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FROM MANAGEMENT DURING ANALOGUE SPACE MISSIONS TO INNOVATIVE RESEARCH IN SPACE

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Purpose: The main objective of the article is to summarize the results of research conducted as part of the “Space Architecture” research project, which was established in 2017 under the supervision of Prof. Klaudiusz Fross at the Faculty of Architecture of the Silesian University of Technology. The article presents the most important results of research from analog space missions in LunAres habitats. At the same time, the article highlights the role of the 8-year Research Project, which led PhD student Wiktoria Dziaduła to conduct a research experiment as part of the IGNIS space mission.

Design/methodology/approach: The following methods were used: expert qualitative assessment of the facility (based on a proprietary methodology based on simplified POE – Post Occupancy Evaluation, in terms of technical, functional, organisational, economic and behavioural quality), observations of the behaviour of mission participants, short surveys, conversations and interviews with the crew during the mission.

Findings: Conclusions and guidelines were obtained for the design of space facilities where people stay, including analogue space habitats on Earth, space stations and hotels, and residential bases on Mars or the Moon. Answers were obtained to the questions: how can architecture positively influence rapid adaptation to extreme conditions? What solutions and design decisions help build a supportive environment. What influences the improvement of the quality of life and work.

Research limitations/implications: Conclusions were drawn within the limited scope permitted by the location and types of missions. The basis for drawing conclusions for design purposes was the participation of architecture students and specialists (researchers, architects, managers, etc.) in four analogue space missions in the LunAres habitat. Due to the extensive and multifaceted research material, only selected conclusions are presented in this article.

Practical implications: Based on the research findings, specific design guidelines were formulated for space objects and other objects operating in extreme conditions.

Social implications: An important objective was to conduct observational studies of user behaviour and ways of using the habitat. Observations of relationships that occur in group cooperation during missions.

Originality/value: Research in the space habitat is conducted by the participants themselves. For the purposes of the research, original methods of qualitative assessment and observational research were developed.
Keywords: space architecture, qualitative research, analog space missions.
Category of the paper: Research paper.

1. Introduction to the subject

The main and important reason for this article is the recent achievements of PhD student Wiktoria Dziaduła[1], who, together with the Extremo Technologies[2] team, conducted research during the Ax-4 mission on the International Space Station during the stay of Polish astronaut Dr Sławosz Uznański-Wiśniewski. This research is part of the Space Volcanic Algae project. It is an experiment that involves testing extremophile microalgae in microgravity conditions. The organisms under study, which are resistant to environmental conditions, have the ability to produce oxygen and valuable bioactive compounds, making them a potential component of future life support systems in space habitats. The aim of the research is to test the possibility of using these microorganisms in closed space ecosystems and in sustainable architectural systems on Earth[3]. Due to the confidential nature of the research, the article only describes how it was conducted, without providing any data from the results. As Wiktoria Dziaduła states: Participation in the Space Volcanic Algae project was one of the most important experiences in my scientific and professional career to date. The opportunity to work on such a prestigious project and in such a legendary place as the Kennedy Space Centre, where we prepared the experiment before launch, was an extraordinary experience, both professionally and personally. It was a moment that confirmed my belief that courage in thinking, consistency and passion can take you really far. The entire work on the experiment has been going on for over 1.5 years", says Wiktoria Dziaduła. It involved preparations, research and the construction of the experiment as part of the IGNIS mission – the first Polish technological and scientific mission organised by the Ministry of Development and Technology, the Polish Space Agency and the European Space Agency. Of course, the launch of the rocket on 25 June was a key moment for the experiment to be placed in orbit under the supervision of Dr Sławosz Uznański-Wiśniewski[4]. As already mentioned, due to the closed nature of the research and the fact that the analysis of its results has only just begun, the article does not provide any data.

[1] Currently, a student at the Doctoral School of the Silesian University of Technology, she is working on her doctoral thesis entitled: „Architecture in Extreme Conditions: The Problem of Self-Sufficiency in Space Architecture and Its Impact on Sustainable Development", under the guidance of dr hab. inż. arch. Klaudiusz Fross, Prof. PŚ.
[2] A project involving doctoral student and architect Wiktoria Dziaduła-Crisosto, oceanographer Ewa Borowska, and engineer Weronika Urbańska.
[3] The 'green' box from the Space Volcanic Algae experiment with red microalgae, known from photographs, held by astronaut Dr Sławosz Uznańskie-Wiśniewski during his stay at the International Space Station.
[4] According to the information posted on www.polsl.pl.

As analogue astronaut and architect Wiktoria Dziaduła states: The Space Architecture Research Programme initiated by Professor Klaudiusz Fross at the Faculty of Architecture of the Silesian University of Technology was a great support on my scientific path. When choosing a field of study such as space architecture, I never thought that I would be able to develop in Poland. This subject was practically non-existent in Poland, only abroad, mainly in the USA. I seriously considered moving abroad for my master's degree, but this programme encouraged me to stay at the Silesian University of Technology, and I continued my academic career there, completing my master's degree and now my PhD in space architecture.

Figure 1. Visualisation of the space habitat concept, master's thesis by Wiktoria Dziaduła, supervisor Prof. Klaudiusz Fross, Silesian University of Technology. Analogue astronauts Klaudiusz Fross, Igor Gdula and Wiktoria Dziaduła. Wiktoria Dziaduła at NASA and the Extremo Technologies team. Polish astronaut Dr Sławosz Uznański-Wiśniewski at the International Space Station during the Ax-4 mission and the green box of the Space Volcanic Algae experiment. (photo: archive Wiktoria Dziaduła, Axiom/NASA/ESA, fb: International Space Station, Extremo Technologies, 2025)[5].

[5] more at: www.axiomspace.com, www.plinspace.pl.

Thanks to the support of Prof. Fross, who was one of the first to recognise the potential in this field, as part of the programme I had the opportunity to conduct my own research work in the Lunares analogue habitat, as well as in the Santander habitat in Spain, co-create the only Space Architecture Research Club in Poland, present projects at international conferences and develop my skills. All these steps led me to a research internship at the world's only space architecture centre in Houston, where, under the supervision of NASA experts, scientists and world-class specialists from the space sector, I conducted research for my PhD. I am currently fulfilling what is probably every scientist's dream – I am co-creating an experiment that is currently in orbit, which I had the opportunity to prepare in a NASA laboratory with the Extremo Technologies team. They say that a journey of a thousand miles begins with a single step, and for me, that first step was definitely the Space Architecture Research Programme and the support and open-mindedness of my supervisor, Prof. Klaudiusz Fross[6] (Figure 1).

2. Methodology, purpose and scope of research

The main objective of the article is to highlight the significance and summarise the results of research conducted as part of the Space Architecture Research Project, which was established in 2017 under the supervision of Prof. Klaudiusz Fross at the Faculty of Architecture of the Silesian University of Technology. The article also presents the path taken by doctoral student and architect Wiktoria Dziaduła, the main co-implementer of the Research Programme. It presents the research process from master's theses, through analogue space missions (simulated conditions on the Moon) to real research in space as part of the Ax-4 mission (Figure 2). Interesting research was conducted by architecture student Natalia Ściora during the PEGASUS analogue space mission. It focused on detailed analyses of space utilisation and space management. The research and conceptual designs for the space habitat[7] were partially published[8]. This article, however, provides a comprehensive summary of the research conducted in space habitats and as part of the Scientific Programme of Space Architecture (SPSA) (Dziaduła, Fross, 2022).

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6 Quoted from Wiktoria Dziaduła, July 2025.

7 More broadly in: Fross, Dziaduła, 2022, Analog…, p. 57.

8 Four publications: Fross, 2023; Dziaduła, Fross, 2022, About…; Fross, Dziaduła, 2022, Analogowe…; Fross, Dziaduła, 2022, Qualitative…; Fross, Dziaduła, 2021.

Figure 2. The Extremo Technologies team at NASA, USA (photo: archive Wiktoria Dziaduła).

2.1. Purpose and scope of research

The scope of the research presented in the article is limited to four analogue space missions in the LunAres habitat. The aim of the research was to assess the quality of the habitat, learn about the living conditions in the habitat and the procedures. The second aim was to observe the behaviour of users. It was important to obtain conclusions and guidelines for the design of space facilities where people stay, including analogue space habitats on Earth (Hauplik-Meusburger, Bishop, 2021; Häuplik-Meusburger, 2020; Heinicke, Orzechowski, Avila, 2020), space stations and hotels, and residential bases on Mars or the Moon (20). Of course, this was limited by the space and types of missions available. The basis for obtaining results and conclusions for design was the participation and conduct of planned research by architecture students and specialists (researchers, architects, designers, managers, etc.) in analogue space missions in the LunAres habitat. As part of the Space Architecture Research Programme, four analogue space missions and one foreign study trip took place between 2021 and 2024. These were, in order, the following international missions: ‘Panda’ (2021, LunAres) (Fross, Dziaduła, 2022; Fross, Orzechowski, Dziaduła, Mintus, 2022), ‘Sirius’ (2022, LunAres), ‘Pegasus’ (2024, LunAres), the innovative 24-hour mission “Weninger” (2023, LunAres) (Fross, 2023), and the foreign study visit ‘Santander’ (2023, Spain) (Figure 3).

Figure 3. Participants in analogue space missions in the LunAres habitat: 'Panda' (2021, LunAres), 'Sirius' (2022, LunAres), 'Pegasus' (2024, LunAres), the innovative 24-hour mission "Weninger" (2023, LunAres) (photo: archive Wiktoria Dziaduła, Igor Gdula, Natalia Ściora, Klaudiusz Fross).

Architecture students participating in professional international missions performed all tasks specified in the mission programme under the supervision of commanders. At the same time, they conducted individual qualitative and observational research under the supervision of Prof. Klaudiusz Fross from the Silesian University of Technology. In each mission, it was important to prepare the research materials (scope of research, survey forms, interview questions, etc.) in advance and to manage the research during the stay in the habitat. It should be mentioned that conducting research in parallel with the mission tasks was not easy. The participants had a carefully planned schedule for the entire day, and their free time was limited. The participants (analogue astronauts) formed an international team of different ages and professions who did not know each other beforehand. Before each mission, a meeting was held between the leader, Prof. Klaudiusz Fross from the Silesian University of Technology, and the participant, during which the objectives and scope of the research were discussed. After each mission, another meeting was held to discuss the course of the mission, the results of the research and to receive a detailed written report. Each participant was required to submit a research report. The scope of the research concerned the qualitative assessment of the habitat itself as well as various aspects of behaviour and relationships between users (mission participants). The researchers were also free to modify the planned research and adapt it to the possibilities available during the mission.

2.2. Research methodology

During all four analogue space missions (PANDA, SIRIUS, WENINGER, PEGASUS), the following were used: expert qualitative assessment of the facility (based on a proprietary methodology based on simplified POE – Post Occupancy Evaluation, in terms of technical, functional, organisational, economic and behavioural quality), observations of the behaviour of mission participants, short surveys, conversations and interviews with the crew during the mission. Attempts were made to answer the following questions: how can architectural design positively influence rapid adaptation to extreme conditions? What design solutions and decisions help to build a supportive environment? What improves the quality of life and work? Also in terms of the psychology of space. At the same time, analogue astronauts participated in the research objectives of individual missions. In the PANDA mission: crew management and procedure training, and the study of behaviour in isolation. Research on the impact of isolation on human health, well-being and reactions (Fross, Dziaduła, 2022).

Supplementary research: The impact of freeze-dried food on dental health. In the SIRIUS mission: Psychological study of the level of immersion of mission participants and the impact of replacing freeze-dried meals with everyday food products. Supplementary research: The human factor in space missions. In the PEGASUS mission: Crew management and procedure training involving a person in a wheelchair.

Interesting research was conducted by architecture student Natalia Ściora (during the PEGASUS mission) (Figure 5). It focused on detailed analyses of space usage and space management. The aim of the research was to assess how habitat users move around, compare the paths of each user, and compare the way they move during days with spacewalk simulations (EVA) and without spacewalk simulations. Before the mission began, tables were prepared for data collection by analogue astronauts.

The method involved a set of tables placed on the doors to each room – upon entering, it was necessary to note: which room you came from, the time of entry; the time of exit, which room you were going to, what you did in that room, and how much time you spent in the room. According to Natalia Ściora, each of the analogue astronauts received a set of tables to fill in themselves during designated days of the mission. Data was collected at the beginning of the mission (days 3 and 4), in the middle of the mission (days 7 and 8) and at the end of the mission (days 12 and 13). Each pair of days includes a day with a spacewalk simulation (days: 3, 7, 13) and days without these simulations (days: 4, 8, 12). Six members of the M2.24 mission crew took part in the study. Before the start of isolation, the crew was informed about the planned study and how it would be conducted. The study, entitled 'User Paths,' was designed to examine how people move around the habitat during the mission and the changes that occur over time (comparison of the beginning, middle and end of the mission).

Figure 4. During the analogue PEGASUS, WENINGER and PANDA missions. The PANDA mission was featured on the Dzień Dobry TVN television programme (photo archive: Klaudiusz Fross).

The method involved a set of tables placed on the doors to each room – upon entering, it was necessary to note: which room you came from, the time of entry; the time of exit, which room you were going to, what you did in that room, and how much time you spent in the room. According to Natalia Ściora, each of the analogue astronauts received a set of tables to fill in themselves during designated days of the mission. Data was collected at the beginning of the mission (days 3 and 4), in the middle of the mission (days 7 and 8) and at the end of the mission (days 12 and 13). Each pair of days includes a day with a spacewalk simulation (days: 3, 7, 13) and days without these simulations (days: 4, 8, 12). Six members of the M2.24 mission crew took part in the study. Before the start of isolation, the crew was informed about the planned study and how it would be conducted. The study, entitled ‘User Paths,’ was designed to examine how people move around the habitat during the mission and the changes that occur over time (comparison of the beginning, middle and end of the mission)[9].

[9] According to the research report from the ‘User Paths’ mission, Natalia Ściora, 2024.

Figure 5. Round-the-clock monitoring of mission participants and microclimate parameters in the habitat, as well as all resources, including oxygen, drinking water, grey water, waste, etc. Architecture student Natalia Ściora during the PEGASUS mission (photo archive: Klaudiusz Fross, Natalia Ściora).

The author of the study adapted the data collection method on an ongoing basis to the conditions prevailing in the habitat, as each member of the crew had their own individual projects. For this reason, the data collection method was simplified as much as possible and adapted to the conditions and possibilities prevailing in the habitat. This simplification involved the removal of certain points originally included in the data collection.[10] During the 14 days in the habitat, analogue astronaut Natalia Ściora also observed the behaviour of the participants. The people taking part in the mission were diverse in terms of age, nationality and education. The paths of each crew member in the habitat depended on their tasks, assigned roles and behaviour. For example, a person acting as a Biolab Officer and willing to help with other tasks will spend more time between the biolab and other rooms. On the other hand, a person focused only on their own tasks will mostly limit their paths to the rooms necessary for them. During data collection during the mission, there were two main problems with the proper completion of the sheets. The first problem was that the crew forgot to complete the table – despite reminders to fill in the tables, there were situations where crew members forgot to complete their paths on an ongoing basis[11].

[10] According to the author of the study, despite the use of these measures, the data collected is incomplete and does not always represent the actual route taken by a given user during a given day. Modifications to the data collection method are needed to eliminate errors, possibly through automation of the process.

[11] According to the research report from the 'User Paths' mission, Natalia Ściora, 2024.

2.3. Research results

The results of research from individual space missions were compiled in the form of comprehensive reports. They provided many guidelines for designing structures in extreme conditions (habitats, bases and space stations). The conclusions drawn can be used not only for programming, designing and creating concepts for space habitats on Earth, bases in space, space settlements or hotels, but also for facilities on Earth where people stay in confined spaces for long periods of time (e.g. submarines, mining), such as bases in extreme conditions (e.g. in Antarctica).

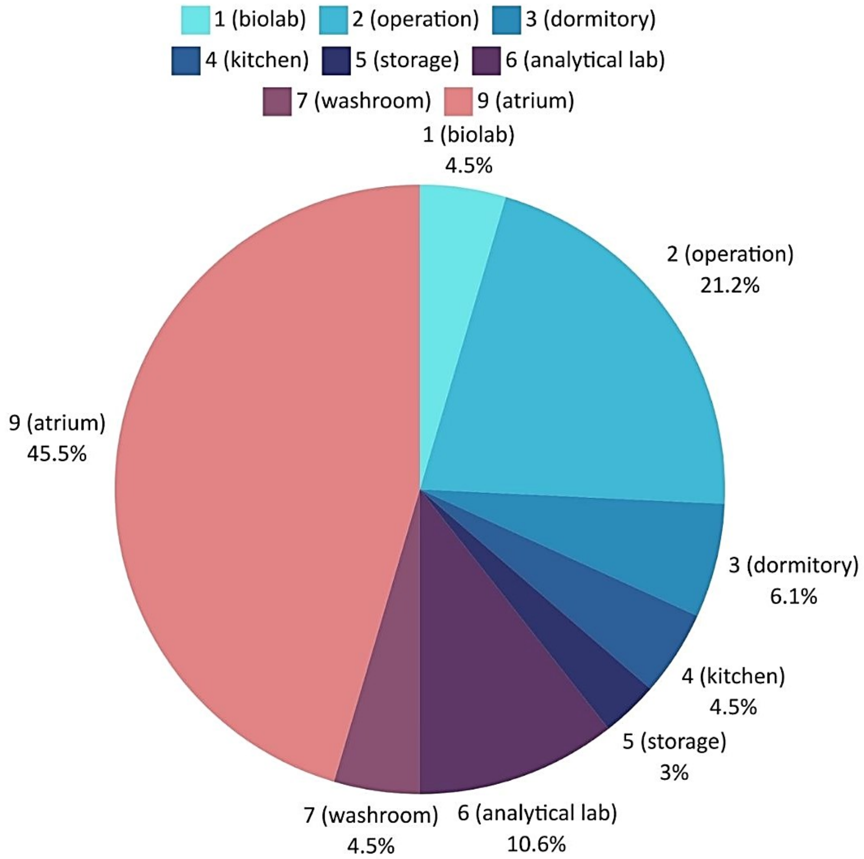
participant no. 1*	
room no.	**frequency**
1 (biolab)	6
2 (operation)	7
3 (dormitory)	9
4 (kitchen)	5
5 (storage)	2
6 (analytical lab)	10
7 (washroom)	6
8 (airlock)	4
9 (atrium)	39
10 (EVA area)	0

participant no. 2*	
room no.	**frequency**
1 (biolab)	4
2 (operation)	4
3 (dormitory)	7
4 (kitchen)	6
5 (storage)	2
6 (analytical lab)	12
7 (washroom)	7
8 (airlock)	15
9 (atrium)	31
10 (EVA area)	2

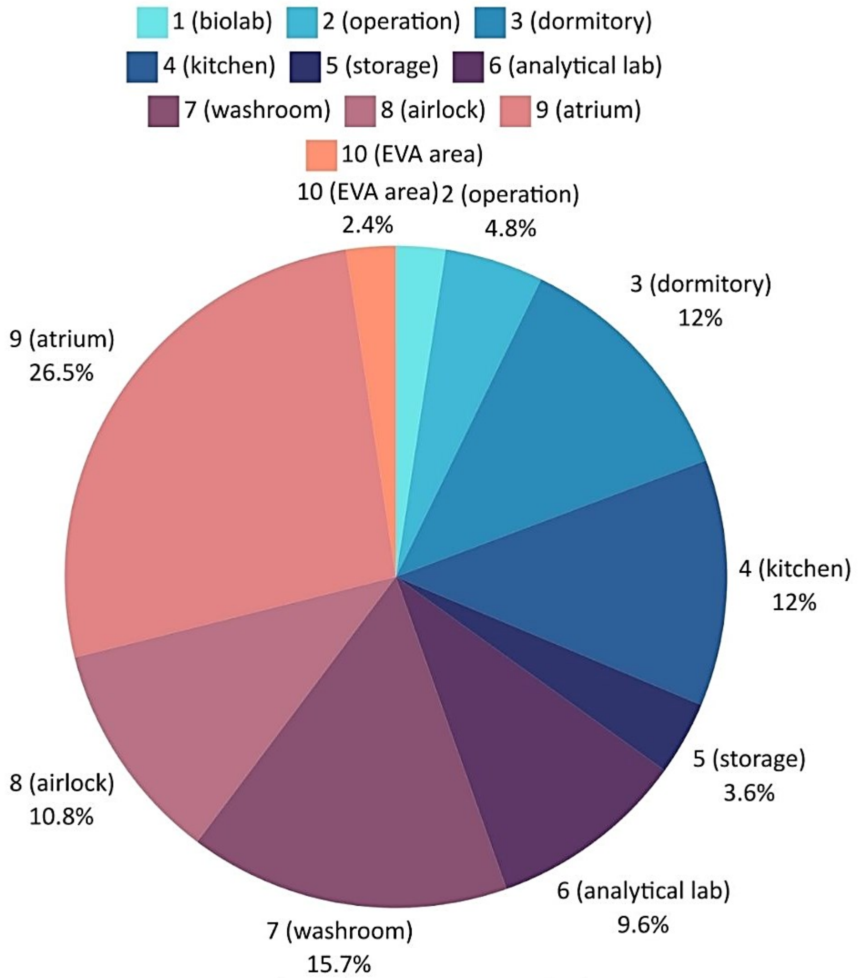
Figure 5. Research results (author: Natalia Ściora).

Selected conclusions may also provide a scientific basis or inspiration for innovative solutions for working in windowless rooms (e.g. large-area shops, factory and warehouse halls), micro-apartments, mini-houses, energy self-sufficient facilities, defence infrastructure (such as bunkers and shelters), as well as concepts for underground cities in the future (as alternatives and perhaps responses to the needs and limitations of the world of the future) (Figure 5)[12].

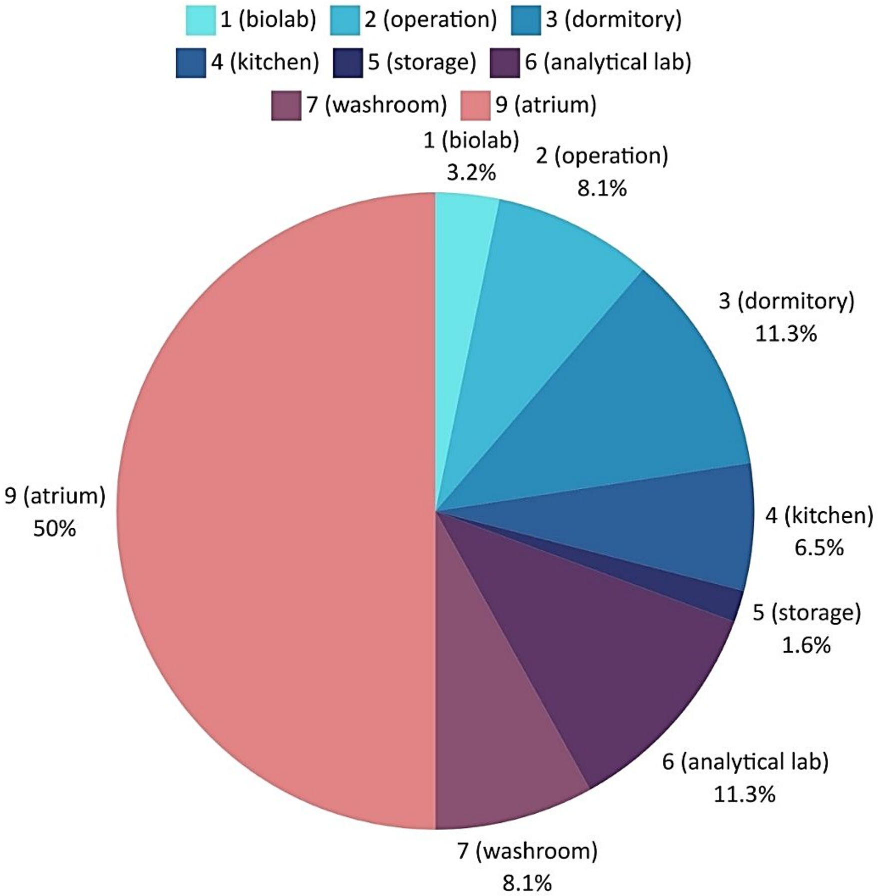
[12] According to Klaudiusz Fross, Summary of research based on reports from analogue space missions, Space Architecture Research Project – Scientific Report 2017-2025.



pie chart no. 5.3.1:
presentation of data from the table
mission day: 7/ participant no. 1

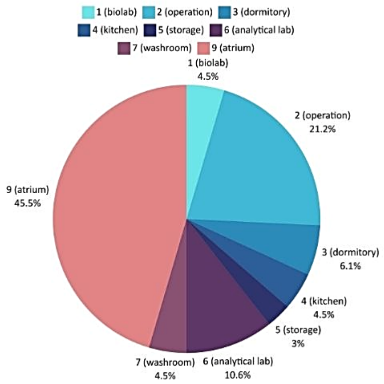


pie chart no. 5.3.2:
presentation of data from the table
mission day: 7/ participant no. 2

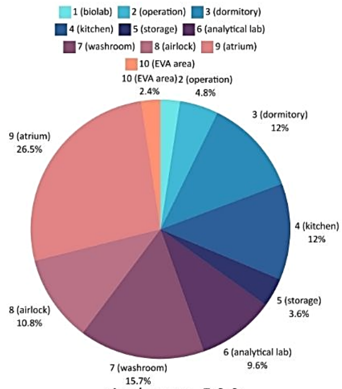


pie chart no. 5.3.3:
presentation of data from the table
mission day: 7/ participant no. 3

Results from day 7 of the mission:



pie chart no. 5.3.1:
presentation of data from the table
mission day: 7/ participant no. 1
author: Natalia Ściora



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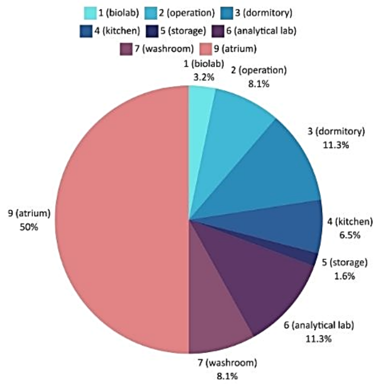
mission day: 7/ participant no. 2
author: Natalia Ściora



pie chart no. 5.3.3:
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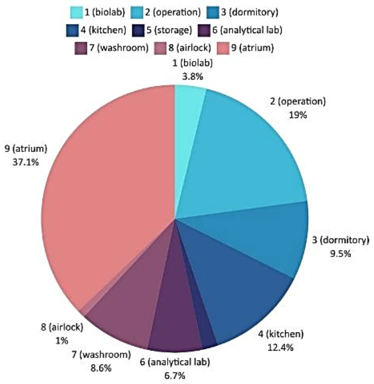
mission day: 7/ participant no. 3
author: Natalia Ściora



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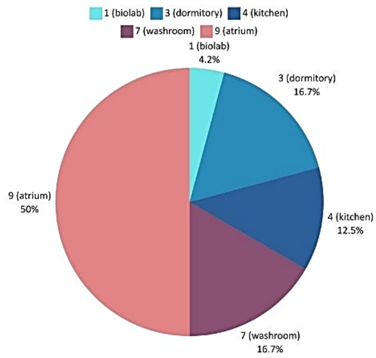
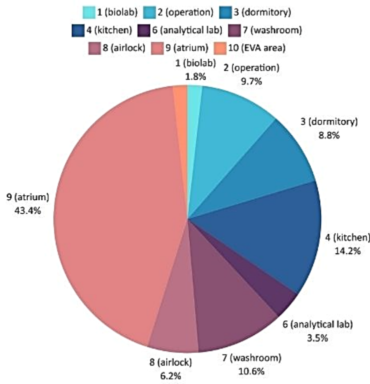
author: Natalia Ściora



pie chart no. 5.3.5:
presentation of data from the table
mission day: 7/ participant no. 5
author: Natalia Ściora



pie chart no. 5.3.6:
presentation of data from the table
mission day: 7/ participant no. 6
author: Natalia Ściora

Figure 6. Users Paths – results of research from day 7 of the PEGASUS mission. Comparison of diagrams from 6 participants and 3 selected diagrams in enlarged view with the possibility of detailed data analysis (author: Natalia Ściora).

Below are some examples of observations and conclusions from the reports. The atrium also played an important role during the EVA simulation – it is the place from which the mission is managed, all preparations are organised and the simulation is concluded. The atrium is surrounded by other rooms, so it was often a 'stop' in the users' paths. On each of the days studied, all crew members spent most of their time in the atrium. This is due to the fact that the crew had organised workspaces in the atrium and most crew members preferred to work in the company of others (faster exchange of information, being among others during complete isolation also improved their mood). The rooms that were used the least were the airlock and the storage room. For some crew members, this also included the operations room and the biolab. The path of a person moving around in a wheelchair is in most cases different from that of the rest of the crew. Although all rooms (except for the EVA area – test subject no. 5 did not participate in EVA simulations as an EVA team member) were adapted for wheelchair access (ramps were added before the mission), her path is significantly shorter than that of the others.

Figure 7. Participants of the PEGASUS mission and Klaudiusz Fross during the WENINGER mission after leaving the EVA zone (photo archive: Klaudiusz Fross, Natalia Ściora).

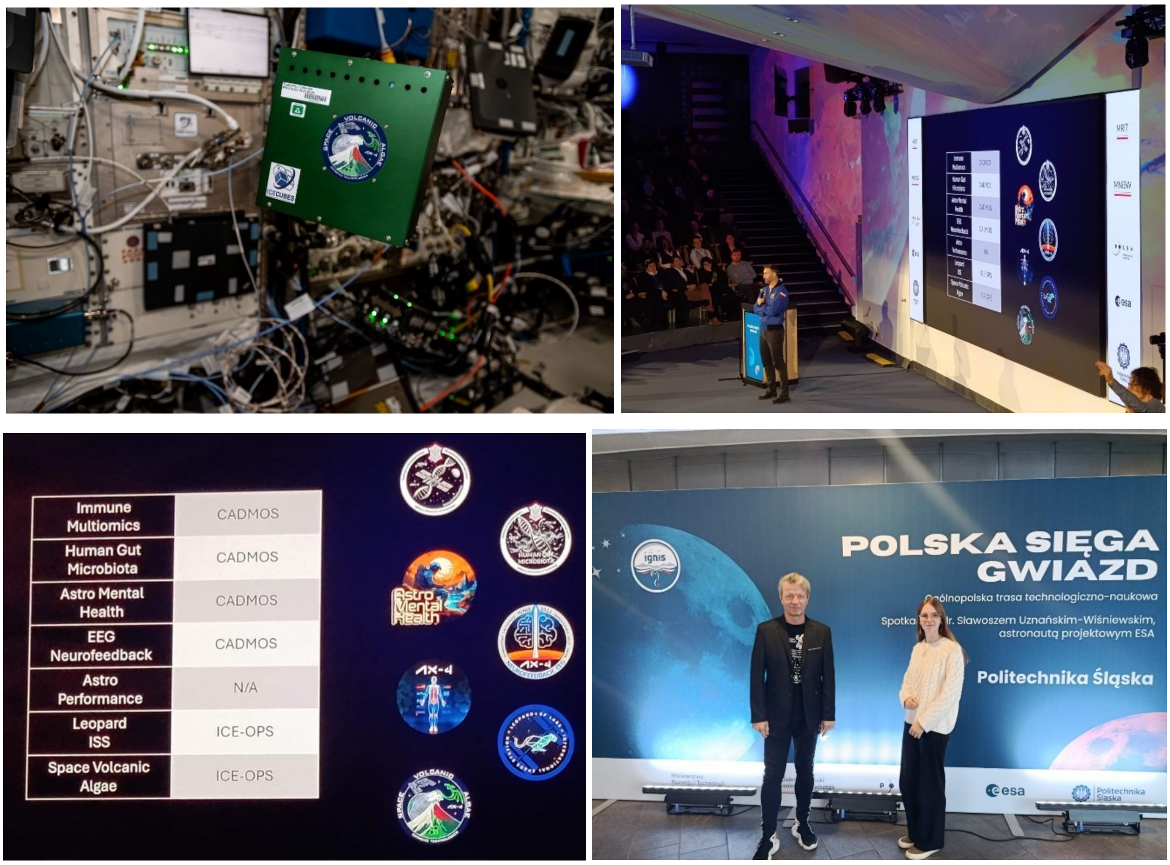


Figure 8. The 'green' box of the Space Volcanic Algae experiment with red microalgae. Polish astronaut Dr. Sławosz Uznański-Wiśniewski presenting research experiments conducted during the mission, including Space Volcanic Algae, during a meeting at the Silesian University of Technology. (photo: Axiom/NASA/ESA, fb: International Space Station, Extremo Technologies 2025; Klaudiusz Fross 2025)[13].

The study entitled 'User Paths' provided a wealth of information on both the data collection method and the research results. The creation of successive versions of spreadsheets with tables allowed us to develop the best method for collecting data in mission conditions (each crew member has their own tasks to perform, related to the habitat infrastructure, the daily life of

[13] more at: www.axiomspace.com, www.plinspace.pl.

a group of six people, and the performance of their own research/projects). The summary of the collected data in the form of tables and pie charts allowed us to present the rooms that were used most and least frequently. This showed how users use the habitat depending on their roles and degree of disability, and how these paths changed during the mission. In addition, differences between days with and without EVA simulation were revealed (Figure 6)[14].

3. Summary and conclusions

Many people have asked why we should conduct research in space when we have so many problems on Earth. The results of space research are already having a significant impact on improving the quality of life on Earth. We are largely unaware of how many valuable space inventions we currently use on Earth, e.g. freeze-dried food used by mountaineers, travellers and in diets, smartphone cameras, scratch-resistant glass in spectacles, flexible polyurethane foam, infrared thermometers, smoke detectors, water filters, portable vacuum cleaners, headsets, frozen food and airtight packaging, baby food, computer mice, swimsuits, autonomous cars, air traffic control systems, grooved surfaces, foil blankets and memory foam (Fross, Dziaduła, 2021).

Currently, the most well-known and commonly used building materials on Earth are concrete (reinforced concrete), steel, ceramics, glass, and wood. These materials are unlikely to find widespread use in space, mainly due to their weight and the associated costs of transporting them by rocket. In space, materials are needed that can be made from processed regolith, i.e. rock from the Moon or Mars. Regolith, as a weathered, fragmented, surface layer covering the planets, can be used to produce 'Moon Concrete' or 'Mars Concrete' on site, in space conditions. Other materials that can be considered include graphene composites or innovative hybrid nanomaterials with many functions specific to the conditions prevailing in space. Polymers, which when mixed with regolith through 3D printing can form structures for space objects, can be considered another material of the future. The space materials of the future will certainly be developed in laboratories on Earth with the participation of civil engineers, materials scientists, architects and researchers from many other fields. There is certainly a chance that some technologies, after space testing, could also be used on Earth in the future (Fross, Dziaduła, 2021).

Our research focused mainly on assessing the quality of interiors and aspects of teamwork, human behaviour in isolation, and other interpersonal relationships. It provided many valuable tips, inspiration, ideas, and warnings about potential hazards. Extreme space conditions do not forgive mistakes, which can be catastrophic. The research conducted in the habitats yielded

[14] According to the research report from the 'User Paths' mission, Natalia Ściora, 2024.

a number of interesting conclusions. Selected ones are listed below (Gabler 1986; Heinicke, Orzechowski, Avila, 2020).

The most important conclusions, according to the Space Architecture Research Project manager

Based on the research conducted, the manager of the Space Architecture Research Project formulated a number of conclusions. The eight most important ones are listed below:

1. The advantage of a crew (e.g. of 6 people) may be diversity in terms of age and generation, gender, education and profession. In critical situations, this gives a better chance of solving a problem (based on the WENINGER mission).
2. Contact with 'real' greenery (in the form of interior decoration or bionic crops) is one of the most important needs affecting well-being, emotional connection with Earth, family home, and the environment left behind for the duration of the mission (based on the SIRIUS mission).
3. Measurement of all parameters, resources, supplies, and waste (e.g., oxygen, water, grey water, food, rubbish, etc.) and individual consumption (e.g. how much water a person uses per shower or toilet flush) provides knowledge, increases awareness and responsibility for fellow crew members, the environment and the planet (based on the PANDA, SIRIUS and PEGASUS missions).
4. Even 24 hours in confinement without access to the outside world (windows) causes a loss of time, while 14 days causes a complete loss of sense of time. In such a case, in order to maintain a 24-hour circadian rhythm (day and night), artificial regulation of the day and night based on a clock is necessary. One way to do this is to use smart lighting that mimics daylight (e.g. Philips dynamic lighting) or another form of light signalling (conventional change in colour and intensity of artificial lighting) to indicate whether it is day or night. In the LunAres habitat, such regulation is possible (based on the PANDA, SIRIUS, PEGASUS and WENINGER missions).
5. Use of the latest technologies (wall-sized LED screens, TeamLab technology, etc.) to visually simulate the 'left behind' world, e.g. displaying images (static, animated, from live cameras) of nature (park, forest, landscape), life among people (in the city, in the countryside, contact with friends) (based on the PANDA, SIRIUS, PEGASUS, WENINGER missions).
6. Use of the latest technologies (MR - mixed reality, VR - virtual reality, etc.) to visually simulate the 'left behind' earthly world, e.g. displaying images (static, animated, from live cameras) of nature (park, forest, landscape), life among people (in the city, in the countryside, contact with friends) (based on the PANDA, SIRIUS, WENINGER missions).

7. The use of 3D printing technology as a basic necessity resulting from the lack of a component (e.g. during a Mars rover failure) or other item (e.g. everyday use). The inability to leave the habitat to go to a shop and the lack of an item in the unit's warehouse meant that 3D printing was the only and most important action in emergency situations (based on the PANDA mission).
8. While staying in the habitat, important for well-being and comfort, apart from rooms and 'work' areas (related to the mission objective), a common room for everyone (a place for meetings and conversations, a sense of connection, of being in a group), and the possibility of individual isolation (the need to be alone with one's thoughts) (based on the PANDA and PEGASUS missions)[15].

"For me, as an architect, researcher, teacher and designer, Space Architecture frees me from my daily routine and gives me the incredible passion of a designer-traveller into the unknown. But a question I have been asked many times is: Don't we have enough problems to solve on Earth without worrying about space? Another question arises from the above: Why do we need space architecture? It is obvious that space architecture offers new possibilities, freedom of thought, a creative design context and specific design conditions, as well as new technological challenges. Research conducted in different conditions allows both architects and students to unleash their research imagination. Space solutions for self-sufficient residential buildings can have a significant impact on the development of future construction on Earth"[16].

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[16] Quote: Klaudiusz Fross, author's statement.

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