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Mars Space Exploration and Astronautical Religion in Human Research History: Psychological Countermeasures of Long-Term Astronauts

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Abstract: As the development of science and technology has reached the point where the desire to travel to Mars has become a tangible reality, the physical limits of human movement are also part of the systematic research based on the space environment. The critical issues of radiation, altered gravity, hostile environment, isolation or confinement, and distance from Earth (travel time) are the five major hazards for astronauts during spaceflight. The prepared technology of space medicine is significant for physical health. However, how would the lone space exploration (2.5 to three years) affect the mental conditions of the astronauts? How can the space community keep astronauts safe from psychological obstacles, such as depression, conflict, resentment, bipolar disorder, obsession, and addiction? This paper explores the environmental factors of a healthy lifestyle (well-being) of the spacecraft. It presumes that a successful mission often relies on positive interactions between crew members and between the crew and ground personnel. The paper considers the mental sustainability from stress, emotions, and perceptions to improve human tonicity or vitality and argues a new mental strategy in space exploration policy that the role of an astronautical religion beyond human intelligence and artificial intelligence (AI) could be a psychiatric anchor (in a moral, ethical, and self-sacrificial context) of each astronaut and leadership of the space team as a psychoanalytical countermeasure, along with physical exercise, hobbies, pets, and virtual and augmented reality (VR/AR) entertainment, especially in the case of unexpected crises where science and technology fail its general function.

Keywords: Mars; space exploration; human factor; astronautical religion; psychological countermeasure

Citation: Kim, D.W. Mars Space Exploration and Astronautical Religion in Human Research History: Psychological Countermeasures of Long-Term Astronauts. *Aerospace* **2022**, *9*, 814. https://doi.org/10.3390/aerospace9120814

Academic Editor: Ephraim Suhir

Received: 10 November 2022
Accepted: 8 December 2022
Published: 12 December 2022

1. Introduction

The space trip to Mars is no longer science fiction based on the dreams of creative children but is a present reality in the achievement of human history. The last two decades (2000–2021) witnessed many international organisations poised to launch orbital and landed missions to the Red Planet (35 million miles from Earth). Eight nations have attempted the experimental investigation and analysis of the Martian environment a total of 55 times. The landing process on Mars requires a more difficult technique, and only eight attempts achieved their procedural goal among 18 landing tries [1]. The National Aeronautics and Space Administration (NASA) sent various orbiters, including the Mars Global Surveyor (MGS, 1996), the 2001 Mars Odyssey, the Mars Reconnaissance Orbiter (MRO, 2005), and the Mars Atmosphere and Volatile Evolution (MAVEN, 2013) [2]. The European Space Agency (ESA) sent the Mars Express (2003) and the ExoMars Trace Gas Orbiter (TGO or ExoMars Orbiter, 2016) (This ESA project was a collaborative project with the Russian Roscosmos agency (Roscosmos State Corporation for Space Activities)). The Mangalyaan project (or Mars Orbiter Mission: MOM) was also designed by the Indian Space Research Organisation (ISRO) in 2014 [2]. The Phoenix (2008), an uncrewed space probe, landed on the surface of Mars in 2008, followed by the robotic lander called the InSight (The Interior Exploration using Seismic Investigations, Geodesy and Heat Transport, 2018) to explore the deep interior of the planet Mars [3].

The efforts of Mars Rover projects, like Mars Exploration Rovers (*Spirit* and *Opportunity*; NASA), Mars Science Laboratory (*Curiosity*; NASA), and ExoMars Rovers (or *Rosalind Franklin*, ESA), provided scientific sources for Martian research. NASA's Mars 2020 mission's *Perseverance* (Percy), a car-sized Mars rover, landed on Mars on 18 February 2021 [4]. Notably, *Ingenuity*, a solar-charged battery-powered coaxial drone rotorcraft, has advanced technology and capability to scout locations of interest for the first arrival of the Martian version of 'Neil Armstrong' as well as its colonial settlement project. By 22 November 2022, the self-control helicopter secured 625 scientific photos through its 34 flight experiences. With the capacity to fly 12 metres high and travel 7392 metres, it pioneered many different places, including 'Airfield U' (For more details, see "Helicopter Tech Demo," *NASA Science: Mars*, https://mars.nasa.gov/technology/helicopter/#Flight-Log (accessed on 24 November 2022)). The Emirates Mars Mission (مشروع الإمارات لاستكشاف المريخ; United Arab Emirates Space Agency) sent *The Hope* orbiter (Misbar Al-Amal) to Mars, and it eventually reached the planet on 9 February 2021. Furthermore, China, a late starter in the space program, also launched a Mars project, and their remote-controlled rover *Zhurong* (祝融, named after the Chinese god of fire and the south) landed on Mars second, after the USA, on 15 May 2021 [5,6]. In this regard, Kathy Lueders (NASA Human Exploration and Operations Mission Directorate Associate Administration) said that since 'NASA has a long history of robotic successes at Mars, humanity knows more about the Red Planet than the Moon to which when we sent the first astronauts there in 1969' [2].

Martian historians count the year 2023 as Mars 42. Since the 1880s, manned missions to Mars have been a subject of science fiction. The end of the Second World War saw the continuous development of aerospace engineering and scientific proposals with the goal of sending two to eight astronauts. The international organisations of NASA, ESA, and ISRO, as mentioned, had human mission proposals for Mars travel in the 2010s–2020s. Among them, NASA's Artemis program of Mars-forward technologies has been designed, with its partners, to send humans (testing for four astronauts) to the Red Planet in the early 2030s (maybe 2033, which is the next low-energy launch period for an Earth–Mars trip) after the moon in the mid-2020s (projected, 2024) [7,8].

Due to the different speeds of Earth's and Mars's orbiting of the Sun, the spacecraft can stay on Mars for 30–45 days in the case of an 'opposition-class mission' [8]. The whole mission trip for the first Mars crews would be two years short or three years long (alternatively, 26 months) by the 'conjunction-class mission' or 'the Crocco flyby' [9–12]. The lowest energy transfer to Mars is a Hohmann transfer orbit, which takes nine months of travel time to Mars and then another nine months to return to Earth [13]. The Food Processing and Nutrition (FP&N) System, which is an advanced life support system for the members of the spaceship, is also working to assist the Martian mission trip with less power and energy (Figure 1) [14].

Figure 1. An artificial vegetable production system at the Kookmin University, Seoul.

Why Mars? Mars is more hospitable for humans than Venus or Mercury. The Martian day is 24 h and 40 min. The average temperature on Mars ranges from −140° to 30 °C, while Earth ranges from −88° to 58 °C. The evidence of plentiful CO_2, which is related to the possibility of growing plants, is harmonised 'with a dense gaseous atmosphere and liquid (water and ice) oceans'. Buchanan here argues that Martian methane (CH4) and oxygen (O_2) can be used as fuel sources [15,16].

Nevertheless, the critical issues of radiation, altered gravity, hostile environments, isolation or confinement, as well as the distance from Earth (travel time) are the five major hazards for astronauts during space flight [17,18]. The prepared technology of space medicine that could test psychological troubles and psychiatric symptoms of astronauts would be significant for physical health [19–21] (The ESA explores such issues in the so-called HUMEX study (ESA SP–1264)). However, the problems and mental impairments caused by living on a limited spaceship cannot be perfectly solved by space medical science to support healthy community skills between colleagues in a restricted space for a long time of two to three years (space travel period). Given these limitations, what would be an alternative mental illness prevention strategy to sustain positive human vigorous during the arduous Martian trip?

2. Space Exploration and Mental Sustainability

Astronauts have spent a significant amount of time in space since 1970. With the commercialization of space tourism in the early 2000s, a limited number of civilians have also experienced short space trips of eight to twelve days, costing $20–55 million per person. Meanwhile, the International Space Station (ISS) has offered astronauts up to six-month stays (the longest period was recorded as 437 days and 18 h in space). The long-term mission of the Shuttle-Mir Space Program (SMSP) provided an opportunity to experiment on the instances of reduced energy levels, mood changes, poor interpersonal relations, faulty decision-making, and lapses in memory and attention [22,23]. However, emergencies may still cause stress and anxiety, while the difficulty of being unable to speak with family members leads to loneliness and lethargy. The communication technique is also not well developed—sending and receiving messages take 40 min between Earth and a Mars spaceship. Under such conditions, an ISS female astronaut, despite having a long-term involvement with NASA projects, had a public outburst of rage among members with cross-cultural backgrounds. The ISS diagnosed her (an American Navy captain who was selected for NASA in 1996) with a psychiatric disorder and depression, and the mission was eventually cancelled in 2007. Cosmonaut Valeri Polyakov of the *Mir* Russian station (1986–2001) likewise confessed that 'it will be hard to have the kind of social novelty we crave' [24,25].

2.1. Space Experience with Religion

About 570 people have been to space throughout space exploration history. According to NASA data, 23 of 28 Apollo moon program astronauts were religious and were leaders in their churches [26]. Astronauts Frank Borman, Bill Anders, and Jim Lovell even read the book of Genesis from Apollo 8 on Christmas Eve, 1968 (Russian Orthodox cosmonauts also celebrated Christmas on the ISS in 2011 as they had the day off) [27]. The message of Pope Paul VI, with the statements of other world leaders, was preserved on the moon by Apollo 11. The Mission Commander of Apollo 15, David Scott, left a Bible on his lunar rover. Astronauts delivered the Blessed Sacrament, and three Catholic astronauts received Holy Communion on Space Shuttle Mission STS-59 in April 1994, followed by Michael S. Hopkins, who received Holy Communion weekly on the International Space Station during his 24-week stay in 2013. Pope Benedict XVI had a supportive dialogue with the crew of the Space Shuttle *Endeavour*.

Jeffrey Hoffman, who is an American Jewish, also took various religious objects to space between 1985 and 1996, including a yad, menorahs, Torah scroll, dreidel, Torah breastplate, hand-woven tallit, mezuzah and kiddush cups. Israeli Ilan Ramon travelled with a microfilm Torah on the Space Shuttle *Columbia* (2003). Canadian Steve MacLean was the same, carrying a Torah to the ISS in 2006. In 2015, before the Soyuz TMA-16M spacecraft launched to the ISS, an Orthodox priest was invited to bless crewmembers (NASA Astronaut Scott Kelly, Russian Cosmonauts Mikhail Kornienko and Gennady Padalka (Roscosmos)) as well as the Soyuz rocket in Kazakhstan (Figure 2).

Figure 2. An Orthodox priest blesses members of the Soyuz rocket © Philip Scott Andrews: https://time.com/3759467/rocket-blessing-soyuz/ (accessed on 24 October 2022).

During the 2000s space projects, other astronauts started to reveal their religious backgrounds. Sunita Williams, of Hindu origin, brought a personal copy of the Bhagavad Gita (a part of the epic *Mahabharata*) to the ISS in 2006, as well as an *Om* picture (a sacred spiritual symbol) and the Upanishads (उपनिषद्, late Vedic Sanskrit texts, 2012). When the Indian Space Research Organisation (ISRO) launched a PSLV-C51 rocket, another Secure Digital (SD) card version of the Bhagavad Gita was delivered into space in February 2021. While not included in public announcements, astronauts positively promoted religion as a divine power to sustain humans' internal vitality in space life and provide non-scientific support for the technical success of space missions [28]. While Japanese Buddhism does not have any inherent conflict with space science [29], Muslim astronauts demonstrated a humanistic desire beyond intellectual knowledge. Of 11 Muslims in space in the mid-1980s, there were ten males and one female. They came from nine different countries, including Saudi Arabia, Syria, the Soviet Union, Azerbaijan, Afghanistan, Kazakhstan, Kyrgyzstan, the United States, Malaysia, and United Arab Emirates. Anousheh Ansari was the first female Muslim from the United States for the 2006 Soyuz mission of Soyuz TMA-9. In 2007, the Malaysian National Space Agency (MNSA) and its Department of Islamic Development under the *Angkasawan* program (of Soyuz TMA-11) published a guidebook for Muslim astronauts (including Sheikh Muszaphar Shukor). The simplified and practical regulations included the daily prayer method, Mecca direction, attitude, ritual washing, diet, limited foods (pork and alcohol), and Ramadan.

Thus, for the previous Apollo moon and Earth orbit mission projects, many people have wanted to keep their religious lifestyle throughout the history of space exploration. There have been no negative outcomes, and the achievement of their space mission was not irrelevant to their hopes for the future of humanity [30]. If this is a typical case, one cannot ignore it as the internal benefit of astronauts for the development of Mars's long-term mission. Therefore, this paper argues that devotional behaviour in space life functioned as the main character of a mental anchor for individual astronauts, teams, and space control centres on Earth. It also served as an internal backup in case science and technology failure occurred in any procedure of the space project. The perfect plan and operation (100%) allow for the achievement of its goals. Still, the religiosity of those crew members involved in the project, either directly or indirectly, could bring a miracle(s) (=non-scientific achievement(s)) when human intelligence is unsuccessful in space travel. For the Mars space travel mission, the personal characteristics of willpower, self-confidence, endurance, self-sacrifice, and hope, based on divine will, could play a role as the final step toward escape from an unexpected crisis. This non-scientific dimension of religiosity may not be testable, but it is still good to keep in mind that not everything can be perfectly measured by space science and technology. In particular, the mental and psychological potentials of individual astronauts are beyond the capacity of human AI (artificial intelligence).

Through the project of colonising the Red Planet, *Mars One*—which is composed of the Dutch not-for-profit Stichting Mars One (Mars One Foundation) and Swiss Mars One Ventures—aims to establish a permanent human settlement on Mars. The European space agency, in this regard, stated that astronauts would bring to Mars their own ideas about religion. The *Mars One* project encourages religious freedom and activity as a matter of individual choice, while the Martian residents would be dependent on science, research, and technology for human survival and the formation of a new society.

The definition of 'astronautical religion' is not related to the concept of the Martian religion that Konrad Szocik (2019) demonstrates in *The Human Factor in a Mission to Mars: An Interdisciplinary Approach* in which humans create a new religion for those who will be born in the colony of Mars [31,32]. Szocik, a cognitive scientist specialising in philosophy, is interested in the role of religion in a situation where the first group(s) of astronauts (first Martian citizens) struggle in an extremely harsh environment. He suggests that religion has often helped maintain cooperation in society on Earth. In this way, the Polish philosopher imagines the necessity of a Martian version of a new religion for the child colonists [31]. He does not himself create the theological theory of the first Martian religion but suggests an idea of spacecraft imitating Noah's Ark. The critical role of religion is presumed in the following statement [31]:

> 'We must consider the mental and spiritual well-being of future humans in addition to providing for them physically ... as we are human beings, not robots, ... it is no doubt that religious stories—of course for believers—are much more efficient in providing sense and hope than science, technology, or philosophy'.

2.2. Human Factors in Space Exploration

Global space agencies have started to analyse the sphere of human factors. In particular, the Russian Academy of Science and NASA Extreme Environment Mission Operations (NEEMO) conducted the *Mars500* project in 2010–11, where they put six males from several different countries and cultures in underwater diving environments for 520 days [33]. David F. Dinges found psychological and behavioural changes in each individual, including depression, abnormal sleep-wake cycles, stress, homesickness, insomnia, and physical exhaustion [34]. The Hawai'i Space Exploration Analog and Simulation (HI-SEAS) similarly experimented with a stress management program where six men and women spent eight months in an isolated and confined environment (ICE). The Chinese space agency also completed the mission of a scientific space experiment on 18 September 2021 where three astronauts (Nie Haisheng, Liu Boming, and Tang Honbo) spent 90 days at the Tianhe module of China's space station (Shenzhou-12 crewed spacecraft). Kirsten Weir, a psychologist from the University of Rochester Medical Center, asserted that the psychological test presents significant research, but the *Mars500*, HI-SEAS, and Tianhe projects cannot be the perfect answers for the two- to three-year virgin Martian space exploration [35]:

> There is not enough objective data to determine the seriousness of behavioural impairments in past spaceflight missions. Nevertheless, there are reasons to suppose that psychological problems have already occurred on spaceflights. In addition, these problems will increase in frequency and severity as missions become longer and more complex, as crews become larger and more heterogeneous, and as the dangers of spaceflight become more fully appreciated.

The space trip in a small capsule for a long time exposes the team members to cumulative stress caused by various environmental factors [36]. Unexpectedly fewer choices in space often increase internal stress. In *Exploring the Nature of Space for Human Behaviour in Ordinary Structured Environments*, Boeka, a space psychologist, demonstrates the significance that 'when spatial conditions are lacking or meaningless, participants express frustration and confusion and are unable to articulate how they might engage in social activity within the image' [37]. The uncomfortable levels of temperatures, humidity, and low light are the practical factors of personal stress, followed by noise, vibrations, constant vigilance, floating particles, and limited facilities for sanitation and refreshment. The Soviet Soyuz T14-Salyut 7 mission was known to be terminated due to symptoms of depression resulting from (environmental) stress [38]. Researchers have previously analysed the physical challenges of human life from the perspective of safety and psychological well-being [39,40]. Among the five major hazards mentioned, the scientific issue of space radiation badly affects the human central nervous system, including the DNA, cells, and tissues. Galactic cosmic radiation exposure also increases various health risks like cardiovascular disease, cancer, suspicious space odour, and acute radiation syndrome (ARS) [41,42].

The prolonged period of altered gravity or micro-gravity is another issue for space travellers, giving rise to motion sickness, muscle wasting, and changes in visual perception. The cosmic phenomenon negatively impacts perception and motor behaviour. Likewise, cognitive dementia and the disruption of circadian rhythms can be potential problems due to the shorter cycle of day and night times. To counteract these effects, gymnastic activities are encouraged, and bicycle exercise (two hours for two days or 90 min for three days) is a recommended practical regulation [39]. Furthermore, the condition of weightlessness is related to the risk of urinary tract infection (UTI) and critically harms cardiovascular and neurological functions [43,44].

Space medical science can measure the physical disadvantages of the Martian trip through symptoms of nausea (or vomiting), blocked nose, muscle and bone loss, sleep deprivation, and the chance of (unknown space) disease. According to a survey of astronauts, '47 out of 89 (53%) astronauts on short space shuttle flights and 14 out of 23 (61%) on longer ISS missions shed herpes viruses in their saliva or urine samples [38]. Furthermore, the possible loss of consciousness directly involved in mission operations relates to the 4G speed of the spacecraft, where the human body feels four times lighter, and the brain would artificially need a blood supply to stay conscious [45]. The human body would face risks differently between a space station and spaceship travel to Mars. Therefore, the psychological details of brain damage during long-duration space travel are illustrated by the notion that the astronauts would experience swollen faces, thinner bone density, mineral loss, a lack of sunlight, deteriorated vision by squeezing of the optic nerves, increased iron levels, and distorted coordination [46,47]. Parihar et al. (2016) demonstrated the damage to brain function illustrated by reducing the complexity of dendrites as well as behavioural changes: memory deficits, increased anxiety, and deficits in executive function [48].

The scientific results of current psychological research have insinuated various environmental problems of human behaviour and performance in space and fewer solutions [37]. Advanced development of sophisticated space technology could reduce the impact of some major hazards like radiation, altered gravity, and a hostile environment. Nevertheless, diagnosing mental conditions that arise from isolation or confinement and distance from Earth (long space travel time) is not within the scientific or medical sphere unless researchers apply sleep therapy for a long time (for example, 20–80 h [about three days] at a time) (The medical technology of long-term sleep therapy has not yet been proved safe. See "How Long Do Sleeping Pills Stay In Your System?," in the Recovery Village, https://www.therecoveryvillage.com/sleeping-pill-addiction/how-long-stay-in-system/ (accessed on 8 July 2022)) or temporarily induce unconsciousness to consider the physical conditions of awakening or recovery [11,49]. Previous studies in deep sleep research (including hypnosis technique) have found that poor sleep quality, along with fatigue and insufficient sleep, brings more stress and inefficiency to subjects' cognitive and psychomotor performance [50].

2.3. Astronautical Religion for Long-Term Astronauts

Given this context, the creative theory of applying 'an astronautical religion' for the ascetic culture of the Martian space odyssey could be one of the mental countermeasures in the science of mind beyond human's intellectual knowledge and experiences (The term, 'astronautical religion' in this paper does not indicate the necessity of creating a new religious movement or a particular belief. It is the hypothetical proposal of a prosocio-religious environment in the space community life of astronauts. For example, the group of Christian astronauts would be mentally beneficial for the US NASA Mars space program, while the Buddhist and/or Confucian astronauts would be harmonious for the Chinese Mars space program). Science's relationship with religion is often depicted as one of 'water' and 'oil', which never associate with each other. However, as a portion of oil becomes water in the refinement process, the respect and encouragement of private religious life could improve crew members' well-being, productivity, and success rate on the Martian mission, while advanced scientific technology could lead the mechanical and software perspectives of these missions [51]. Furthermore, the effective maintenance of individual spirituality, like the cases of the Apollo moon and ISS astronauts, can psychiatrically aid the development of a positive environment in the space community, where the astronauts are without family love (from partners, children, parents, siblings, or friends). Each crew and leader's mental sustainability directly supports the achievement of the mission by deterring negativity, restlessness, despair, anger, rage, and irritation of personal situations or technical issues. Thus, experts (scientists and engineers of human factors) have discovered various issues. Nevertheless, the solutions for such physical and psychological phenomena have remained in the ambiguous stage. While computer therapy or psychoactive drugs (anxiolytics, sleep pills [such as Ambien (zolpidem) and zaleplon], anti-psychotics, intramuscular promethazine, or pain killers) can assist each astronaut's intrapersonal conflict, this support may lead to another addiction [52].

Likewise, there are no answers for many other perspectives relating to the dynamic environment of the space community, such as mental fears, uncertainty, anxiety from being in isolation or confinement, distance from Earth (lone travel time), and hostile environments. For example, stressors arising from a confined environment can relate to interpersonal distance, territoriality, and privacy. The increase in these stressors often violates the fundamental need to control the space community in emergencies [39]. A confined space team has lower motivation levels, which are directly connected to a poor ability to perform planned activities (According to Rohrer, there are three stages of reactions to isolation and confinement occur. The first period of heightened anxiety is related to perceived danger at the initial time of a long mission. While the prolonged period of boredom and depression is the second movement, the end of the mission time is the movement built up by the hypomanic effect and increased aggression and hostility) [39]. The monotonous pattern worsens human mental sustainability in space, leading to symptoms like boredom, loss of energy, concentration, distracting thoughts, and interpersonal friction. The 'asthenia' syndrome, which was first discussed by Soviet psychiatrists in the 1990s, may result from reduced stimulation levels during long monotonous travel time in space [37].

In this regard, a creative interior design is suggested to optimise living space through movable bulkheads, advanced sound insulation, curtains, and multi-purpose seats. Each person can also enjoy their hobby: sports, reading books, movies, computer games, walking, painting, etc. The following have already been simulated to maximise the crews' behaviour in the limited environment: various ideals of recreational materials, reminders of home, window decoration, relocation of furniture or equipment, keeping items of personal significance, and multimedia resources (including Netflix, YouTube, Facebook, etc.). The freedom of individuals to have pets (or artificial pets) is another idea to improve private life, provided that space technology and the space environment can support animal life. In this regard, a study reports that owning pets decreases one's blood pressure responses to mental stress [50,53].

However, there has been a lack of experimentation on the psychophysiology of emotion, despite its connections to physiological reactions, behavioural reactions, cognitive reactions, and subjective feelings of pleasure, sorrow, and disappointment [54]. Harrison and Fiedler, though, emphasise the significant role of behavioural health, for it decreases risk, increases positive performance, and offers substantial well-being to astronauts and their family members [19,22]. The survey method for emotional reactions proposes using three primary response channels. First, the language responses can be measured based on reports of feelings, evaluative judgements, and expressive communications. The second channel measures behavioral reactions like avoidance, attack, and performance deficits [52,55]. The third measures alterations of the sympathetic-adrenal-medullary system and the hypothalamic-pituitary-adrenal axis, including hormonal secretions, muscle tension, heart and respiration rate, as well as gastrointestinal, symptoms.

From this perspective, one of the most effective countermeasures to psychological difficulties could be identified by measuring and comparing each person's mental sphere in their private and astronautical lives. The *Science of Religion* (=spirituality), for which one analyses religion in a scientific way, has never been analysed in a mental dimension of space science (The concepts of 'religion' and 'spirituality' can be defined differently; while the former is a community-based group of beliefs, the latter resides within individuals. There is spirituality within religion, but someone who has spirituality does not necessarily follow a certain religion. In a broad way, this paper accepts the two terms as interchangeable and beneficial, despite the social difference. The character of 'religiosity' can be revealed either from the social motivation of religion (=community belief) or spirituality (=personal belief) for the benefit of space travel problems.). However, the systematic and efficient diagnosis for mental stability should not exclude the prosocial role (competence) of spirituality (behind human intelligence, including AI technologies) that allows space crews to naturally refresh their stressed minds through meditation and religiosity, providing a non-chemical source of vitality for healthy community life during space missions (Figure 3) [56].

Figure 3. Sacred icons being used by astronauts during their space mission, public domain.

2.4. Psychological Countermeasures in Spirituality

According to a socio-cultural survey of 74 astronauts and cosmonauts, using a common language is essential for maintaining confidential interpersonal cooperation levels [52]. If possible, this could mean choosing members of a particular nationality or at least recommending that all community members be familiar with the official language of the mission. Different cultural backgrounds could be an obstacle to earnest or serious communication in space community life [57]. Cross-cultural understanding is the interaction issue beyond linguistic dysphoria. Being members of the same ethnic identity could be advantageous to a group of astronauts for risk management and security of the initial long space journey; selecting those of the same identity could be more harmonious than choosing those selected only based on physical qualifications and scientific and technological abilities and skills [58].

In addition to social capabilities, adopting the prosocial character of religion has not been considered a human factor in previous research, where astronauts only travelled around the Earth or the Moon for times ranging from days to almost 18 months [59]. Nevertheless, Melkizedek Owuor (2021) points out that spirituality in human history has 'played a very vital role not only in unifying humanity but also in sharpening the life of humans and giving human's life meaning' [60]. Greenstein maintains that the mental health of religious life in society creates a sense of belonging (teamwork), offering a trustworthy social engagement and providing life mentorship, compassion, forgiveness, gratitude, and life lessons [61]. In this way, during the two- or three-year journey, religious behaviour could be an adaptive human factor for stimulating multiple aspects of humanity that support survival and prevent deterioration of the community. As a new hypothesis for the private and public well-being of Martian astronauts, religion can reduce social and psychological dangers in the space community. The psychiatric policy of spirituality could be a behavioural strategy as a mental countermeasure, rather than ignoring the non-scientific benefits of emotional stability and recovery (When astronauts have no alternative hope in space from technological assistance, the invisible beliefs of the space community could function to offer humans a tonic beyond limitation. It is impossible to measure the ability or capacity of religious power scientifically, but personal experience bolsters confidence, even in emergencies). For example, the minor stress that occurs from conflicts, disagreements, or misunderstandings between space colleagues during the daily operation can be released in the way of internal healing, for which the nature of religion teaches the attitudes of generosity, solicitude, scarified spirit, and mercy.

Religious behaviours used to be considered an irritating superstition in developing space science, but the experimental data of psychology, sociology, human interactions, and health research strongly prove the mental benefits of prosocial religion [62,63]. Religion is unique in that it exists in a moral and ethical context where the metaphysical conscience can enhance the prosocial behaviour of each member for the common purpose of a space community [17,64]. For instance, what kind of crew would more willingly self-sacrifice in dangerous space operations (A religio-scientific experiment would be a good chance to prove the mental management skills of religion)? Joshua Hordern (2011) argues that individuals' religious cultures connected to their consciences are a potential source of moral conduction in human communication [33,65]. The scholar presumes that group members can follow a set project or planned procedure in a normal situation. However, in an emergency, sacrificial volunteerism or solicitude is required for others or the technical success of the Mars project. Religious practices correlate with an advanced rate of committed care for other people (One can oppose this view, as it is a very one-sided view of religion) [66,67]. Fear and selfishness can arise in timeless or dangerous situations, but members' religious attitudes could altruistically solve the critical issue in the spirit of self-sacrifice (Of course, others can also argue that self-sacrifice and altruistic behaviour do not require religion).

Stone et al. (2003) identify the crisis management mechanisms of religious people through a case scenario where 'people in crisis experience a temporary loss of coping abilities and paralysis of action' [68]. While people can view the situation as either a challenge or a threat, the crisis is appraised as a challenge if people have sufficient ideas or resources. On the other hand, the opposite case could be perceived as a threat with emotional dysfunction. Stone et al. (2003) argue for the positive social support of religious beliefs in the case of a threat. This psychological support is demonstrated in a mental sphere where advanced self-esteem, self-competence, and optimistic moods enhance one's *self-concept* (self-image). They also find that inner strength and courage with fresh ideas act 'as a *stress buffer* [stress-resistance mechanism], moderating the effects of stress on both physical and mental health' [68]. This does not mean that only religious people have good mindsets and that atheists or irreligious members are not qualified or suited for an astronautical team for Mars (The detailed policy of the issue can be developed by policymakers or official authorities of the mission project. For example, non-religious people can be put in a different group or be tested for religiosity/spirituality health before being included in a team). Rather, the former group frequently considers the problems beyond personal benefits or the logical probability of success.

The attitude of endurance is another non-measurable power of religion when a dangerous or physical condition during space operation persists over a long period [69]. For example, with a religious background, certain astronauts could exert themselves over limitations and remain active for extra time, resisting and recovering effectively in the uncomfortable conditions they face, including noise, vibration, and constant vigilance. The devotional and intellectual members of the team may also have the creative motivation and dynamic of willpower that they could employ for other members' safety or security of the spaceship [70]. Thus, religious culture's non-scientific abilities and volunteerism would not be obvious in a normal situation, but it would be apparent in a life-threatening circumstance where members encounter a detrimental moment either for themselves or others.

Each member's character can be stronger when team members concede (or accept) the same or similar religion. People should respect the principle of religious diversity in any circumstance, but 'a single faith space community' (this refers to the case where 'the astronauts in space' belong to one religious group, such as Christianity (Protestanism and/or Catholicism), Judaism, Islam, or one of the other major ones) could follow an easy decision-making process when time is limited. Promoting a new mental health policy for daily reflection on long space missions would reduce conflict and divisions. Regular, private religious services would be a time to recharge or heal internally and would promote mutuality and the generous behaviour of serving others [62]. The canonical devotion or study could be a group activity followed by casual fellowship (including therapeutic recreations) with finger foods. Such time of *Koinonia* (κοινωνία, an idealised state of unity) helps members understand each other's character and personalities (Figure 4). Establishing a close camaraderie would reduce controversial communication in the limited condition of space life, creating bonds like a healthy relationship with their family on Earth [71]. Listening to sacred music, watching related movies, and VR/AR entertainment during the private time would increase internal stability (peace). Personal prayer can be encouraged to eliminate worry, anxiety, and apprehension [72] (Roberts 2015, 211–213).

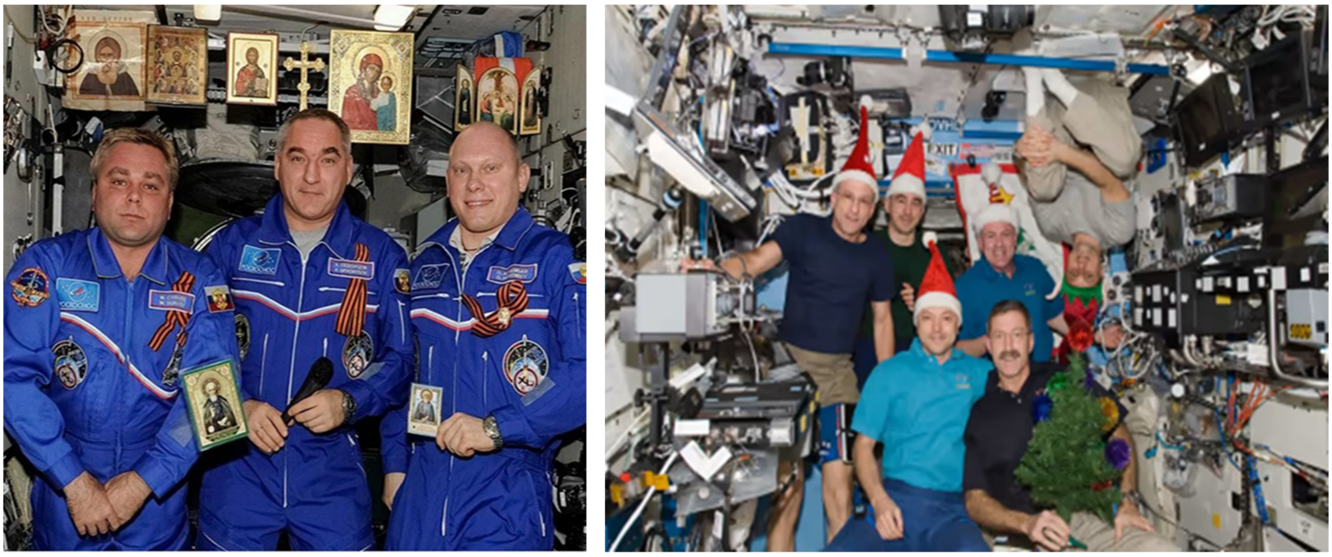

Figure 4. The scenes of *Koinonia* in space life (Soyuz and NASA), public domain.

However, such effectiveness from religious practices cannot be easily verified and accepted from a scientific perspective. This may mean that the non-scientific method of human factors may not be good enough without persuasive data. Nevertheless, the critical approach can be re-interpreted because science cannot measure or perfectly evaluate everything in the world, especially the mental world of human nature (This principle can be reflected in the aspect by which human knows well about science, but science is not perfectly able to understand its creator). Monchon et al. (2011) psychologically assert the benefit of religious involvement in the context of personal well-being. They indicate that weakly affiliated members may be less happy, and a weak religious affiliation is more detrimental to well-being than being unaffiliated counterparts with religion. However, those actively involved in religion—without smoking, drugs, sexual addiction, and drinking—'tend to be healthier, live longer and have higher levels of subjective well-being' (This is in contrast to atheists, agnostics, and those who support no religion) [73]. In terms of social levels, American scholars find that religious members commit fewer crimes (including sexual abuse), have lower rates of deviance, and have higher levels of cooperation and positive civic involvement. Individually, religion as a powerful antidote has good physical health effects, including lower rates of coronary disease, emphysema, and cirrhosis; a stronger immune system; lower blood pressure, and a longer life expectancy. Psychological disorders, including depression and lower rates of drug and alcohol use, have also been found to be greatly mitigated by religion [73,74].

Maintaining the psychiatric sustainability of humans in space is challenging. Medical assistance could be an instant solution, but it cannot be the ultimate measure for various mental situations. Some astronaut candidates, though physically perfect and intellectually qualified, may come from unstable private or family backgrounds, such as those with addictive behaviours (drug, alcohol, gambling, or sex), single parents, divorce or criminal experience, and these candidates may require more psychological therapy in space [75]. Therefore, an astronautical religion, as a moral and ethical agency, could be an effective and valuable countermeasure for such socio-environmental obstacles, including confinement, distance from Earth (long lone travel time), and a hostile environment. Furthermore, by applying the psychiatric strategy of spirituality to long-term astronauts, the human issues of cross-cultural teams, gender equality, and diverse ages (e.g., old and young, married) could be positively understood through the 'people person communication' skills (=interpersonal capacities of listening, empathizing, and problem-solving) of *Koinonia* fellowship that consider other colleagues first [76,77]. The social cohesion would relate to the common interests and activities which motivate harmony within the Mars space community. Ives and Kidwell (2019) probe the intersection of social values and religion for sustainability, in which religion as a nexus has a 'great capacity to effect change within society because its activities span both deep and shallow leverage points' (1359) [78]. They countenance the nature of religion 'as a multi-faceted embodied institution of substantial social and political relevance' (1361) [78] and as one of the key factors that can enable the dissemination of community values across multiple social scales (a special research project funded by the NRF, Korean Government (A2022-0359), is on its way to conducting psycho-religious interviews with 50–100 previous, present, and future astronauts. It would be considered to emphasise the religious or spiritual aspects that allow for the greater emotional stability of the astronauts. The international team concerns the personal experience of space life by using a professional questionnaire for the details of private and psychic attitudes. Further, a professional experiment could rationally systemise such a socio-religious policy of a space lifestyle during the long lone journey to Mars. This future research could be analogised based on the results of its mental and religious experiments since other medical factors, including aging and neurology for space trips, have already been conducted by space institutes in the USA and Europe) [17].

3. Conclusions

In general, American evangelical Protestants are less interested in supporting space exploration due to the presumption that human life is limited on Earth. However, in 2021, advanced human desire resulted in the scientific success of sending exploring rovers and a drone rotorcraft to Mars [4]. The mission project of sending humans to Mars is approaching, and it is scheduled for early 2033. Space technology is reliable enough and provides confidence, but the research priority of Martian colonization has overshadowed the study of human factors. The sustainability of humans during the two- or three-year-long trip remains an unsolved issue without scientific assurance. This paper has attempted to explore the fringe benefits of mental science from a psychiatric perspective of religion and its impacts. As many previous astronauts kept their personal religions (Judaism, Catholicism, Protestantism, Islam, Russian Orthodox Church, and Hinduism) for various reasons, there is an argument for a non-scientific method of sustaining human vitality through an astronautical religion (The hypothetical argument can be developed in the initial research field of space science and human factor study within the three perspectives of the literature study, interviewing former and current astronauts about their experiences, and a practical experiment of astronaut candidates (possibly five) in cooperation with the Human Research team, NASA) [79].

Since medical science still contains limitations for protecting the mental stability of astronauts exposed to various environmental hindrances, the psychological benefits of religion provide an alternative countermeasure beyond aerospace technology. The internal characteristics of beliefs are neither visible nor helpful for solving scientific and technical problems. However, individuals can potentially identify the divine in the context of mental health. Either for themselves or others, religious believers can avoid a lot of stress or pressure from a range of challenges, including insomnia, hatred, depression, addiction, collusion, obsession, and schizophrenia [80]. Especially in emergencies, feelings of mutuality could elicit voluntary and self-sacrificial ideas in addition to logical survival methods [81].

This paper argued that sacred strength is not rational in a secular norm, but the psychiatric aspects of an astronautical religion affect the space community's safety, security, and wholesomeness. As an effective human factor, a detailed model of religious behaviour is hypothesised regarding morality, ethics, endurance, and willpower. Regular private service activities, canonical texts, casual fellowship (with therapeutic recreations), prayer, sacred music, movies, and VR/AR entertainment are promoted for personal stability and internal relaxation. The Mars mission requires further investigation and the resolution of many scientific, technical and medical issues to improve the space trip's success. In this realm, unless the development of space travel reduces its return time to less than one year, 'the psychiatric character of religion' (This term in this paper can be defined as the nature of religion, though not visible for scientific and technical data, has a psychiatric character of medicine. The treatments of medicine (by drug and therapy) and religion (by sacred teaching and meditation) are different, but the successful results of religious psychiatry can be gleaned from astronauts' attitudes of positivity, confidence, assurance, and trust under logically impossible circumstances of space) should not be disregarded as a mental tonic for the sustainability of long-term astronauts participating in the Martian exploration project.

Funding: This research has been financially supported by the National Research Foundation (NRF: A2022-0359), Korea Foundation (KF), and the Academy of Korean Studies (AKS), Korean government.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are contained within the article.

Conflicts of Interest: The author declares no conflict of interest.

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