# SPACE INSURANCE – INNOVATIONS AND CHALLENGES FOR THE INSURANCE BUSINESS

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**Abstract:**[2] The study focuses on the theoretical and applied aspects of insurance in the aerospace industry. The author's aspiration is to substantiate the role of space insurance as one of the main methods of increasing corporate security in space companies. The increased insurance needs and interests in the space sector in recent years have stimulated innovations in insurance activity and posed new challenges for insurers. The harmonious combination of insurance with the prevention and limitation of the impact of space risks is a prerequisite for effective corporate risk management in the space sector. The article proposes a model of the space insurance market, which analyses the relationships between its entities and substantiates the interrelationships between the space industry and the insurance business.

**Keywords**: space insurance, insurance products, space industry, space risks, environmental pollution liability insurance

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## Introduction

Over the last decade, the space industry has seen a leap in its development, mainly due to high technological progress and the introduction of innovation processes in space activities. The implementation

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of a large part of the space activities is accompanied by a number of risks, as well as the discharge of harmful substances into nature. In addition, there is a possibility of production accidents, the consequences of which are related to environmental pollution. The manifestation of these risks leads to the occurrence of adverse consequences, such as: non-pecuniary damages related to the life, health and working capacity of the crew members of the space mission; property damage to launch complexes; damage from orbital explosions; loss of launch vehicles, spacecraft, satellites, etc.

In the conditions of globalization and a strong competitive environment in the space industry, the insurance business worldwide is facing new challenges and making innovative management decisions related to the adaptation of insurance services and products to the specifics of space missions and activities. In the effort of countries to increase national and international security in combating space risks, insurance is an effective mechanism for compensating for losses from accidental events in the space sector.

The implementation and development of the “space insurance” institution allows to significantly reduce the impact of space risks, reduce state expenses for environmental protection, guarantee the constitutional rights of citizens to a favourable natural environment, as well as to compensate for the damage caused to their health, work capacity and property through insurance protection.

The realization of space risks is very likely to lead to transboundary pollution of the environment. It is possible that the manifestation of the complex impact of some space risks could spread beyond the borders of the country and threaten not only national but also regional security. It is also possible that the manifestation of space risks could lead to an increase in space debris and pollution of the Earth's space environment – an issue related to international security and safety.

The relevance of the studied issue is determined by the need to offer adequate insurance protection, tailored to the demand for insurance by business entities in the space industry. In the Bulgarian insurance literature, there are still not enough publications related to the study of the impact of space risks on the environment and the effects of insurance protection for the space industry. Insurance companies still do not have enough experience and traditions in offering space insurance on the Bulgarian insurance market. The limitations of the study are due to the lack of official statistical data on the national insurance market, and therefore the author

refers to information on the international insurance market and on the practice of leading countries in space insurance. The author's aspiration is to delve into this wide-ranging topic by exploring the possibilities of space insurance as a mechanism to promote the sustainable development of the space industry.

In the process of the historical development and growth of the space industry, the functioning of the space insurance market is carried out in response to the manifestation of new insurance needs and interests of different categories of customers. On the one hand, the space industry is one of the “most exciting and promising industries” of our time. On the other hand, the implementation of space activity is accompanied by a number of technological, financial and organizational-legal problems. Despite the fact that today the space industry has reached “high technical maturity”, launching spacecraft and operating them in orbit remains a rather risky activity. In this regard, the space industry implements security measures related to reducing the likelihood of such risks occurring and improving risk management in the sector. Practice shows that one of the most effective measures to combat risk is insurance.

The purpose of the study is to substantiate the importance of insurance for the space industry and outline the prospects for the insurance business in making innovative management decisions in accordance with consumer demand in the space insurance market. In the context of the formulated objective, the article substantiates the structure of the space insurance market and analyses the elements, connections and relationships between its participants. The author offers a model of the space insurance market and emphasizes the relationship between the space and insurance industries.

## 1. Literature review

Space insurance is carried out in accordance with the insurance legislation of the individual countries in which it is practiced, as well as in accordance with the principles of environmental law, on the one hand, and space law, on the other – as one of the newest areas of international law. The construction of the general conditions of space insurance implies the synchronization of the insurance legislation with the policy of the EU in relation to the protection of the environment and with the space policy of the member states.

A matter of wide public importance, which affects both the space industry, the insurance business and society as a whole, is the question of protecting the Earth's environment and the space in orbit around the Earth from the harmful effects of space activities. According to experts, the problem with the so-called space junk is becoming relevant today, and providing a precise definition of the concept of "space waste" turns out to be a difficult task. When discussing the issue in the Scientific and Technical Subcommittee of the UN Committee on the Peaceful Uses of Outer Space in 1997, it was proposed that the concept of "space debris" should include a non-functioning man-made space object incapable of resuming the performance of its tasks, including its fragments and parts. Space debris can also be created as a result of the explosion and collision of aircraft, from the solid motor debris of rockets, etc. According to *Belova, G.*, "so far, there are no economically viable and acceptable methods for cleaning outer space from the accumulated garbage. Therefore, the main efforts will be directed to measures to control and limit space debris, to prevent orbital explosions, etc.". The author shares the opinion of a number of experts, according to whom the existing principles for the prevention of outer space pollution need to be supplemented with sanctions, and regulations have to be put into effect no later than 2030 if humanity wants to preserve space for the next generations (Belova, 2010). In this sense, *Solomon Passy*, as early as 2011, raised the question of the need to implement effective mechanisms to control movement in space and to improve "space law (and the instructions for its application) to regulate and guarantee the peaceful use of Space for decades to come" (Passy, 2011).

In her publication, *Popova, R.* believes that "space debris can be considered in the context of the more general concept of "space traffic management" (STM), which is a hot point of debate in the scientific discussion and could lead to proposing a new legal regime (or regional regimes)" (Popova, 2011). The opinion of specialists in space law is that, "international cooperation to protect the Earth's environment from the harmful effects of activities in space can be defined as ineffective in the light of the application of universal international treaties". In this sense, *Milanov, Al.* and *G. Peychev* consider that "the latter cannot guarantee the interests of humanity due to the following reasons: a) lack of definition of the term "harmful pollution" in the Outer Space Treaty; b) unedited definition of the term "harm" in the Liability Convention; c) poorly balanced and ineffective rules on international liability for environmental damage also in the Liability Convention" (Milanov & Peychev, 2020).

According to *Markova, I.*, damages resulting from environmental pollution from space risks of a technogenic nature can be compensated under the Environmental Pollution Liability Insurance (EPLI) (Azman-Saini et al., 2010), (Misheva, 2015). The issue concerns innovation in the insurance business, which is called upon to adapt to the new risk situation of space objects and entities and to offer effective insurance security. With the help of EPLI, the insurer can protect the property interests of space companies and compensate property, non-property and moral damages to injured third parties. The successful implementation of EPLI in the space industry will depend to a large extent on the harmonization of national legal norms with international legal norms in the areas of space law, environmental law and insurance legislation.

The development of effective product and market strategies in insurance companies for *innovation in the broad and narrow sense* of the word is an essential prerequisite for responding to consumer demand in the space insurance market and *improving business models in the entrepreneurial activity (*Denchev et al., 2020) of insurers.

The increase in revenue in the space industry from activities related to space, infrastructure, ground stations and space-based products ($427.6 billion in 2022 compared to $396.2 billion in the previous year), as well as the largest business – the sale of satellite data for position, navigation and weather (39% of all commercial revenues), is expected to give *impetus to the development of the insurance business* in the near future (Grush & Kendall, 2023). This means that the development of space infrastructure in parallel with the challenges of space data – generation, processing and transmission of data in space – is a prerequisite for innovations in insurance activity. The increasing pace of development in the space industry is *driving advances in space insurance*, which must keep up with the challenges of bringing satellites to market. For example, the production of 40 to 60 satellites per month, or two to three per day, represents a pace never before seen in the space industry, while simultaneously reducing the cost of a satellite to between $400, 000 and $500, 000 (Coykendall et al., 2023). Orbit-based space services based on satellite systems such as Galileo, Copernicus and EO are a prerequisite for offering *new insurance services* adapted to the requirements of the environment. The offering of flexible insurance services and products by the insurers specializing in space insurance will significantly expand the capacity of the two insurance branches – personal insurance and non-life insurance – not only at the

national level (Prodanov et al., 2022), but also in the regional aspect (Prodanov et al., 2023).

In the context of the issues, the conclusion is drawn in scientific circles that the discussed problems should be solved by adopting common standards for reducing the level of outer space pollution, which should be adopted with the widest possible participation and cooperation between countries and with the coordination of the various international structures.

## 2. History, development and regulation of space activity worldwide

The space industry encompasses a wide variety of space activities, operations and types of work that, over several decades, has become “a thriving complex industry with fierce political and technological competition between major industrial powers”.

Since the 1970s, outer space has become a field for the manifestation of various economic interests, especially with the advent of telecommunication technologies (telephones, television), and then with the advent of surveillance technologies (Spot) and navigation (GPS, Galileo). There are currently 90 nations operating in space. According to data for 2021, in a ranking of countries' investments in the Space Tech Sector, the following countries fall into the top 10: USA, China, United Kingdom, India, Izrael, Switzerland, Canada, Germany, Sweden, Belgium. The leader in the sector is the USA. The second place is occupied by China and the third position belongs to the United Kingdom (WorldEconomicForum, 2022).

The establishment of the International Space Station (ISS) is the first major intergovernmental cooperative project aimed at carrying out numerous studies in microgravity, and in the long term, towards future space travel to the Moon or Mars. For example, the ARTEMIS manned space program, initiated by the United States, has a primary goal related to manned flights to the Moon.

Today, launching artificial satellites is a common industrial activity. The number of satellites launched by multiple operators – both public and private – is growing every year. The use of smartphones, for example, would not be possible without the GPS positioning provided by constellations of satellites (Zajdenweber, 2017). The current period of the development of the space industry is defined in scientific circles as the “space renaissance”, and the sector is the basis for innovations in a number

of other branches of economy. In this sense, satellite imagery helps farmers monitor crops, businesses monitor their environmental, social and economic performance, governments monitor CO2 emissions and real-time events on the ground, etc. Data shows that 10 times more satellite images of Earth are being produced today than five years ago, and 10 times more communications bandwidth is being spread around the planet (Forum, 2022).

International legislation in the field of space activities finds expression in a number of instruments and normative acts for the regulation and control of the sector. Among the most important is the Outer Space Treaty of January 27, 1967, which establishes the global legal framework. It states that the exploration and use of outer space, including the Moon and other celestial bodies, must be for the benefit of all countries and specifies that space cannot be the object of national ownership. The Treaty of 27 January 1967 was supplemented by the Convention of 29 March 1972 on International Liability for Damage Caused by Space Objects and the Convention of 1975 on the Registration of Objects Launched into Space.

Spaceflight safety issues are still regulated at the level of each country's government agencies. However, the cooperation between space powers, the emergence of new players (India, Brazil, China) and the emergence of private operators of “space tourism” outline the need to reform and harmonize the existing legislative framework and adapt it to the new reality. The mission of the International Association for the Advancement of Space Security (IAASS) conference is to implement this reform.

The emergence, development and rise of NewSpace gives rise to new legal issues related to the provision of services in Earth orbit and the introduction of new space activities other than traditional activities such as telecommunications, satellite positioning and Earth and space surveillance. SpaceX operations, Blue Origin and other private companies that launch their own rockets and deploy satellite constellations are the leading players in the space industry. Lower costs of space missions “open the door for new start-ups and encourage established aerospace companies to explore new opportunities that once seemed too expensive or difficult” (Brukardt, 2022). Companies that operate in the space value chain and contribute to the growth of the global space sector are specialized in six major areas: (Coykendall et al., 2023) Space data-as-a-service; In-space manufacturing (ISM); Additive manufacturing; Robotics in space; Space sustainability; National security space. Table 1 provides information on the state of the

aerospace industry in 2023 and the types of segments responsible for the growth of the sector (Coykendall et al., 2023). Satellite integration has the largest relative share with 21% among the other segments. Continuous technological improvements and ambitious projects in the space industry encourage investment in the space economy.

*Table 1.*
*Segments in driving the growth of the global space sector in 2023 (in %)*

| rank | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| relative share | 21 | 20 | 17 | 16 | 15 |
| segments | Satellite integration | Components | Launch vehicles | Value-added services | Payloads |

*Source: The Deloitte 2023 Riding the Exponential Growth in Space Survey.*

Table 2 provides an update on investments in the sector in 2023 and their role in enhancing national security, facilitating ground-based space activities and activities in Earth orbit.

*Table 2.*
*Investments in driving the growth of the global space sector in 2023, in %*

| rank | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| relative share | 30 | 24 | 12 | 10 |
| investments | National security | Satellite communications | Edge computing and artificial intelligence | Earth observation and remote sensing |

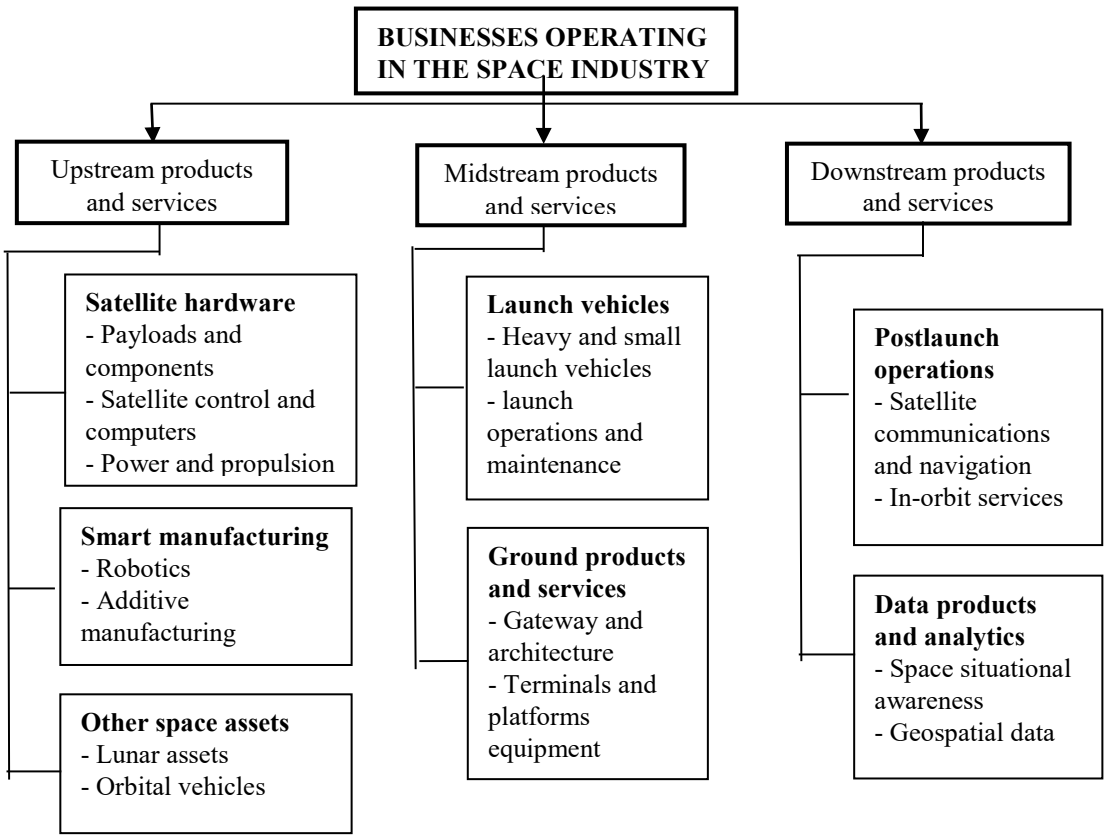
*Source: The Deloitte 2023 Riding the Exponential Growth in Space Survey.*

Figure 1 shows the types of space activities that underpin the growth of space industry and create added value.

The vast potential of space defines the challenges facing the space industry.

The competitive environment, the globalization of the space industry market and the construction of an effective regulatory framework regarding space activities are key prerequisites for the growth and sustainable development of space industry. According to the Space Foundation, the size of the global space economy in 2023 is estimated at $570 billion in 2023, compared to $531 billion in 2022, an increase of 7.4% and evidence of the continued growth of the industry in both the public and private sectors. This growth is in line with the industry's five-year compound annual

growth rate (CAGR) of 7.3% and is almost double the size of the space economy a decade ago.




*Source: The scheme was made by the author based on information from Deloitte analysis.*

*Figure 1. Space activities along the value chain and growth in the space industry*

## 3. Structure and state of the space insurance market

Space insurance marks its beginning in 1965, and only for about 60 years of development, it has become a leading sector of the international insurance market.

The launch of the Early Bird satellite on April 6, 1965 was associated with the conclusion of the first space insurance, the coverage of which was limited to the inclusion of terrestrial risks only. Lloyds of London provides insurance coverage for Itelsat 1 for material damage. In 1968, the Intelsat III series of satellites was insured in the launch phase. In 1975, insurance liability was extended to full risk coverage, i.e. the risks assumed at the time

of signing the insurance contract refer to the end of the existence of the satellite in orbit.

The first claim compensation dates back to 1977 with the destruction of the Thor-Delta launch vehicle and the loss of the OTS1 satellite. In 1980, six new commercial satellites were insured. In the early 1990s, the boom in the development of the information industries sector stimulated the construction of satellites and launch vehicles.

In the international market of space insurance, the leading countries in the supply of space insurance for the "until rocket launch" phase are the following: France, Great Britain, USA, Italy, Germany, Bermuda, Austria, Scandinavian countries, Belgium, Japan (Draganov & Neikov, 2000).

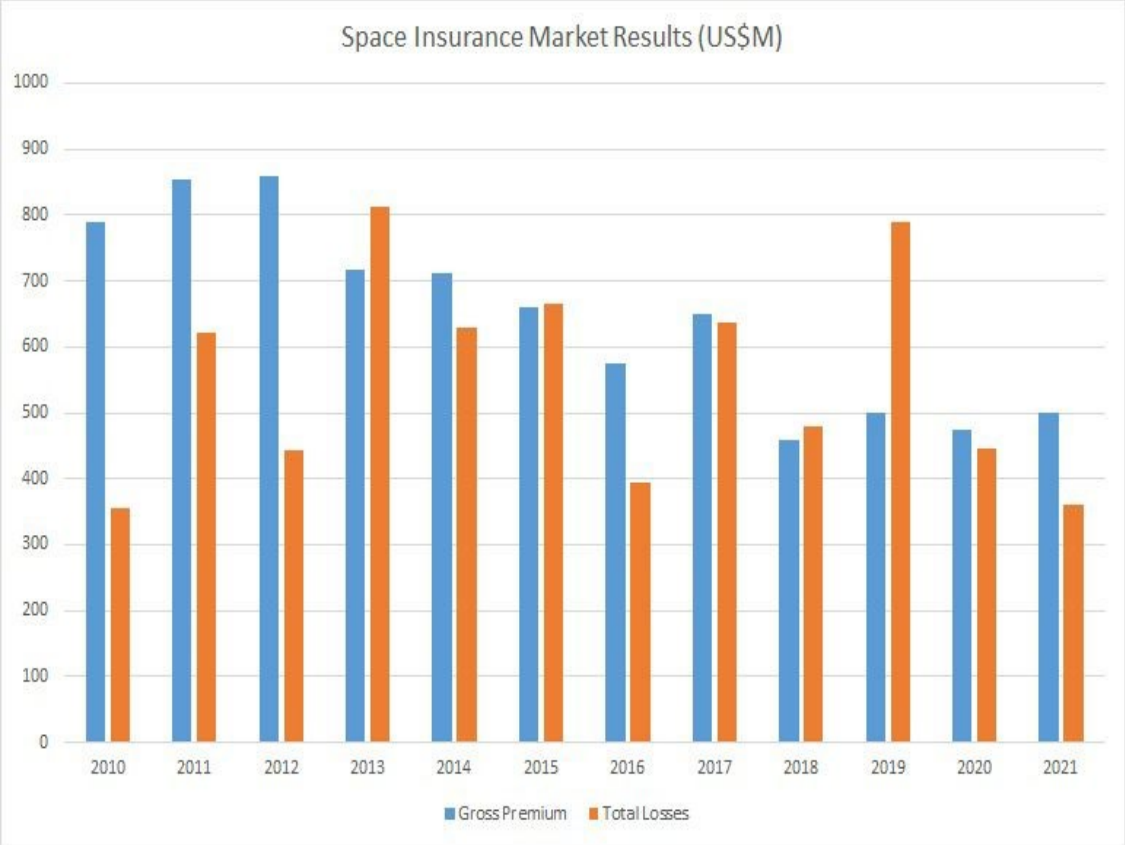
Table 3 presents information on the market share of the leading 10 countries in the space insurance market in 1997.

*Table 3.*
*Market share of countries in space insurance for 1997 (in %)*

| Country | Market share (in %) |
|---|---|
| Great Britain | 21.94 |
| France | 21.83 |
| USA | 16.79 |
| Italy | 13.54 |
| Germany | 10.40 |
| Bermuda | 5.42 |
| Austria | 3.25 |
| Belgium | 3.03 |
| Scandinavian countries | 2.71 |
| Japan | 1.08 |

*Source: Draganov & Neikov, 2000*

Claims made for insurance benefits lead to a decrease in the number of satellites launched and a significant impact on the space insurance market. Collected insurance premiums for the period 1987 – 1997 range between 120 and 820 million dollars. The compensations paid range from 53 to 750 million dollars. In 1998, large losses due to cumulative losses of satellites in orbit halted the development of the space industry. About 15 – 20 years later, the situation in the space insurance market is radically changing. Figure 2 provides information on the state of the international space insurance market through the indicators "premium income" and "claims paid" for the period 2010 – 2021.




*Source: Seradata (https://payloadspace-com.translate.goog/the-space-insurance landscape/?_x_tr_sl=en&_x_tr_tl=bg&_x_tr_hl=bg&_x_tr_pto=sc).*

*Figure 2. Space insurance market dynamics for the period 2010 – 2021*

The data show a trend towards an increase in the premium income from space insurance in the range of about 300 to nearly 900 million dollars, with the highest premium income observed at the beginning of the analysed period (2010 – 2013). The largest amount of insurance payments during the period was observed in 2013 and 2019 – nearly 800 million dollars.

At the current stage of development, space insurance accounts for 15 to 20% of the total budget of space programs, and this share is constantly increasing, today occupying third position in the budgets of space operators. Approximately 20 new satellites are insured for launch each year, bringing more than 150 insured satellites launched or currently in orbit (L'assurance spatiale - Atlas Magazine, 2023). The number of satellites in low orbit (LEO) is growing in parallel with the increase in the number of private space operators. This also determines the leap in the development of space insurance, designed to meet new insurance needs, as well as to identify, monitor and analyse new and atypical risks. On average, there are about a hundred satellite launches each year, and of those, only a third are insured. The *Galileo satellites* that failed to enter orbit

in 2014 were not insured. But now the market is facing a major tipping point with more and more private operators and smaller satellites for which insurance is a mandatory step in their financing.

*Table 4.*
*Insured satellites in orbit as a market segment in space insurance for 2018*

| Active satellites | Number of satellites | Satellites in percent | Insured satellites (in %) |
|---|---|---|---|
| GEO satellites | 492 | 22 | 43 |
| LEO satellites and others | 1. 715 | 78 | 6 |
| Total satellites | 2. 207 | 100 | 49 |

*Source: International Union of Aerospace Insurers and author's calculations.*

Data show that nearly 50% of active satellites in orbit were insured in 2018. GEO satellites are only 22 in number, but 43% of them are insured, as opposed to LEO satellites and others, of which only 6% are insured. Five years later, in 2023, there are more than 9,000 satellites in LEO – low Earth orbit, of which only about 50 are insured. This shows a more than 5-fold increase in the number of LEO satellites, but little interest from companies in insurance. In 2023, the total number of satellites in orbit reaches 10,000, with only 300 of them are insured and the majority of them are in GEO.[3] The total number of satellites in orbit has also increased by more than 5 times over the last five years (in 2023 compared to 2018).

Forecasts are for the number of low orbit satellites to increase tenfold over the next five years, clarification by Dominic Rora, Head of Space Insurance at Axa XL To address this development, *Axa XL* signs a partnership agreement with French startup *SpaceAble* to improve the coverage of satellite operators by aggregating, processing and modelling spatial data. According to Denis Bousquet (Senior Space Underwriter), the Axa XL partnership will continue the group's development in long-term space insurance. The launch relies on data processing software and The Orbiter inspection satellite. The data provided by the startup will be critical in an increasingly complex environment that operates “several thousand active satellites, along with space junk”.

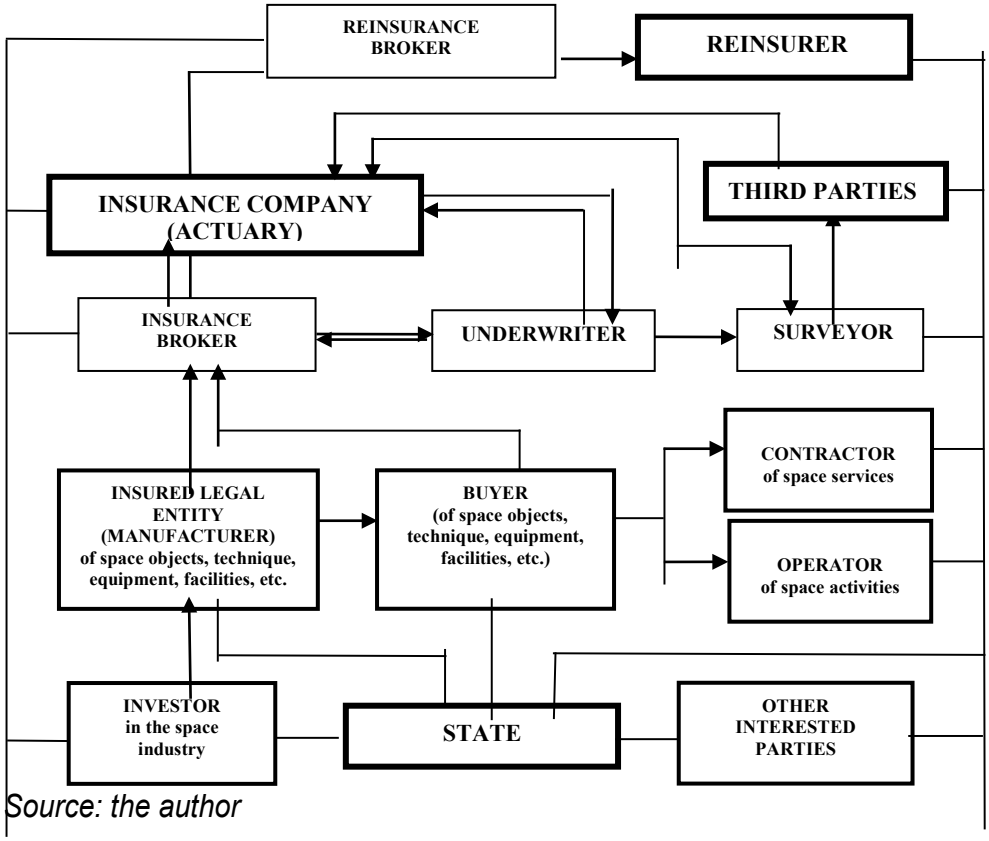
According to a *Technavio report*, the global market – for satellite launch and space insurance – was forecast to reach US$1.3 billion by 2022. Experts from the company indicate that the growth of the market is explained by the increase in the number of satellite launches. According to *The Space Report* 2022 of *the Space Foundation*, the space economy was worth $468 billion in 2021, a 9% increase over the previous year. In addition, more than 1, 000 spacecraft are launched in the first six months of

[3] www.datacenterdynanics.com.

this year, which is more than those launched in the first 52 years of space exploration (WorldEconomicForum, 2022).

The space sector is a key factor for the growth and efficiency of other sectors of the economy. *The European Space Agency* points out that "the deployment of new space infrastructure has brought benefits to sectors such as: meteorology, energy, telecommunications, transport, maritime, aviation, urban development, including insurance". The report states that more investment in the space industry comes from the private sector rather than the public sector.

A large number of participants in the space industry are also entities in the space insurance market. The participants in the space insurance market and the relationships between them are presented in figure 3.




*Source: the author*

*Figure 3. Space insurance market model*

The main participants in the space insurance market are insurance companies and users of insurance services and products, between which specific economic relations arise – insurance relations. *The insurer* and *the insured* are both parties to the insurance legal relationship when signing an insurance contract. *Leading insurance companies* with experience and traditions in the international space insurance market are: Generali, AGF, Mazcham, La Reunion Spatiale, SCOR, INTEC, Munich Re, USAIG, ACE,etc.

Other participants in the space insurance market are *insurance brokers*, whose intermediary activity is the transfer of risk from the client to the insurer. Some of the leading players in insurance mediation in the space insurance market are Insurance brokers *Verspieren International*, *AJ Gallagher,* etc.

The development of space insurance would not be effective without risk equalization through reinsurance. This means seeking financial security for the insurer by transferring part of the original insurance liability to *the reinsurer*, which is the main entity in the space insurance market. *The reinsurance broker* is a specialized intermediary with in-depth general and special training who is at the heart of the relationship between the insurer and the reinsurer regarding the levelling of the risk outside the insurance company and assists in the placement of the reinsurance contract.

For insurance companies, it is important to conduct an adequate risk assessment, carried out by a specialized expert in insurance – *an underwriter*. In terms of space insurance, two-level underwriting is appropriate, given the specifics of space risks (Misheva , 2015). *Actuaries* in insurance companies are directly related to the development of insurance products and the construction of insurance tariffs. In order to price insurance products and ensure the solvency of insurance companies through adequate reserves, actuaries must assess the risk of future insured events (Pavlov & Mihova, 2018) – such as death, illness and disability – that may materialize into personal insurances for space missions in future, for astronauts and tourists during space travel related to space tourism. The international space insurance market currently offers a number of insurance products, such as: life, health and work capacity insurance for astronauts and personnel carrying out space activities; satellite insurance for operation in orbit; spacecraft liability insurance; insurance for damage during construction and installation of launch pads, and others.

A wide range of *consumers* of insurance products participate in the space insurance market, which are governmental and non-governmental segments, respectively a wide range of legal entities and individuals. Figure 3 shows the groups of market segments that determine the demand on the space insurance market, such as: *manufacturers of space objects, buyers of space equipment, space service providers and operators of space activities*. Therefore, this includes the so-called space companies that create products such as launch vehicles and satellites and/or provide services to users in space. *The new space service providers* are startup companies where *engineers* develop reusable components for launch vehicles, reducing costs.

*Investors* in the space industry are an important player in the space insurance market, interested in insuring their investments and projects. Forecasts indicate that the global space economy will be worth $1.8 trillion

by 2035 (Report, 2024). *Investments in research and development* are aimed at further reducing startup costs. Relativity Space, for example, plans to use 3D printing, artificial intelligence and autonomous robotics to build a fleet of fully usable, low-cost rockets. A large part of *the investment* in the space industry *has gone into innovation in space activities*. Driven by robust private and public sector growth, the global space economy is expected to reach $570 billion by 2023, with commercial revenues accounting for 78% and exceeding $445 billion (Space Foundation). In the US, *public agencies*, particularly *NASA*, *the Department of Defense and the intelligence community*, have traditionally provided the most investment in space.

A trend is emerging where commercial funding could replace government funding within 20 years. On the other hand, this trend is expected to lead to mutually beneficial *public-private partnerships* between entities in the space insurance market.

For *manufacturers in the space industry*, increasing demand for satellites is important, as well as reducing costs and obtaining economies of scale by increasing production volume. There are also *other interested parties* involved in the conduct of space insurance, which include: scientific laboratories, innovators, researchers, analysts, academia, the IT sector and other sectors of the economy, application users, as well as other non-space companies affected by space commercialization and services.

Thanks to *researchers,* new technologies such as higher-resolution sensors are being created to improve image capture, data processing, and other functions. Satellites can now collect, analyze and transfer much larger data stores than they could just five years ago. Satellites are becoming more sophisticated every year, allowing researchers to develop new proposals. Many companies now deploy smaller, cheaper LEO satellites to provide better satellite connectivity. SpaceX's Starlink has already launched a LEO constellation and has customers paying for its satellite broadband network. Although much uncertainty remains, *analysts* are optimistic about the space industry and expect it to become a $1 trillion industry thanks to the development of entirely new applications. The new applications can be divided into two broad categories: Space-to-Earth applications, which facilitate ground-based activities, and Space-to-Space applications, which only involve activities that take place in orbit.

Thanks to *innovators,* 3D printing and other innovations are helping to reduce costs by streamlining the manufacturing process and improving supply chains. The cost of LEO satellite launches has dropped from $65,000 per kilogram to $1,500 per kilogram in 2021, a reduction of more than 95% (Brukardt, 2022). The new generation of satellites and applications support major sectors of the economy, including insurance. For the insurance business, better imaging could allow more insurers to assess risk and damage

in remote locations, with improved resolution, and more clearly pinpoint problems and eliminate the need for in-person visits (Brukardt, 2022).

Despite the existing difficulties, *stakeholders* in the space industry can consider measures that will help space companies and other economic entities navigate the new situation and take measures to reduce the likelihood of space collisions and space debris.

## Conclusion

Despite the complex of reasons that make insurance activities difficult, there are favourable prospects for the development of space insurance.

The application of robotics in space and the use of artificial intelligence allows the space sector to remotely operate and control spacecraft, rovers and other devices for the study of celestial bodies. This is a factor in expanding insurance liability by including *new space technologies* in insurance coverage.

Increasing revenues in the space industry from activities related to space-based products, ground stations as well as the largest business – the sale of Position, Navigation and Time (PNT) satellite data is expected to boost the development of the insurance business in near future. This means that the development of the space infrastructure in parallel with the challenges of space data – generation, processing and transmission of data in space is a prerequisite for innovations in terms of insurance services and products, by including new space activities and risks in the insurance liability.

Improving *the relationship between the parties to the insurance contract* – insurance companies and space companies – is a prerequisite for *adapting the insurance programmes* to the increased requirements of the space sector. On the one hand, the direct financing of preventive measures regarding space risks by insurance companies leads to an increase in corporate security in the space industry. On the other hand, stimulating the preventive activities of space companies through the insurance conditions and tariffs reflects on the price of the insurance protection and leads to its reduction.

The participation of other entities and interested parties in *initiatives related to reducing the impact of space risks* on the Earth's environment and outer space is an important factor in the development of national space insurance markets.

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