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DEVELOPMENT AND EXPANSION OF NEW BEVERAGES FOR THE COMMERCIAL SPACE TRAVEL ERA

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Abstract

With the expansion of private space travel in recent years, the demand for space-adapted food and beverages has been increasing. In particular, the development of appropriate beverages is a crucial challenge for maintaining nutrition and enhancing performance in microgravity and enclosed environments. This project aims to develop a sustainable energy drink suitable for space travel that supports both nutritional replenishment and performance enhancement. The goal is to create a beverage that is not only beneficial for astronauts and private space travelers but also appealing to consumers on Earth, ultimately expanding into the global market. ASTRAX has been developing an energy drink formulated with 100% natural ingredients, optimized with caffeine, vitamins, and amino acids. The available flavors include blueberry, strawberry & kiwi, caramel, and red fruits. These beverages are designed for easy consumption in microgravity and account for the changes in taste perception that occur during long-duration space missions. With manufacturing based in Mexico, ASTRAX plans to launch distribution in the U.S., Panama, Guatemala, and Colombia in 2025, followed by expansion into Asian and European markets by 2027. Ultimately, the aim is for the beverage to be adopted in commercial space travel programs, with potential applications in orbital stations, lunar and Martian bases, and interplanetary spacecraft.

This study discusses the composition, functionality, adaptability to microgravity, and commercial strategy of the beverage. It also explores test plans for space environments, the integration strategy with ASTRAX's separately developed space beer, and the potential for establishing a sustainable space beverage industry.

Keywords: Private space travel, space energy drinks, adaptation to zero gravity, nutritional supplementation and performance improvement, global market development, sustainable space beverage industry

1. Introduction

It is said that there are over 300 types of space food available to astronauts on the International Space Station. Of these, only about 10 are served as beverages. All of these are prepared for astronauts engaged in national projects and not for general space travelers.

Meanwhile, with the start of general space travel aboard private spacecraft in 2021, the need for a wider variety of space foods is expected to grow. Some space travel itineraries already offer beverages.

Furthermore, the needs for space beverages must consider not only the type of beverage, but also the method of serving and consuming it, as well as religious considerations and preparation methods tailored to individual preferences. Furthermore, in addition to the demand for beverages similar to those consumed on

Earth, it will likely be necessary to meet the demand for beverages unique to space.

This paper summarizes the results of a study on space beverages.

2. Background and Issues

Space beverages provided to astronauts in previous space development projects include water, juice packets, coffee, and milk. On the ISS, the standard method is to reconstitute powder or concentrated packets with water, with water being supplied via a recycling system (recycled from urine and moisture).

The need for nutritional supplementation and performance maintenance (including mental health

during long-term stays and in confined environments) has also been considered.

Furthermore, research has been conducted on the unique constraints of a zero-gravity environment (challenges with carbonated beverages and foaming, and a dulled sense of taste).

In the future, demand for space beverages as "enjoyable beverages" is expected to expand among commercial travelers.

2.1 Examples of Existing Space Beverages

Space beverages provided to astronauts and space travelers to date include the following:

- Main Types
- Water (essential, always available)
- Coffee (instant, espresso machine "ISSpresso" installed)
- Tea (black tea, herbal tea)
- Green tea, barley tea, oolong tea (JAXA's allocation)
- Juices (orange, apple, grape, etc.)
- Sports drinks (Pocari Sweat, Aquarius, etc.)
- Soup drinks (borscht-style soup, miso soup, bouillon, etc.)

There are around 20 types of drinks available at any given time, and when JAXA, NASA, Russia, and ESA's allocations are combined, the options reach nearly 30.

2.2 Examples of Space Drinks for Commercial Travel

This is still in its infancy, but it emphasizes "comfort and enjoyment" in line with the space tourism business.

- (1) Virgin Galactic: Water, juice, and light energy drinks (limited variety due to short duration)
- (2) Blue Origin (New Shepard): Mainly water and light energy drinks
- (3) SpaceX Crew Dragon (private passenger mission): Offers powdered drinks almost identical to those used on the ISS
- (4) Space Perspective (balloon-based space travel): Planning champagne-flavored drinks and cocktail-style non-alcoholic drinks
- (5) World View: Considering offering beverages that utilize regional characteristics

(6) Japanese research and private development: Promotional beverages such as space beer, space wine, and space tea

Currently, there are approximately 5-10 types of beverages in the practical stage (mainly water, juice, and sports drinks). In the future, it is likely that "space bar experiences" and "space specialty beverages" will become more widely available.

3. ASTRAX Beverage Development Initiatives

ASTRAX has been conducting research and development to make space beer drinkable in space (see References []). In addition to space beer development, the company has also been developing space tequila in Mexico.

ASTRAX is currently developing a space energy drink. This paper summarizes the development of this space energy drink. ASTRAX space energy drink is being developed with the following objectives in mind:

- (1) Design concept based on 100% natural ingredients
- (2) Ingredient composition: Optimal blend of caffeine, vitamins, and amino acids
- (3) Flavor variations: Blueberry, strawberry & kiwi, caramel, red fruit
- (4) Accommodating changes in taste (addressing the tendency for strong cravings for sweet and spicy flavors during long-term space stays)
- (5) Developing a container and texture that takes into account ease of consumption in zero gravity

4. Technical Considerations

The following research is planned for technical considerations.

- (1) Liquid handling methods in a zero-gravity environment (especially carbonated beverages)
- (2) Container design (Earth-like drinking methods/space-specific drinking methods)
- (3) Shelf life and sustainability (room temperature storage, refrigerated storage, shelf life, lightweight design)
- (4) Space environment testing plans (demonstration tests on parabolic flights and various spacecraft)

5. Market Development Strategy

5.1 Manufacturing and Global Expansion

ASTRAX is developing a space energy drink and plans to expand its market both in space and on Earth, focusing on the following:

(1) Manufacturing Base: Reasons for Based in Mexico (Cost, Logistics, Market Access)

(2) Expansion Schedule:

- 2026: United States, Panama, Guatemala, Colombia
- 2027: Expansion into Asia (including Japan) and Europe

(3) Dual Strategy Targeting Both the Terrestrial and Space Markets Simultaneously

(4) Brand Value: Premium Value as a "Space Drink"

5.2 Integration Strategy with Space Beer

(1) Synergy with ASTRAX's "Space Beer" Development

(2) Separation of Alcoholic and Non-Alcoholic Beverages

(3) Packaging "Beverage Experiences" in Space Hotels and Tourism Programs

5.3 The Potential of a Sustainable Space Beverage Industry

(1) The Significance of "Dual-Use Beverages" Connecting Earth and Space

(2) Technology Reimported from the Space Environment (Applications to Disaster Prevention, Medical, and Outdoor Markets)

(3) The Role of "Food and Beverages" in Shaping Space Culture

5.4 Concrete Demonstration Experiments for Market Development

To develop the market for space energy drinks and space beers, we are planning the following demonstration experiments:

(1) Offering at a space izakaya (currently suspended) run by a colleague of the ASTRAX Group

(2) Offering at a space bar that ASTRAX plans to open in the future

(3) Offering during ASTRAX's zero-gravity flight service

(4) Expanding sales channels and selling at various restaurants, events, online, etc.

6. Conclusion

More than just providing nutrition, space beverage development contributes to "improving the quality of life in space" and "expanding the appeal of space travel."

ASTRAX's efforts have the potential to simultaneously invigorate both the terrestrial and space markets and create a sustainable space beverage industry.

References

Reference to a conference/congress paper:

[1] T. Yamazaki, 民間商業宇宙飛行士と新規宇宙ビジネスの展開について, 3D18, 50th Space Science and Technology Conference, Kita Kyushu, Japan, 2006, 8- 10 November.

[2] T. Yamazaki, OVERVIEW OF ASTRAX SPACE SERVICES INCLUDING OVER 50 SPACE BUSINESSES, ISDC-2018-Many Roads to Space, International Space Development Conference 2018, Los Angeles, USA, 2018, 24-27 May.

[3] T. Yamazaki, ASTRAX ZERO GRAVITY FLIGHT SERVICES IN JAPAN, ISDC-2018-Many Roads to Space, International Space Development Conference 2018, Los Angeles, USA, 2018, 24-27 May.

[4] T. Yamazaki, ASTRAX LUNAR CITY DEVELOPMENT PROJECT, ISDC-2019-Many Roads to Space, International Space Development Conference 2019, Washington D.C., USA, 2019, 5-9 June.

[5] T. Yamazaki, ASTRAX SPACE SERVICES PLATFORM BY USING BLOCKCHAIN TECHNOLOGY, ISDC-2019-Many Roads to Space, International Space Development Conference 2019, Washington D.C., USA, 2019, 5-9 June.

[6] Taichi Yamazaki, Buhe Heshige, Yoshihide Nagase, ASTRAX UNIVERSAL SERVICE PLATFORM BY USING BLOCKCHAIN TECHNOLOGY, IAC-19-E6.5-GST.1.6, 70th International Astronautical Congress (IAC), Washington D.C., United States, 2019, 21-25 October.

[7] Taichi Yamazaki, MISSION CONTROL CENTER TO SUPPORT COMMERCIAL SPACE MISSIONS AND PASSENGER'S ACTIVITIES INSIDE OF THE CABIN, IAC-19-B3.2.3, 70th International Astronautical Congress (IAC), Washington D.C., United States, 2019, 21-25 October.

[8] Taichi Yamazaki, ASTRAX ACADEMY AND SPACE BUSINESS AND SPACE FLIGHT SUPPORT EDUCATIONAL SYSTEM, Next-Generation Suborbital Researchers Conference

- (NSRC), Broomfield, CO, United States, 2020, 2-4 March.
- [9] Taichi Yamazaki, MISSION SUPPORT CONTROL CENTER AND SUBORBITAL SPACECRAFT SIMULATOR TO SUPPORT COMMERCIAL SPACE MISSIONS AND CUSTOMER ACTIVITIES, Next-Generation Suborbital Researchers Conference (NSRC), Broomfield, CO, United States, 2020, 2-4 March.
- [10] Taichi Yamazaki, ZERO-G-NAUT AND MISSION COMMANDER TO SUPPORT COMMERCIAL SPACE MISSIONS AND CUSTOMER ACTIVITIES INSIDE CABIN, Next-Generation Suborbital Researchers Conference (NSRC), Broomfield, CO, United States, 2020, 2-4 March.
- [11] Taichi Yamazaki, "SPACE SCOOTER": SPACE MOBILITY SYSTEM USED IN SPACE HOTELS AND SPACE STATIONS, IAC-20-B3.7.17, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [12] Taichi Yamazaki, ASTRAX LUNAR CITY DEVELOPMENT PROJECT 2020, IAC-20-D4.2.11, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [13] Taichi Yamazaki, ASTRAX LUNAR CITY ECONOMIC SYSTEM BY USING BLOCKCHAIN TECHNOLOGY, IAC-20-E6.2.9, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [14] Taichi Yamazaki, ASTRAX SPACE SERVICE CATALOG SYSTEM FOR SPACE TOURISM, IAC-20-B3.2.12, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [15] Taichi Yamazaki, ASTRAX UNIVERSAL SERVICE PLATFORM BY USING BLOCKCHAIN TECHNOLOGY, IAC-20-D4.1.20, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [16] Taichi Yamazaki, EXPERIENCE AND LESSONS LEARNED FROM THE COVID-19 PROBLEM IN JAPAN AND APPLICATION TO SPACE TRAVEL, IAC-20-A1.3.15, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [17] Taichi Yamazaki, ZERO-G-NAUT AND MISSION COMMANDER TO SUPPORT COMMERCIAL SPACE MISSION AND CUSTOMER ACTIVITIES INSIDE CABIN, IAC-20-B3.2.13, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [18] Chieko Takahashi, Yuko Kirihara, Creating a new business of Space Flight Attendant service & SFA Academy, IAC-20-B3.2.10, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [19] Taiko Kawakami, Taichi Yamazaki, THE IMPORTANCE OF KIMONO IN SPACE, IAC-20-E1.9.2, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [20] Taiko Kawakami, Taichi Yamazaki, WHAT WOMEN NEED FOR SPACE TRAVEL, IAC-20-E3.2.9, 71st International Astronautical Congress (IAC), The CyberSpace Edition, 2020, 12-14 October.
- [21] Hayaki Tsuji, Taichi Yamazaki, Satoshi Takamura, Yoichi Sugiura, PEACE THOUGHT AND SOCIO-ECONOMY FOR THE SPACE AGE USING SATELLITES, IAC-20-E5.5.5, 71st International Astronautical Congress (IAC) – The CyberSpace Edition, 2020, 12-14 October.
- [22] Taichi Yamazaki, ADVANCED SPACE SERVICE ACCESS APPLICATION TOOL: ASTRAX UNIVERSAL USER INTERFACE (U2U), IAC-20-B3.1.11, 71st International Astronautical Congress (IAC) – The CyberSpace Edition, 2020, 12-14 October.
- [23] Taichi Yamazaki, Taiko Kawakami, ASTRAX LUNAR CITY DEVELOPMENT PROJECT 2021, IAC-21-D3.1.6, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [24] Taichi Yamazaki, COMMERCIAL SPACE MISSION SUPPORT CONTROL CENTER AND SUBORBITAL SPACECRAFT SIMULATOR TO SUPPORT COMMERCIAL SPACE MISSIONS AND PASSENGERS ACTIVITIES IN SPACE, IAC-21-B6.2.12, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [25] Taichi Yamazaki, INITIATIVE OF DEVELOPMENT OF THE SOLAR SYSTEM ECONOMIC BLOC BY USING BLOCKCHAIN TECHNOLOGY, IAC-21-D4.1.11, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [26] Taichi Yamazaki, Mika Islam, SPACE FASHION AND SPACE CULTURE IN THE AGE OF SPACE TRAVEL AND THE POSSIBILITIES OF "SPACE HAGOROMO", IAC-21-E5.3.6, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [27] Taichi Yamazaki, Taiko Kawakami, Keiichi Iwasaki, Akifumi Mimura, MAKING ASTRAX ACADEMY ONLINE AND MULTILINGUAL, IAC-21-E1.7.10, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.

- [28] Taichi Yamazaki, POTENTIAL FUTURE PLAN OF SPACE IZAKAYA AS A PLACE TO CREATE NEW PRIVATE SPACE BUSINESS, IAC-21-E1.9.10, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [29] Taichi Yamazaki, FOSTERING UNIVERSAL HUMAN RESOURCES AND SUPER NEWTYPES FOR THE SPACE AGE, IAC-21-E1.9.8, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [30] Taichi Yamazaki, Shunsuke Chiba, DEMAND AND SUPPLY MATCHING BY THE ASTRAX LUNAR CITY BUSINESS COMMUNITY AND RESIDENCE CLUB, IAC-21-D3.3.3, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [31] Taichi Yamazaki, OUTLINE OF ASTRAX PRIVATE SPACE BUSINESS CREATION EDUCATION AND TRAINING CENTER, IAC-21-B3.2.5, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [32] Taichi Yamazaki, PROTOTYPE PLANS FOR VARIOUS COMMERCIAL SPACECRAFT TRAINING SIMULATORS, IAC-21-B3.2.2, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [33] Taichi Yamazaki, Yuki Yamazaki, EXPERIMENTS ON COLORING SOAP BUBBLES UNDER MICROGRAVITY, IAC-21-A2.6.5, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [34] Taichi Yamazaki, STUDY OF THE SELECTION OF LOCATION FOR COMMERCIAL SPACEPORTS IN JAPAN, IAC-21-D6.3.8, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [35] Taichi Yamazaki, SPACE RADIATION SHIELDING BY WATER DOME IN ASTRAX LUNAR CITY ON THE MOON, IAC-21-A1.5.10, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [36] Taichi Yamazaki, Hiroki Nakaegawa, INTRODUCTION OF A PRACTICAL EXAMPLE OF ASTRAX LUNAR CITY MAPPING WITH MINECRAFT AND ITS LINKAGE TO ECONOMIC ACTIVITIES ON EARTH, IAC-21-D4.2.6, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [37] Taichi Yamazaki, Hiroki Nakaegawa, DEVELOPMENT OF A CIVILIAN SPACECRAFT INTERIOR SIMULATOR USING MINECRAFT, IAC-21-B6.3.11, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [38] Taichi Yamazaki, PROPOSAL TO ADD A SPACE ECONOMICS SUBCOMMITTEE TO THE UN OFFICE FOR OUTER SPACE AFFAIRS' COMMITTEE ON THE PEACEFUL USES OF OUTER SPACE (COPUOS IN UNOOSA), IAC-21-E3.4.7, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [39] Ayako Kurono, Haruto Kurono, Taichi Yamazaki, THE GENDER GAP AND ITS IMPACT IN MANGA, ANIME AND OTHER SPACE CREATIONS, IAC-21-E5.3.10, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [40] Ayako Kurono, Haruto Kurono, Taichi Yamazaki, CAREER DESIGN IN SPACE - FROM CHALLENGED TO CHALLENGING, IAC-21-B3.9-GTS.2.1, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [41] Haruto Kurono, Ayako Kurono, Taichi Yamazaki, THE EFFECTS OF USING MINECRAFT TO TEACH CHILDREN ABOUT SPACE, IAC-21-E1.8.2, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [42] Tomoko Imaizumi, Taichi Yamazaki, MAINTAINING THE HEALTH OF PILOTS AND CREW, IAC-21-D6.3.4, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [43] Taichi Yamazaki, Mami Oka, CONSIDERATION ON THE CREATION OF A CHICKEN EGG MARKET AT THE MOON VILLAGE, IAC-21-D4.2.10, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [44] Chieko Takahashi, Yuko Kiriara, Taichi Yamazaki, CONSIDERATION OF THE FUTURE PROSPECTS OF THE SPACE FLIGHT ATTENDANT(SFA) PROFESSION WITH THE EXPANSION OF SPACE TRAVEL MARKETING, IAC-21-B3.9-GTS.2.10, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [45] Taiko Kawakami, Taichi Yamazaki, PROBLEMS AND SOLUTIONS THAT ARE PREVENTING MORE WOMEN FROM BECOMING SPACE TOURISTS, IAC-21-B3.2.3, 72nd International Astronautical Congress (IAC), Dubai, United Arab Emirates, 2021, 25-29 October.
- [46] Taichi Yamazaki, Taiko Kawakami, DEVELOPMENT OF A TERIPPER FOR INTRA-SPACECRAFT TRANSPORTATION,

- IAC-22-A1.3.17, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [47] Taichi Yamazaki, Taiko Kawakami, POSSIBILITY OF ZERO-GRAVITY FLIGHT SERVICE BY MRJ (MITSUBISHI REGIONAL JET), IAC-22-A2.IPB.1, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [48] Taichi Yamazaki, Taiko Kawakami, DEVELOPMENT OF ASTRAX COMMERCIAL SPACECRAFT EDUCATION AND TRAINING SIMULATOR, IAC-22-B3.IPB.4, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [49] Taichi Yamazaki, Taiko Kawakami, DEVELOPMENT OF SPACE SHOWER, IAC-22-B3.3.5, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [50] Taichi Yamazaki, Taiko Kawakami, PRODUCTION OF SPACE SUITS AND REPLICAS FOR SPACE TRAVEL, IAC-22-B3.9-GTS.2.1, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [51] Taichi Yamazaki, Taiko Kawakami, ADVANCED SPACE SERVICE ACCESS APPLICATION TOOL “ASTRAX UNIVERSAL USER INTERFACE (ASTRAX U2U)”, IAC-22-B5.IP.7, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [52] Taichi Yamazaki, Taiko Kawakami, ASTRAX SOLAR SYSTEM ECONOMIC BLOC CONCEPT USING NFT AND METAVERSE TECHNOLOGIES, IAC-22-D4.1.10, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [53] Taichi Yamazaki, Taiko Kawakami, DEVELOPMENT OF A REAL-LIFE (ANALOG) ASTRAX LUNAR CITY CONSTRUCTION PROJECT IN JAPAN, IAC-22-D4.2.6, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [54] Taichi Yamazaki, Taiko Kawakami, MULTILINGUALIZATION OF ASTRAX ACADEMY, IAC-22-E1.7.10, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [55] Taichi Yamazaki, Taiko Kawakami, POSSIBILITY OF ZERO-GRAVITY FLIGHT AND SPACE FLIGHT BY PEOPLE WITH DISABILITIES, IAC-22-E1.9.18, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [56] Taichi Yamazaki, Kentaro Chimura, Taiko Kawakami, DEVELOPMENT OF SPACE TOILET "SPACE BENKING" IN JAPAN, IAC-22-E5.IP.10, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [57] Taichi Yamazaki, Taiko Kawakami, DISASTER PREVENTION AND EVACUATION TECHNOLOGIES ON EARTH AND THEIR APPLICATION TO SPACE TRAVEL, IAC-22-E5.4.9, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [58] Mika Islam, Taichi Yamazaki, CLEANING METHODS FOR REUSING CLOTHES IN SPACE, IAC-22-B3.7.7, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [59] Mika Islam, Taichi Yamazaki, HOW TO GO TO SPACE WITH DIFFERENT HAIRSTYLES, IAC-22-E1.9.7, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [60] Yuko Kirihaara, Airi Negisawa, Chieko Takahashi, Taichi Yamazaki, Cocoro Tamura, RESEARCH ON PSYCHOLOGICAL CHANGES AND GROWTH OF CHILDREN THROUGH EDUCATION RELATED TO COMMERCIAL SPACE BUSINESS, IAC-22-E1.IPB.9, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [61] Ayako Kurono, Taichi Yamazaki, WHAT DO THEY NEED FOR A SPACE MUSEUM?, IAC-22-E5.5.8, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [62] Haruto Kurono, Taichi Yamazaki, ESTABLISHMENT AND DEVELOPMENT OF A LUNAR COMMUNITY AND ACTIVITY SPACE BY CHILDREN FOR CHILDREN, IAC-22-D4.2.10, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [63] Akifumi Mimura, Taichi Yamazaki, VIDEO EDITING SERVICES FOR SPACE TRAVELLERS, IAC-22-B3.2.6, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [64] Akifumi Mimura, Taichi Yamazaki, TECHNOLOGIES ON A TRANSPARENT RESTROOM COULD BE USED FOR LUNAR HABITATS, IAC-22-E5.1.8, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [65] Taiko Kawakami, Taichi Yamazaki, ASTRAX LUNAR CITY PROJECT 2022, IAC-22-D3.1.12, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [66] Chikako Murayama, Taichi Yamazaki, THE NEED FOR A SPACE VERSION OF HAND SIGNALS, A COMMUNICATION TOOL FOR SPACE TRAVELERS, IAC-22-B3.2.1, 73rd International

- Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [67] Chikako Murayama, Taichi Yamazaki, Taiko Kawakami, PHOTOGRAPHY SERVICES AND TECHNIQUES REQUIRED FOR SPACE TRAVEL, IAC-22-D6.1.8, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [68] Chikako Murayama, Taichi Yamazaki, ON IMAGES OF THE UNIVERSE INFLUENCED BY MANGA AND ANIME, IAC-22-E1.9.3, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [69] Hikaru Otsuka, Taichi Yamazaki, A SPACE EDUCATION PROGRAM TO SOLVE THE SHORTAGE OF COMMERCIAL SPACE TEACHERS IN JAPANESE SCHOOLS, IAC-22-E1.7.8, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [70] Yasuko Fukushima, Taichi Yamazaki, HOW TO CAPTURE THE COSMIC DIVERSITY THAT IS COMING, IAC-22-E1.9.22, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [71] Chieko Takahashi, Taichi Yamazaki, THE ROLE OF SPACE FLIGHT ATTENDANTS IN LARGE, LONG-DURATION SPACE TRAVEL, IAC-22-B3.2.10, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [72] Kiyomi Shigematsu, Taichi Yamazaki, PROPOSAL FOR A BUSINESS MODEL THAT ENABLES AND ENCOURAGES OLDER ADULTS TO TRAVEL TO SPACE, IAC-22-E5.IP.22, 73rd International Astronautical Congress (IAC), Paris, France, 2022, 18-22 September.
- [73] Taichi Yamazaki, Taiko Kawakami, Fumihiro Oiwa, DEVELOPMENT OF ASTRAX ZERO GRAVITY AIRCRAFT EDUCATION AND TRAINING SIMULATOR, IAC-23-A2.5.9, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [74] Taichi Yamazaki, Taiko Kawakami, DEVELOPING TECHNOLOGY FOR DRINKING CHILLED CARBONATED BEVERAGES IN SPACE, IAC-23-B5.1.11, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October."
- [75] Taichi Yamazaki, Taiko Kawakami, Hiroki Nakaegawa, DEVELOPMENT OF COMMERCIAL SPACECRAFT EDUCATION AND TRAINING SIMULATOR USING THE METAVERSE, IAC-23-D1.1.6, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [76] Taichi Yamazaki, Taiko Kawakami, CONSTRUCTION PLAN OF ASTRAX LUNAR CITY SIMULATION FACILITY IN JAPAN, IAC-23-D4.2.9, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [77] Taichi Yamazaki, Taiko Kawakami, Kentaro Chimura, DEVELOPMENT OF THE SPACE TOILET CALLED "SPACE BENKING" 2023, IAC-23-E5.4.3, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [78] Taichi Yamazaki, Taiko Kawakami, INTRODUCTION OF COMMERCIAL SPACE R&D CENTER "ASTRAX LAB" IN JAPAN, IAC-23-B3.IP.5, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [79] Taichi Yamazaki, Taiko Kawakami, ANALYSIS OF PASSENGERS' NEEDS AND DEMANDS OF ASTRAX ZERO GRAVITY SERVICES AND APPLICATION FOR SPACE TRAVEL SERVICES, IAC-23-B3.IP.1, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [80] Taiko Kawakami, Taichi Yamazaki, THE SENSES AND CREATIVITY THAT CAN BE ACHIEVED BY BRINGING ENTERTAINMENT IN SPACE, IAC-23-E1.IP.22, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [81] Taiko Kawakami, Taichi Yamazaki, TECHNOLOGY, PROBLEMS AND SOLUTIONS FOR DRINKING ALCOHOL IN SPACE, IAC-23-E1.9.2, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [82] Taiko Kawakami, Taichi Yamazaki, TECHNOLOGY, PROBLEMS, AND SOLUTIONS FOR SPACE TRAVEL MEALS AS REPRESENTED BY "YAKITORI", GRILLED CHICKEN, IAC-23-B5.IP.2, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October."
- [83] Taiko Kawakami, Taichi Yamazaki, THE POSSIBILITY OF DEVELOPING JAPANESE CULTURE THROUGH "NATTO" IN SPACE, IAC-23-E5.IP.17, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [84] Hikaru Otsuka, Taichi Yamazaki, LOCAL REVITALIZATION PROJECT TO TURN MY HOMETOWN, KOMONO TOWN, INTO "SPACE TOWN", IAC-23-E1.9.3, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [85] Hikaru Otsuka, Taichi Yamazaki, METHODS AND PRACTICES FOR INTRODUCING PRIVATE SPACE EDUCATION PROGRAMS INTO JAPANESE SCHOOLS, IAC-23-E1.2.8, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.

- [86] Masahiko Takehara, Taichi Yamazaki, ASTROLOGY IN THE SPACE AGE: WHAT WILL HAPPEN TO THE HOROSCOPES OF THOSE BORN ON THE MOON?, IAC-23-E1.9.8, 74th International Astronautical Congress (IAC), Baku, Azerbaijan, 2023, 2-6 October.
- [87] Taichi Yamazaki, Taiko Kawakami, COMMERCIAL SPACE SUIT R&D CENTER "ASTRAX WAER LAB" 2024, IAC-24-E5,IP,26, 75th International Astronautical Congress (IAC), Milan, Italy, 2024, 14-18 October.
- [88] Taichi Yamazaki, Taiko Kawakami, DEVELOPMENT OF ASTRAX COMMERCIAL SPACECRAFT MISSION SUPPORT CONTROL CENTER IN JAPAN 2024, IAC-24-B6,1,8, 75th International Astronautical Congress (IAC), Milan, Italy, 2024, 14-18 October.
- [89] Taichi Yamazaki, Taiko Kawakami, ASTRAX LUNAR CITY SIMULATION FACILITY CONSTRUCTION PLAN IN JAPAN 2024, IAC-24-D4,2,9, 75th International Astronautical Congress (IAC), Milan, Italy, 2024, 14-18 October.
- [90] Ayako Kurono, Taichi Yamazaki, EXPLORING THE CONCEPT AND POTENTIAL OF SPACE MUSEUMS FOR PRESERVATION, EDUCATION, AND TOURISM, IAC-24-E5,5,10, 75th International Astronautical Congress (IAC), Milan, Italy, 2024, 14-18 October.
- [91] Taichi Yamazaki, Taiko Kawakami, DEVELOPMENT OF RAMEN EATEN IN SPACE, IAC-25-B3,IP,21,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [92] Taichi Yamazaki, Taiko Kawakami, THE POTENTIAL OF SPACE NFTS, IAC-25-E3,IP,15,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [93] Taichi Yamazaki, Taiko Kawakami, UNIFORMS FOR PRIVATE SPACEFLIGHT MISSION COMMANDERS AND SPACE FLIGHT ATTENDANTS, IAC-25-B3,IP,22,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [94] Taichi Yamazaki, Taiko Kawakami, DEVELOPMENT AND EXPANSION OF NEW BEVERAGES FOR THE COMMERCIAL SPACE TRAVEL ERA, IAC-25-E6,IP,39,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [95] Taichi Yamazaki, Taiko Kawakami, A VERSATILE SPACE APPLICATION TOOL TO SUPPORT LIFE IN SPACE: INTRODUCTION TO ASTRAX U2U, IAC-25-D2,IP,25,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [96] Taichi Yamazaki, Taiko Kawakami, A SPACE VALUE STANDARD TO SUPPORT LIFE IN SPACE: INTRODUCTION TO ASTRAX VALUE, IAC-25-IP,6,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [97] Taichi Yamazaki, Taiko Kawakami, DEVELOPMENT OF ASTRAX SPACE MISSION SUPPORT CONTROL CENTER 2025, IAC-25-B3,4-B6.4,15,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [98] Taiko Kawakami, Taichi Yamazaki, ASTRAX LUNAR CITY PROJECT 2025, IAC-25-D4,2,12,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [99] Taiko Kawakami, Taichi Yamazaki, CONSTRUCTION PLAN OF ASTRAX LUNAR CITY SIMULATION FACILITY IN JAPAN 2025, IAC-25-E5,IP,21,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [100] Hikaru Otsuka, Taichi Yamazaki, IMPLEMENTING A RURAL REVITALIZATION PROJECT TO TURN MY HOMETOWN, KOMONO TOWN, INTO A 'SPACE TOWN', IAC-25-E1,9,12,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [101] Ayako Kurono, Haruto Kurono, Taichi Yamazaki, WHO GOVERNS SPACE MUSEUMS? LEGAL AND POLICY CHALLENGES IN THE NEW SPACE ERA, IAC-25-E5,5,9,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [102] Taiko Kawakami, Taichi Yamazaki, ESTABLISHING A CULTURE OF DRINKING IN SPACE: REALIZING A BEER EXPERIENCE IN SPACE EQUIVALENT TO THAT ON EARTH, IAC-25-E1,9,18,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.
- [103] Taichi Yamazaki, Taiko Kawakami, SPACE BUSINESS DEVELOPMENT EDUCATION AND TRAINING ACADEMY: ASTRAX ACADEMY 2025, IAC-25-E1,LBA,9,76th International Astronautical Congress (IAC 2025), Sydney, Australia, 29 Sep-3 Oct 2025.

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民間宇宙旅行時代の新たな飲料開発と展開

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Abstract

With the expansion of private space travel in recent years, the demand for space-adapted food and beverages has been increasing. In particular, the development of appropriate beverages is a crucial challenge for maintaining nutrition and enhancing performance in microgravity and enclosed environments.

This project aims to develop a sustainable energy drink suitable for space travel that supports both nutritional replenishment and performance enhancement. The goal is to create a beverage that is not only beneficial for astronauts and private space travelers but also appealing to consumers on Earth, ultimately expanding into the global market. ASTRAX has been developing an energy drink formulated with 100% natural ingredients, optimized with caffeine, vitamins, and amino acids. The available flavors include blueberry, strawberry & kiwi, caramel, and red fruits. These beverages are designed for easy consumption in microgravity and account for the changes in taste perception that occur during long-duration space missions. With manufacturing based in Mexico, ASTRAX plans to launch distribution in the U.S., Panama, Guatemala, and Colombia in 2025, followed by expansion into Asian and European markets by 2027. Ultimately, the aim is for the beverage to be adopted in commercial space travel programs, with potential applications in orbital stations, lunar and Martian bases, and interplanetary spacecraft. This study discusses the composition, functionality, adaptability to microgravity, and commercial strategy of the beverage. It also explores test plans for space environments, the integration strategy with ASTRAX's separately developed space beer, and the potential for establishing a sustainable space beverage industry.

Keywords: (maximum 6 keywords)

アブストラクト

近年、一般人による民間宇宙旅行の拡大により、宇宙空間に適応した様々な食品・飲料の需要が高まっている。また、無重力環境や閉鎖空間における栄養補給とパフォーマンス向上のため、適切な飲料の開発が重要な課題である。そこで、本プロジェクトの目的は、宇宙旅行中の栄養補給とパフォーマンス向上を図るために、宇宙環境における持続可能なエナジードリンクを開発し、宇宙飛行士・民間宇宙旅行者だけでなく、地上の消費者にも適した飲料として世界市場に展開することである。ASTRAXは、これまで、100%天然成分を使用し、カフェイン、ビタミン、アミノ酸を最適配合したエナジードリンクの開発を進めてきた。フレーバーにはブルーベリー、ストロベリー & キウイ、キャラメル、レッドフルーツの4種類がある。これらは、宇宙飛行士や民間宇宙旅行者向けに無重力下でも飲みやすい設計がされており、長期間の宇宙飛行における味覚変化にも対応している。また、メキシコでの製造拠点を基盤に、2025年からアメリカ、パナマ、グアテマラ、コロンビアなどの市場に展開し、2027年にはアジアやヨーロッパ市場にも進出する予定である。最終的には、商業宇宙旅行プログラムでの採用を目指し、軌道上ステーションや月面基地や火星基地、惑星間移動用宇宙船内でも使用されることを視野に入れている。

本研究では、飲料の成分、機能性、無重力環境での適応性、および商業戦略について、宇宙環境でのテスト計画、ASTRAX が別途開発を行っている宇宙ビールとの統合戦略についても議論し、持続可能な宇宙飲料産業の新たな創出の可能性について論じる。

キーワード: 民間宇宙旅行、宇宙エナジードリンク、無重力環境適応、栄養補給・パフォーマンス向上、世界市場展開、持続可能な宇宙飲料産業

1. 序論

国際宇宙ステーションの宇宙飛行士が食べることができる宇宙食は 300 種類以上あると言われている。そのうち、飲み物として提供されているものは約 10 種類ほどである。これらはすべて国家事業に関わる宇宙飛行士のために用意されたものであり、一般の宇宙旅行者向けに作られたものではない。

一方、2021 年から民間各社の宇宙船による一般的な宇宙旅行が現実的に始まり、今後はますます多様な宇宙食のニーズが高まっていくことが予想される。そのなかで、すでに飲み物を提供している宇宙旅行も存在する。また、宇宙飲料のニーズとしては種類だけでなく、提供方法や飲み方に始まり、宗教的な配慮や個々人の嗜好に合わせた調理方法などを考慮する必要がある。さらに、地上と同様の飲み方に対する需要に加えて、「宇宙ならでは」の飲み方に対する需要にも応えていくことが求められるだろう。

本論文では、そのような宇宙飲料に関する検討結果をまとめて発表する。

2. 背景と課題

これまでの宇宙開発において宇宙飛行士に提供されてきた宇宙飲料には、水やパック状のジュース、コーヒー、ミルクなどがある。ISS では「粉末または濃縮パックを水で戻して飲む方式」が標準であり、水自体はリサイクル装置（尿や湿気から再生）によって供給される。

また、栄養補給やパフォーマンス維持の必要性（長期滞在や閉鎖環境でのメンタル面を含む）も検討されてきた。さらに、無重力環境特有の制約（炭酸飲料や泡立ちの課題、味覚の鈍化）に関する研究も進められてきた。今後は、民間旅行者にとって「楽しむ飲料」としてのニーズが拡大していくことが予想される。

2.1 既存の宇宙飲料の例

これまで宇宙飛行士や宇宙旅行者に提供されてきた宇宙飲料には以下のようなものがある。

主な種類

水（必須・常備）

コーヒー（インスタント、エスプレッソマシン「ISSpresso」導入）

紅茶（紅茶・ハーブティー）

緑茶・麦茶・烏龍茶（JAXA 枠）

ジュース類（オレンジ、アップル、グレープなど）

スポーツドリンク（ポカリスエット、アクエリアスなど）

スープ飲料（ボルシチ風スープ、みそ汁、ブイヨンなど）

常時利用可能なレパートリーは 20 種類前後であり、JAXA・NASA・ロシア・ESA の枠を合わせると、選択肢は 30 種類近くに及ぶ。

2.2 民間旅行用の宇宙飲料の例

こちらはまだ発展途上であるが、宇宙観光ビジネスに合わせて「快適さ・楽しさ」を重視している。

(1) Virgin Galactic: 水、ジュース、軽い栄養ドリンク（短時間のため種類は少ない）

(2) Blue Origin (New Shepard): 基本的に水と軽い栄養ドリンク程度

(3) SpaceX Crew Dragon (民間乗客ミッション): ISS 仕様とほぼ同じ粉末飲料を提供

(4) Space Perspective (気球型宇宙旅行): シャンパン風飲料やカクテル風ノンアルコール飲料を計画中

(5) World View: 地域の特徴を活かした飲料の提供を検討

(6) 日本の研究・民間開発: 宇宙ビール、宇宙ワイン、宇宙茶などの PR 用飲料
現在実用段階にあるものは 5~10 種類程度（水、ジュース、スポーツドリンクが中心）。今後は「宇宙バー体験」や「宇宙特産品飲料」の提供が拡大する可能性が高い。

3. ASTRAX による飲料開発の取り組み

ASTRAX では、これまで宇宙ビールを宇宙で飲めるようにするための研究開発を行ってきた（参考文献【】参照）。さらに、宇宙ビールの開発に加え、メキシコにおいて宇宙テキーラの開発も進めてきた。

また、現在は宇宙エナジードリンクの開発を行っている。本論文では、この宇宙エナジードリンクの開発についてまとめる。ASTRAX 宇宙エナジードリンクは以下の観点で開発を進めている。

(1) 100%天然成分をベースにした設計理念

(2) 成分構成: カフェイン、ビタミン群、アミノ酸の最適配合

- (3) 味覚バリエーション: ブルーベリー、ストロベリー & キウイ、キャラメル、レッドフルーツ
- (4) 味覚変化対応 (長期宇宙滞在で甘味・辛味を強く欲する傾向への対応)
- (5) 無重力下での飲みやすさを考慮した容器・テクスチャー開発

4. 技術的検討

技術的な検討として、以下の研究を行う予定である。

- (1) 無重力環境での液体制御方法 (特に炭酸飲料について)
- (2) 容器設計 (地球と同じように飲める方式 / 宇宙ならではの飲み方)
- (3) 保存性・持続可能性 (常温保存、冷蔵保存、賞味期限、軽量化)
- (4) 宇宙環境テスト計画 (パラボリックフライトや各種宇宙船での実証試験)

5. 市場展開戦略

5.1 製造と世界展開

ASTRAX では、宇宙用エナジードリンクの開発とともに、以下の観点で宇宙と地上の両方における市場展開を計画している。

- (1) 製造拠点: メキシコを基盤とする理由 (コスト、物流、市場アクセス)
- (2) 展開スケジュール:
 - 2026 年: アメリカ、パナマ、グアテマラ、コロンビア
 - 2027 年: アジア (日本を含む)、ヨーロッパ進出
- (3) 地上市場と宇宙市場を同時に狙う二重戦略
- (4) ブランド価値: 「宇宙飲料」というプレミアム性

5.2 宇宙ビールとの統合戦略

- (1) ASTRAX が並行開発している「宇宙ビール」とのシナジー
- (2) アルコール飲料とノンアルコール飲料の棲み分け
- (3) 宇宙ホテルや観光プログラムにおける「飲料体験」のパッケージ化

5.3 持続可能な宇宙飲料産業の可能性

- (1) 地球と宇宙をつなぐ「デュアルユース飲料」としての意義
- (2) 宇宙環境から逆輸入される技術 (防災・医療・アウトドア市場への応用)
- (3) 宇宙文化の形成における「食と飲料」の役割

5.4 市場開拓のための具体的な実証実験

宇宙エナジードリンクと宇宙ビールの市場開拓に向け、以下の実証実験を計画している。

- (1) ASTRAX グループの仲間が運営する (現在休止中) 宇宙居酒屋での提供
- (2) ASTRAX が今後オープン予定の宇宙バーでの提供
- (3) ASTRAX が実施している無重力飛行サービスでの提供
- (4) 販路を拡大し、各種飲食店、イベント、オンラインなどでの販売

6. 結論

宇宙飲料開発は、栄養補給以上に「宇宙での生活の質向上」と「宇宙旅行の魅力拡大」に貢献する。

ASTRAX の取り組みは、地上市場と宇宙市場を同時に活性化させ、持続可能な宇宙飲料産業を創出する可能性を秘めている。

参考文献

学会/国際会議論文

- 【1】民間商業宇宙飛行士と新規宇宙ビジネスの展開について
- 【2】Overview Of ASTRAX Space Services Including Over 50 Space Businesses, 50 以上の宇宙事業を含む ASTRAX の宇宙事業の概要
- 【3】ASTRAX Zero Gravity Flight Services In Japan, 日本における ASTRAX 無重力飛行サービス
- 【4】ASTRAX Lunar City Development Project, ASTRAX 月面都市開発プロジェクト
- 【5】ASTRAX Space Services Platform By Using Blockchain Technology,

ブロックチェーン技術を活用したアストラックス宇宙サービスプラットフォーム

【6】ASTRAX Universal Service Platform By Using Blockchain Technology,
ブロックチェーン技術を活用した ASTRAX のユニバーサルサービスプラットフォーム

【7】Mission Control Center To Support Commercial Space Missions And Passenger'S Activities Inside Of The Cabin,
商業宇宙ミッションと乗客の機内活動を支援するミッションコントロールセンター

【8】ASTRAX Academy And Space Business And Space Flight Support Educational System,
ASTRAX ACADEMYと宇宙ビジネス・宇宙飛行支援教育システム

【9】Mission Support Control Center And Suborbital Spacecraft Simulator To Support Commercial Space Missions And Customer Activities,
商業宇宙ミッションと顧客活動を支援するミッション支援管制センターとサブオービタル宇宙船シミュレーター

【10】Zero G-Naut And Mission Commander To Support Commercial Space Missions And Customer Activities Inside Cabin,
Zero G-Nautと商業宇宙ミッションと顧客活動を支援するミッションコマンダー（船内）

【11】“Space Scooter”: Space Mobility System Used In Space Hotels And Space Stations,
「スペーススクーター」宇宙ホテルや宇宙ステーションで用いられる宇宙移動システム

【12】ASTRAX Lunar City Development Project 2020,
ASTRAX 月面都市開発プロジェクト 2020

【13】ASTRAX Lunar City Economic System By Using Blockchain Technology,
ブロックチェーン技術を活用した ASTRAX 月面都市経済システム

【14】ASTRAX Space Service Catalog System For Space Tourism,
宇宙旅行のための ASTRAX 宇宙サービスカタログシステム

【15】ASTRAX Universal Service Platform By Using Blockchain Technology,

ブロックチェーン技術を活用した ASTRAX ユニバーサルサービスプラットフォーム

【16】Experience And Lessons Learned From The Covid-19 Problem In Japan And Application To Space Travel,
日本の COVID-19 問題から得た経験と教訓、そして宇宙旅行への適用

【17】Zero-G-Naut And Mission Commander To Support Commercial Space Mission And Customer Activities Inside Cabin,
ゼロ G 飛行士とミッションコマンダーが、商業宇宙ミッションと顧客活動を機内でサポートする

【18】Creating A New Business Of Space Flight Attendant Service & SFA Academy,
スペースフライトアテンダントと SFA アカデミーという新しいビジネスの創出

【19】The Importance Of Kimono In Space, 宇宙での着物の重要性

【20】What Women Need For Space Travel,
女性が宇宙へ行くために必要なこと

【21】人工衛星を使用した宇宙時代の平和思考と社会経済学（ワンスマイルファンデーションシステム）

【22】最新型宇宙サービスアクセスアプリケーションツール「ASTRAX U2U (Universal User Interface)」

【23】ASTRAX Lunar City Development Project 2021
ASTRAX 月面シティ開拓プロジェクト 2021

【24】Commercial Space Mission Support Control Center and Suborbital Spacecraft Simulator to Support Commercial Space Missions and Passengers Activities in Space
商業宇宙ミッションと宇宙での搭乗者の活動をサポートするための商業宇宙運用支援管制センターとサブオービタル宇宙船シミュレーター

【25】Initiative of development of the Solar System Economic Bloc by Using Blockchain Technology
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