

# Legal Bases for Securing Human Presence in Space

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The development of the phenomenon “human in the outer space” is closely associated with 1961 when Yuri Gagarin performed the world’s first human spaceflight. The entry of humans into the near-Earth environment, and namely the transition to qualitatively different physical conditions, caused reflection on how to ensure safe human presence in space and to support normal human activity. The “satisfaction of scientific curiosity” has been replaced by “active space exploration and use.” The States began to procure not just a few flights, but ensured, through joint efforts to place technically complex stations in outer space, a long-term presence of humans in a new extraterrestrial environment. However, in the context of human life in space, the concept of security is no longer limited only to security of life and health, but should be interpreted expansively to include also the technical safety aboard the space station during the execution of astronauts’ official responsibilities (in particular, within the orders of the crew commander), coordination with other crew members and security from external risk factors of the space environment (both natural and anthropogenic). When comprehensively approaching the study of hazards that occur in the outer space, three main categories could be distinguished: the physiological reaction of humans to the space environment, naturally occurring hazards, and those of anthropogenic origin.

Thus, the paper will investigate existing initiatives, practices, and mechanisms that directly or indirectly have impact on establishing a secure environment for human presence in space. A special emphasis will be placed on legal instruments of those countries that have enabled human spaceflight, independently or within specific international space programmes. In addition, the attempt will be made to consider the difference in the legal regime of a human in the outer space depending on the legal status provided to him (envoy of mankind, astronaut, tourist etc.). As the outcome, the conclusion will be drawn on how sufficient those legal and policy instruments are, what are their strengths and weaknesses, and finally what is presently the most expedient way forward.

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The development of the phenomenon "human in space" is closely associated with 1961, when Yuri Gagarin made the world's first flight into space. The entrance of humans to near-Earth space, namely the transition to a qualitatively different physical environment, caused reflection on how to ensure a safe human presence in space and how to support normal human activity.

The satisfaction of scientific curiosity has been replaced by targeted exploration and use of the outer space. States began to ensure not just a few flights, but by joint efforts to locate in space the technically capacious stations that envisaged a long-term residence of humans in the new extraterrestrial environments.

However, in the context of human activity in space, the concept of security is not limited to the security of life and health, but has to be expansively interpreted so as to also include technical safety aboard the space station when performing official duties by astronauts (e.g. on the order of crew commander), coordination with other crew members and security from external risk factors of the space environment (both of natural and anthropogenic origin).

In the basic international legal documents regarding outer space, the notion of "human" is presented through such wording as man's entry into outer space<sup>1</sup>, personnel of spacecraft or manmade space objects<sup>2</sup>, personnel<sup>3</sup>, expedition<sup>4</sup>, astronaut<sup>5</sup>, envoys of mankind<sup>6</sup>, spacecraft crew<sup>7</sup>, spacecraft crew member<sup>8</sup>,

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<sup>1</sup> Preamble, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. - [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

<sup>2</sup> Part 2 Article 3, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies. - [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf)

<sup>3</sup> Part 1 Article V, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. - [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

<sup>6</sup> Principle 9, Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf); Article V, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf); Article 10, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

<sup>7</sup> Articles 1, 2, 3 and 4, Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

<sup>8</sup> Article 10, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

person who is on the moon<sup>9</sup>, person in distress<sup>10</sup>, person on board of a space object.<sup>11</sup>

Given that the main array of international space law was formed in the 1960-70's, and the process of commercialization activities in the exploration and use of outer space only started at the dawn of the 21<sup>st</sup> century, along with the emergence of a new phenomenon "space tourism", the status of the "space tourist", although quite common today, remains undefined.<sup>12</sup>

Thus, at present there is no legal enshrinement of the status definitions of all of the abovementioned categories of human in space. Without this, it is difficult to identify the criteria that could form the basis for differentiation of their status and to trace the legal consequences arising from the latter. The common feature for all categories of persons temporarily present in outer space is that: 1) they have to be specially prepared (pass necessary pre-flight training) and 2) they have performed a flight beyond the Earth's atmosphere. We believe that the remaining features are derivatives, but in order for the specific legal regimes to be developed in the future, the following features, among others, might require consideration:

- 1) the initiator / sponsor of the flight (under the space program or on their own initiative);
- 2) the presence / absence of personal obligations connected with the presence in space;
- 3) the purpose and objectives of the stay in space (satisfaction of scientific or personal interest, execution of operations);
- 4) residence time / duration of the mission (short, medium and long-term);
- 5) destination (space stations, planets);
- 6) sole flight / crew member;
- 7) functionality (scientific / technical / medical personnel, tourist);
- 8) the experience of being in space (number of flights, duration of stay and remoteness).

In order to approach the study of hazards for humans in space comprehensively, we can distinguish three main categories: physiological response of human to the change of environment, naturally occurring hazards, and those of anthropogenic origin.

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<sup>9</sup> Ibid.

<sup>10</sup> Ibid.

<sup>11</sup> Article III, Convention on International Liability for Damage Caused by Space Objects [http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

<sup>12</sup> For more info please see: N.R. Malysheva. Space tourists on the market of space services // Bulletin of the National Academy of Sciences of Ukraine. – 2010. - № 3; N.R. Malysheva. Space tourism: game without rules. – Space adventures: science, education, practice. – Proceedings of the international scientific-practical conference. – Kyiv, 2 December 2010.

It is worth noting that there is no exhaustive list of natural threats in space, but the key ones which should be primarily considered are: lunar and extraterrestrial dust, microbiological threats, radiation, microgravity and weightlessness. Particularly important for the long-term human flight into space, which is necessary for the development of planets of the Solar system could include: 1) the study of the effect of weightlessness on human beings and physiological mechanisms of adaptation to it in space flight; and 2) the study of the combined effect of weightlessness and other factors.

In the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, which is the primary framework in relation to the rest of the existing legal sources of international space law, it is stipulated that States Parties regard astronauts as envoys of mankind.<sup>13</sup> The document also laid the foundations for the bounding principle of mutual assistance, notification and rescue. It is noted that when conducting activities in outer space, including on celestial bodies, the astronauts of one State Party to the Treaty shall render to them all possible assistance to astronauts of other States Parties to the Treaty.<sup>14</sup> When having discovered in outer space any phenomena which could constitute a danger to the life or health of astronauts, the States Parties to the Treaty are obliged to immediately inform the other States Parties or the UN Secretary General.<sup>15</sup>

Another essential aspect for formation of the security of a human activity in outer space, as a part of a security regime of exploration and use of outer space, is a special document of international space law – the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects launched into Outer Space.<sup>16</sup>

As can be seen from the title of the document, the main area of the regulation are social relations over reacting and interacting in the event of emergencies related to space activities, including the one that takes place in outer space. It is namely this component that constitutes scientific interest for subject matter.

Given the problems outlined, it should be mentioned the requirement of the Agreement, according to which the state or an international inter-governmental organization which “receives information or discovers that the personnel of a spacecraft have suffered accident or are experiencing

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<sup>13</sup> Article V, Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies  
[http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

<sup>14</sup> Ibid.

<sup>15</sup> Ibid.

<sup>16</sup> Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space  
[http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

conditions of distress or have made an emergency or unintended landing ... in any other place not under the jurisdiction of any State shall immediately:

- (a) Notify the launching authority or, if it cannot identify and immediately communicate with the launching authority, immediately make a public announcement by all appropriate means of communication at its disposal;
- (b) Notify the Secretary-General of the United Nations, who should disseminate the information without delay by all appropriate means of communication at his disposal".<sup>17</sup>

The regulation of the liability principles for damage caused to persons on board of a space object of one launching State to space objects of another launching State is ensured by the Convention on International Liability for Damage Caused by Space Objects<sup>18</sup>. Article III provides that "in the event of damage being caused elsewhere than on the surface of the Earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible"<sup>19</sup>, thus the liability is not absolute.

A special array of rules laid down in the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies is dedicated to the safeguard of human activity during the exploration and use of the Moon. It provides for the right of states to place their personnel anywhere on or below the surface of the Moon for the purposes of pursuing their activities in the exploration and use of the Moon.<sup>20</sup>

As a limitation and at the same time as a disposition of direct action could be seen the provision under which the stations shall be installed in such a manner that they do not impede the free access to all areas of the Moon of personnel, vehicles and equipment of other States Parties conducting activities on the Moon.<sup>21</sup> In addition to this it is indicated that personnel may move or be moved freely over or below the surface of the Moon.<sup>22</sup> In this case the States Parties retain jurisdiction and control over their personnel on the Moon.<sup>23</sup>

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<sup>17</sup> Article 1, Ibid.

<sup>18</sup> Convention on International Liability for Damage Caused by Space Objects  
[http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

<sup>19</sup> Article III, Ibid.

<sup>20</sup> Article 8, Agreement Governing the Activities of States on the Moon and Other Celestial Bodies  
[http://www.oosa.unvienna.org/pdf/publications/ST\\_SPACE\\_061Rev01E.pdf](http://www.oosa.unvienna.org/pdf/publications/ST_SPACE_061Rev01E.pdf).

<sup>21</sup> Article 9, Ibid.

<sup>22</sup> Article 8, Ibid.

<sup>23</sup> Article 12, Ibid.

In a separate scope, the provisions that lay down the foundations for securing life and health of humans in space can be united. For this purpose it is expedient, in particular, to refer to the provisions of Articles 10 and 12 of the Moon Agreement. According to these, the States Parties shall take all appropriate measures to protect the life and health of people who are on the Moon (or other celestial bodies).

To this end, they regard any person who is on the Moon as an astronaut within the meaning of Article V of the Outer Space Treaty, as well as the personnel of a spacecraft within the meaning of the Rescue Agreement.<sup>24</sup>

States Parties shall offer shelter in their stations, installations, vehicles and other facilities to persons in distress on the Moon.<sup>25</sup> In the event of an emergency involving a threat to human life, States Parties are allowed to use the equipment, vehicles, installations, facilities or supplies of other States Parties on the Moon<sup>26</sup>, but prompt notification of such use should immediately be sent to the Secretary-General of the United Nations or to the State Party concerned.<sup>27</sup>

It is worth noting that the safety of human life in outer space is the only component of the security regime of the exploration and use of outer space, which was not included in the list of issues on the agenda of the Legal Subcommittee of the UN Committee on Space. The other two – securing the use of space objects with nuclear power sources on board and space debris, were presented for discussion at a fairly regular, if not constant, basis.<sup>28</sup>

However, it should be recognized that these two components have a direct impact on human activity that can, in particular, be followed on the example of their interaction within the operation of the International Space Station (ISS). The station operates at a fairly low orbit, where the risk of collision with space debris, such as separated stages of launch vehicles, satellites that have reached lifetime, and other objects, is very significant.

Collision both with big debris, as well as with debris of a smaller size (several mm) constitutes a significant threat to the station, which is a special environment for human life. In addition, space debris can cause significant damage directly to the astronaut, in case of particles impacting the spacesuit during EVA (to repair certain station modules, scientific experiments, etc.) that could potentially result in the penetration of the cladding and depressurization.

The situation is complicated by the high orbital velocity inversion, consequently accelerated motion and kinetic energy of the non-functioning as well as uncontrolled space objects constituting space debris.

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<sup>24</sup> Article 10, Ibid.

<sup>25</sup> Article 10, Ibid.

<sup>26</sup> Article 12, Ibid.

<sup>27</sup> Article 12, Ibid.

<sup>28</sup> <http://www.oosa.unvienna.org/oosa/en/COPUOS/Legal/repidx.html>.

In order to avoid a dangerous approach and collision of the ISS with the abovementioned category of space objects, a number of ground stations monitor the trajectory of the debris. In the case where there are reasonable grounds to believe that there is a potential danger of collision, the crew station receives a message in time, which usually helps to activate the special mechanism of Collision Avoidance Manoeuvre or Debris Avoidance Manoeuvre.<sup>29</sup>

Such maneuvers are planned within the constraints embodied in the flight rules of the International Space Station. Whether such a maneuver takes place depends mainly on how high is the probability of collision and what are the implications for the implementation of its mission objectives.

In addition, whether it will be a risk to the crew of the station plays an important role in decision-making.<sup>30</sup> Subject to a positive decision on the maneuvering is an increase in orbital velocity of the space station for its temporary move to a higher orbit.

There are instances when, due to a certain circumstances, the information is provided within the timeframe that does not allow the maneuver operation. If so, the actions on a potential crew evacuation (partial evacuation of the station), which, in particular, foresees the use of "Soyuz" transport manned spacecraft and, in case of severe damage of the station, the closing of transition hatches between the ISS and spaceship, their undocking and proper evacuation.

A special category of threats, difficult to minimize, derives from the objects of a natural origin. Natural phenomena are the ones that are hard to predict. Consequently, the cases with their involvement are extremely difficult to simulate. Moreover, as correctly noted by N. Malysheva, neither the international nor the national law of space-faring countries, including - Ukraine, unfortunately, do not foresee any specific legal provisions regarding limitation of exposure to harmful environmental factors on astronauts.<sup>31</sup>

Legal instruments applicable in this regard to the astronauts include the instructive materials, circulars, and in some states the methodological acts with respect to the rules of conduct in zero gravity, as well as personal radiation protection and some other factors encountered during future space flight.

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<sup>29</sup> Usually they calculate at least 30 hours for planning and implementing the maneuvers [http://www.nasa.gov/mission\\_pages/station/news/orbital\\_debris.html](http://www.nasa.gov/mission_pages/station/news/orbital_debris.html).

<sup>30</sup> Debris avoidance maneuvers are planned when the probability of collision from a conjunction reaches limits set in the space shuttle and space station flight rules. If the probability of collision is greater than 1 in 100,000, a maneuver will be conducted if it will not result in significant impact to mission objectives. If it is greater than 1 in 10,000, a maneuver will be conducted unless it will result in additional risk to the crew. [http://www.nasa.gov/mission\\_pages/station/news/orbital\\_debris.html](http://www.nasa.gov/mission_pages/station/news/orbital_debris.html).

<sup>31</sup> N.R. Malysheva. *Essays on Space Law* // Kyiv, 2010. – p. 112.

Recently, the International Academy of Astronautics initiated a study to investigate a number of issues that are directly or indirectly related to the issue of securing humans in outer space.

Thus, for purposes of research the international working groups were established to study the issue through the prism of the need to develop: 1) Medical Safety Guidelines for Space Crews involved in Short-Duration Orbital Space Flights Operations<sup>32</sup>, 2) Space Debris Environment Remediation<sup>33</sup> and 3) Orbital Debris Removal: Policy, Legal, Political and Economic Considerations.<sup>34</sup>

Securing the stay and life of a human in outer space is one of the cores for establishing a legal regime for security of exploration and use of outer space for peaceful purposes. Despite the fact that manned space flight missions, in particular the long-term, currently are realized by only a relatively small number of countries, the development of a harmonized (or even standardized) approach to the problems of security of human life in outer space would be desirable.

Currently, the regulation of this issue is mainly enshrined in by-laws within the national legislation and recommendations which are non-binding documents at the level of international law. However, in most of these, the concept of security is seen primarily through the prism of security of "space activity" including public safety, security of spaceports, launches, etc., but very few are concerned with the questions of "security of outer space" particularly in terms of human life.

The legal document which, at least in general terms, combines the approach of leading space-faring countries to the subject matter is the Code of Conduct for the International Space Station Crew.<sup>35</sup> It is designed to implement Article 11 of the Intergovernmental Agreement on cooperation on the International Space Station dated 1998 (Intergovernmental Agreement Among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the International Space Station).<sup>36</sup>

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<sup>32</sup> Medical Safety Guidelines for Space Crews involved in Short-Duration Orbital Space Flights Operations <http://iaaweb.org/content/view/438/600/>

<sup>33</sup> Space Debris Environment Remediation <http://iaaweb.org/content/view/268/407/>

<sup>34</sup> Orbital Debris Removal: Policy, Legal, Political and Economic Considerations <http://iaaweb.org/content/view/446/607/>

<sup>35</sup> International Space Station Crew <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=2bfb1db89b8e796fb72c1c91549093ea&rgn=div6&view=text&node=14:5.0.1.1.15.4&idno=14>

<sup>36</sup> Agreement among the Government of Canada, Governments of Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation and the Government of the United States of America concerning Cooperation on the Civil International Space Station <http://www.state.gov/documents/organization/107683.pdf>.



At the same time it should be noted that the lack of comprehensive guidelines that could guarantee a uniform level of protection of all individuals, irrespective of who will be launching into space, is not favorable for capacity-building of the space security regime. Development on the international law level of unified rules (requirements) is what would truly guarantee human security standards during spaceflight.

Certainly preparation of the individual through the course of training and medical checks, as well as provision of a standard set of tools and skills, should not depend on whether a person is a professional astronaut or a tourist. However, this is not enough. A comprehensive regime should provide a minimum acceptable level of technical and technological safety for those space objects that bring humans to outer space.

