1 November**	SUSTAINABILITY FOCUS The path to sustainable aviation
19.30 22.30	Tuesday **1 November**	Aviation Law Committee dinner
14.30 15.45	Wednesday **2 November**	Trends in aviation litigation – insurance issues, jurisdiction, MAX and other major causalities, preemption update
09.00 12.00	Thursday **3 November**	Aviation offsite tour

More detailed information on the IBA Annual Conference is available HERE.

European Air Law Association (EALA)

32nd Annual Conference
Athens
3-4 November 2022

The 34TH Annual Conference of the European Air Law Association (EALA) will take place in Athens on 4th November 2022 at Zappeion, Queen Olga's, Av., Athens 105 57.

The panels are currently being finalized with the last details. The programme will include the following:

WELCOMING AND OPENING REMARKS
Pablo Mendes de Leon, president of EALA
Christos Tsitouras, governor, Hellenic Civil Aviation Authority

RESULTS OF THE GENERAL ASSEMBLY OF ICAO (2022)
Impressions provided by Michael Gill, director, legal affairs & external relations bureau, ICAO, Montreal

SANCTIONS IN AVIATION- AN EFFECTIVE REMEDY?
Moderated by Laura Pierallini, name partner, Studio Pierallini, Rome

ENVIRONMENTAL SUSTAINABILITY
Moderated by Regula Dettling-Ott, attorney at law, Dettling-Ott, Chairperson of the Performance Review Body (PRB), Winterthur/ Brussels

STIMULATION OF AIR CONNECTIVITY
Moderated by Anna Masutti, Professor of Air and Space law, Bologna University, partner, RP Legal & Tax, Milan Bologna

COMPETITION AND STATE AID IN AIR TRANSPORT
Interview with Judge Eugène Buttigieg of the CJEU, Luxembourg, conducted by former CJEU advocate general, Henrik Saugmandsgaard Øe, partner, Gorrissen Federspiel, Copenhagen

UPDATE ON BREXIT
Explained by Noura Rouissi, first secretary, transport & fisheries, EU delegation to the UK, London

LABOUR REGULATIONS
Moderated by Iva Savic, associate professor, University of Zagreb, faculty of law

Register now through this link where you will also find information on the conference fee. Please note that the conference fee includes the conference dinner on the evening of 3rd November 2022.

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