

# **IAF Human Spaceflight Symposium**

Held at the 75th International Astronautical Congress  
(IAC 2024)

**Milan, Italy**  
**14-18 October 2024**

**Volume 1 of 2**

ISBN: 979-8-3313-1215-2

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2024) by International Astronautical Federation  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2025)

For permission requests, please contact International Astronautical Federation  
at the address below.

International Astronautical Federation  
100 Avenue de Suffren  
75015 Paris  
France

Phone: +33 1 45 67 42 60  
Fax: +33 1 42 73 21 20

[www.iafastro.org](http://www.iafastro.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## VOLUME 1

### **GOVERNMENTAL HUMAN SPACEFLIGHT PROGRAMMES (OVERVIEW)**

A Unified Vision for Deep Space Human Exploration.....	1
<i>Catherine Koerner, Daniel Baird, Patrick Morris, Charles Esty</i>	
International Development for Lunar Surface Habitation .....	9
<i>Simone Illiano, Raffaele Mugnuolo, Mario Musmeci, Luigi Ansalone, Federica Vagnone, Nicola Genco, Franco Fenoglio, Tiffany Nickens, Eric Alexander</i>	
JAXA's Overview of Human Spaceflight Programs and Space Exploration.....	19
<i>Mayumi Matsuura, Junichi Sakai, Fumiya Tsutsui, Koji Yamanaka, Mika Ochiai, Hiroki Akagi, Masato Shirataki</i>	
Canada and the International Space Station Program: Overview and Status in the Context of Canadian Priorities for Space Exploration .....	26
<i>Timothy Braithwaite, Elisabeth Marceau, Kristen Faccioli, Edward Tabarah</i>	
Argonaut: ESA's Versatile Lunar Lander Enabling Multiple Moon Missions.....	40
<i>Giorgio Cifani, Alexandre Darrau, Flavie A. A. S. D. T. Rometsch, Gustavo Alvarez, Ludovic Duvet, Robin Biesbroek</i>	
Filling the Gaps: How NASA Initiates New Elements into Its Moon to Mars Architecture .....	45
<i>Nujoud Merancy, Daniel Baird</i>	
The National Aeronautics and Space Administration's Current Plans for Future Low Earth Orbit Operations .....	58
<i>Ken Bowersox</i>	
The Future of the International Space Station, Low-Earth Orbit, and International Space Cooperation .....	64
<i>Robyn Gatens</i>	
NASA's Approach to Lunar Communication and Navigation: Artemis and Beyond .....	70
<i>Kevin Coggins, Gregory Heckler</i>	
Gateway Program Development Progress.....	78
<i>Emma Lehnhardt, Jon Olansen, Sean Fuller, Dylan Connell, Jennifer Mason, Tiffany Travis, Christopher Fleming</i>	
NASA's Human Landing System Program: Progress Toward Artemis III and Beyond .....	84
<i>Laura Kiker, Lisa Watson-Morgan, Kent Chojnacki, Rene Ortega, Thomas Percy, John Crisler, Beverly Perry</i>	

### **COMMERCIAL HUMAN SPACEFLIGHT PROGRAMMES**

NASA's Development of Commercial Low Earth Orbit .....	92
<i>Angela Hart, Anna Schneider, Kirt Costello, Christy Hansen</i>	

Starlab Space: A Hospitality-Inspired Paradigm for Commercial Space Stations in Collaboration with Hilton Worldwide .....	98
<i>Donya N. Divsalar, Thierry Coursac, Bradley Henderson, Larry Traxler</i>	
Balanced Architecture: Optimizing Human Habitability and Spin Stability in an Artificial Gravity Space Station .....	102
<i>Molly McCormick</i>	
AstroGate: A Conceptual Design Study for a post-ISS Commercial Crewed Space Station.....	111
<i>Smit Patel, David H. Diaz, Adina Godeanu, Vivien Simon, Julian Herrmann, Hamda Al-Ali, Jingyang Wu, Noemi Delfino, Saira O. Williams, Konrad Kij, Martin Zietz, Benjamin Buchmann</i>	
The Approach of International Space Law Towards Space Tourists and Career Astronauts: Are Changes Needed? .....	126
<i>Laura B. Emödyová, Matúš Babják, Barbora Mracká</i>	
Muninn Mission on Axiom-3: The First Collaboration to Fly an ESA Astronaut on a Commercial Flight .....	140
<i>Christopher Puhl, Chiara Piacenza, Pierre Devatour, Julia Weis, Andrea Campa</i>	
Starlab's Human-Centered Approach to Design a Next Generation Space Station for the Upcoming Era of Commercial Spaceflight .....	145
<i>Donya N. Divsalar, Thierry Coursac, Bradley Henderson, Annabelle Albrecht</i>	
 <b><u>UTILIZATION &amp; EXPLOITATION OF HUMAN SPACEFLIGHT SYSTEMS</u></b>	
Study on Parastronaut Ingress and Egress of Orion and Boeing CST-100 Starliner Space Vehicles.....	149
<i>Jesse Rhoades, Kavya K. Manyapu, Pablo De León</i>	
Testing of In-Situ Resource Utilization Technologies for Future Human Mars Exploration Within the Framework of Upcoming Lunar Missions.....	156
<i>Alessandro Siviero, Luca Guglielmi, Alfredo Gili, Hemanth Alapati, Isaac McCann, Sannya Amoikon, Lorenzo Demaria, Alessandro S. Cesare</i>	
Teleoperated Astropharmaceutical Payload for Long-Duration Space Missions: Project VITA!.....	171
<i>Sedat Izcan, Marialina Tsinidis, Nishanth Pushparaj, Phil Williams, Chantal Cappelletti</i>	
Optimizing Payload Specialist Training and Preparedness for Human-Tended Payload Missions on Suborbital Spaceflight Vehicles: Lessons from the IIAS-01/Galactic-05 Mission .....	184
<i>Aaron Persad, Shawna Pandya, Kellie Gerardi, Yvette M. Gonzalez, Jason Reimuller</i>	
MHI's Lunar Society Concepts and Efforts for Implementation.....	189
<i>Koichi Abe</i>	
Adopting Agile Through Tooling-Driven Processes.....	194
<i>Kelly Gasperski, Matthew Schmeiser</i>	
Artificial Gravity Space Station: Benefits, Design and Theorisation Towards Deep Space Exploration .....	199
<i>David A. V. Stopelli</i>	

## **ASTRONAUT TRAINING, ACCOMMODATION, AND OPERATIONS IN SPACE**

Astronaut Training, Evolution in the New Space Era.....	210
<i>Manuela Aguzzi, Tom Hoppenbrouwers, Olivier Lamborelle, Andrés Martín-Barrio</i>	
Learning Task-Focused Deep Visuomotor Policies for Multimodal Astronaut-Robot Collaborative Manipulation .....	223
<i>Chuanke Pang, Rui Zhong</i>	
LUNA PUPPETEER: A Large Scale and Multi-Agent Gravity Offloading Solution to Train Astronauts for Moon Exploration Missions .....	232
<i>Guillaume Fau, Yannis Hahnenmann, Torsten Siedel, Pierre Letier, Vitaliy Drozd, Wafa M. Sadri, Andrea E. M. Casini, Juergen Schlutz</i>	
The Effectiveness of using an Avatar When Conducting Just-In-Time Training in a Virtual Reality Rendered Columbus Module.....	240
<i>Erik Seedhouse</i>	
Mission Design, Planning, Operations, Crew Dynamics and Human Factors on a Suborbital Research Flight: Lessons from the IIAS-01 Galactic 05 Flight* .....	247
<i>Shawna Pandya, Aaron Persad, Kellie Gerardi, Yvette M. Gonzalez, Jason Reimuller</i>	

## **ADVANCED SYSTEMS, TECHNOLOGIES, AND INNOVATIONS FOR HUMAN SPACEFLIGHT**

The Columbus Data Management Infrastructure (CDMI): A Cloud Above the Sky on the ISS .....	254
<i>Jan Tekiilve, Alexander Balgavy, Christian Altenschmidt, Catriona Bruce, Markus Daugs, Jens Ender, Christine Gläßer, Nora Newie, Nicole Roshardt, Loric Vandentempel</i>	
A European Human Space Transportation System – Drivers for Development.....	268
<i>Lorenzo Gretter, Fabrizio Battazza</i>	
Architecture Design of Manned Spacecraft Autonomous Health Management System .....	275
<i>Peng Li</i>	
Mushroom Missions: Pioneering Nutritional, Culinary and Agricultural Solutions for Deep Space Exploration .....	284
<i>Flavia Fayet-Moore</i>	
Design, Development and Qualification of an European International Berthing and Docking Mechanism (IBDM) .....	292
<i>Joaquín Meléndez, David Meuws, Bert Dobbelaere, Oceano Leys, Lennert Jans, Rutger De Nutte, Maria Spano, Nico Fleurinck, Gabriel Ybarra, Paul J. Schüngel, Oscar Gracia</i>	
A Water-Based, Nuclear-Enabled Lunar Architecture .....	304
<i>Timothy Cichan, Luis Carrio, Christie Iacomini, Adam Marcinkowski</i>	
Reusable Mars Transportation Architecture Modeling for Larger Crewed Missions .....	317
<i>George Lordos, Kir Latyshev, Madelyn Hoying, Olivier De Weck, Jeffrey Hoffman</i>	
Research on Efficient Life Support Systems for Space Habitation Activities, Considering Both Crewed and Uncrewed Period .....	329
<i>Kazuki Toma, Shinichi Nakasuka, Sakurai Masato</i>	

Towards a Reliable Offline Personal AI Assistant for Long Duration Spaceflight.....	336
<i>Oliver Bensch, Leonie Bensch, Tommy Nilsson, Florian Saling, Wafa M. Sadri, Carsten Hartmann, Tobias Hecking, J. Nathan Kutz</i>	

## **HUMAN SPACE & EXPLORATION**

Eleven Countries, an Integrated Spacecraft: The Story of International Collaboration that Built the Orion Spacecraft and Powered the Success of the Artemis I Mission .....	347
<i>Carlos Garcia-Galan, Howard Hu, Antonio Preden, Deloo Philippe, Brian Huermann, Anna Chrobry, William Johns, Charles Dingell, Benjamin Van Lear</i>	
Design Constraints and Improvements Associated with Radiation Hazard in Space Habitats .....	364
<i>Olga Bannova, Eszter Gulacs</i>	
HI-SEAS: The Hawai‘i Space Exploration Analog and Simulation Habitat and EMMIHS 2023/2024 Missions and Research .....	372
<i>Kato Claeys</i>	
Charging and Dielectric Breakdown of Dusty Spacesuit: Implications for Astronaut Safety at the Lunar Terminator.....	380
<i>Joseph Wang, Lubos Brieda, Ziyu Huang</i>	
Military Medical Support to the Space Domain. Any News?.....	388
<i>Jacopo Frassini</i>	
Synchronizing the Cosmos: The Critical Role of Timekeeping Systems in Gateway's Operational Success .....	396
<i>Svetlana Hanson, Ruben Lopez, Brendan Luksik</i>	
Human Navigation in Planetary Exploration: Finding Your Way Without a Compass Or GPS .....	403
<i>Scott Dorrrington, Danielle Wood</i>	
Elevating Comfort and Enjoyment in Commercial Space Travel: Integrated Well-Being Strategies.....	413
<i>Thomas Lagarde, Marc M. Cohen, Vincent Alder</i>	
MARTEMIS: Martian Analog Research and Training Experiments on the Moon with International Simulations.....	423
<i>Lanie McKinney, Palak Patel, Mollie Johnson, Michal Delkowski, Lorenzo Nardi, Evan King, Shaan Jagani, Alisa Webb, Annika Thomas, Léonie Gasteiner, Clara Z. Ma, Elizabeth Romero, Anna Tretiakova, Daniel Rojas, Elena López-Contreras, Veronica Orlandi, Fatemeh Tavakoli, Andy Eskenazi, Wing L. Chan, Estelle Martin, Vsevolod Peysakhovich, Andreas Osterwalder, Martin Heyne, Madelyn Hoyng, Alexandros Lordos, George Lordos, Oliver De Weck, Jeffrey Hoffman</i>	

## **FLIGHT & GROUND OPERATIONS ASPECTS OF HUMAN SPACEFLIGHT - JOINT SESSION OF THE IAF HUMAN SPACEFLIGHT AND IAF SPACE OPERATIONS SYMPOSIA**

Proving Ground Capabilities Needed for Lunar in Situ Resource Utilization (ISRU) & Construction Concepts of Operation.....	438
<i>Gerald Sanders, Julie Kleinhenz, Koorosh Araghi, Mark Hilburger</i>	
The ESA Ground Segment for Human Exploration – Migration to a Multi-Mission Environment .....	452
<i>Thomas Mueller, Frank Peters, Marcin Gnat</i>	

## VOLUME 2

Openvoocs Redundancy Concept.....	463
<i>Markus Töpfer, Falk Schiffner, Anja Bertard</i>	
Simulating a Simulation: Developing Lunar Exploration Operations for the LUNA Facility using Europe's Private Analogue Sites.....	469
<i>Matej Poliacek, Alexander Stölzle</i>	
Extended Reality LunAres Experiment (XRLE): A Framework for Human-System Integration Testing using Immersive Technologies.....	477
<i>Corrado Testi, Vittorio Netti, Paolo Guardabasso, Olga Bannova</i>	
Developing an Astronaut Training Tool for Remote Manipulator Systems in Virtual Reality .....	484
<i>Isha Parvaiz</i>	
Human Factors Experiment Design Process in the Context of Deep Space Habitat Maintenance Operations with Autonomous Agents .....	491
<i>Ulubilge Ulusoy, Garrett Reisman, Paige Kaufman</i>	
Developing the New ESA Concept of Operations for the Axiom-3 Mission, the First Mission of an ESA Astronaut on a Commercial Spaceflight.....	505
<i>Joao Lousada, Michael Demel, Claudia Kobald, Alexander Stölzle, Bevan Mairead, Matej Poliacek, Alexander Nitsch, Katja Leuoth</i>	
Enhancing Commercial Public Outreach Services with the Ice Cubes Media Set on the International Space Station.....	509
<i>Saliha Klai, Lode Pieters, Mauro Ricci, Carla Jacobs, Olivier Lamborelle</i>	
Commercial Operation and Training: Preparation and Execution of the Microalgae Life Science Experiment on ISS.....	517
<i>Manuela Aguzzi, Carla Jacobs, Saliha Klai, Olivier Lamborelle, Mauro Ricci</i>	
<b><u>HUMAN AND ROBOTIC PARTNERSHIPS IN EXPLORATION - JOINT SESSION OF THE IAF HUMAN SPACEFLIGHT AND IAF EXPLORATION SYMPOSIA</u></b>	
Astrobee Operations on the ISS: GUI's Impact on the Operators' Cognitive Load .....	524
<i>Andres M. Vargas, Jose Benavides, Jonathan Barlow, Ruben G. Ruiz, Roberto Carlino, Jose Cortez, Aric Katterhagen, Simeon Kanis, Brian Coltin, Kathryn Hamilton, D. Wheeler</i>	
Int-Ball2: JEM Internal Camera Robot - Initial Checkout in the ISS and Prospects of Its Utilization.....	533
<i>Seiko P. Yamaguchi, Masaru Wada, Tatsuya Yamamoto, Shota Inoue, Shinji Mitani, Daichi Hirano, Taisei Nishishita, Keisuke Watanabe</i>	
Staying Alive! : A Human Factors Experiment for the AMADEE - 24 Mars Analog Mission.....	540
<i>Sahil Bhatia, Katrin Schirm, Malinda Mecit, Vera Hagemann, Christiane Heinicke</i>	
Atmosphinder Robot - Human-Robot Interaction in Spacesuits at the Mars Desert Research Station .....	555
<i>Erin Kennedy</i>	
Human-Machine Interaction for Rover Teleoperation During Mars Analog Mission .....	562
<i>Katherine Mulry, André Santos, Elena López-Contreras, Raphaëlle N. Roy, Maneesh K. Verma, Vsevolod Peysakhovich, Lucie Rácková</i>	

Investigating the Efficiency and Feasibility of Space Missions with Robotic Solutions for Dexterous Operations in Spacecraft with Communication Delays.....	567
<i>Masaaki Muromachi, Itoshi Naramura, Hiroyuki Kaneko, Yili Dong, Tetsuaki Kurebayashi, Mako Sudo, Richi Itakura, Seiko P. Yamaguchi</i>	
Advancing Space Health: Towards a Soft Wearable Hypogravity Exosuit (hexsuit) for Enhanced Mobility in Martian Conditions.....	574
<i>Emanuele Pulvirenti</i>	
Validating Rapid Trust Measurements in Spaceflight-Relevant Human-Autonomy Teaming Applications.....	583
<i>Sarah Leary, Yimin Qin, Zhaodan Kong, Torin Clark, Allison Anderson</i>	
Utilizing Lexamus Architecture to Transform Human Space Exploration Operations.....	588
<i>Nicholas Florio, Saira O. Williams, Abhinav Krishnan, Mohan Muvvala, George Thomas</i>	
Intelligent Robotic Teleoperated System for On-Orbit Service of Large Space Structures.....	597
<i>Yizhuang Zhang, Ruijiang Zhang, Choy Kaiyualex, Chunlei Xie, Ling-Bin Zeng, Guangyao Zhu, Siyuan Xing, Xiaoheng Wang, Fanmin Meng, Jianqing Lv, Yue Zhong, Zijie Wang, Mingkun Li</i>	

## **HUMAN SPACEFLIGHT GLOBAL TECHNICAL SESSION**

Astronaut Profile Evolution Study: Analyzing Evolution Since 1961 - How Has Society Shaped the Ideal Astronaut?.....	612
<i>Saira O. Williams, Luísa Santos, Tania Gres, Simran Mardhani, Yumna Majeed, Parisa Acharya, A'Laylah Morin, Megha Choudhary</i>	
Sleep Deprivation and Glymphatic System Dysfunction as a Risk Factor for Sams During Long-Duration Spaceflight.....	622
<i>Joshua Venegas, Mark Rosenberg</i>	
Developing Clothing that Exercises Astronauts' Muscles During Space Missions .....	628
<i>Pinar Ozdemir, Abdurrahman D. Can</i>	
From Call for Ideas to the ISS in Less than a Year: Lessons Learned from the First ESA Project Astronaut Mission. ....	633
<i>Michail Magkos, Christopher Puhl</i>	
Unveiling the Effects of Microgravity on Cognitive Functions During Parabolic Flights .....	640
<i>Raffaella Ricci, Roberto Gammeri, Stefano Chiadò, Claudio Zavattaro, Hilary Serra, Samuel Cento, Mark George, Donna Roberts, Anna Berti, Adriana Salatino, Emanuele Cirillo</i>	

## **INTERACTIVE PRESENTATIONS - IAF HUMAN SPACEFLIGHT SYMPOSIUM**

Lightweight Space Seat and Seatbelts for Crew .....	648
<i>Diego Cagna</i>	
Overview of Activities Conducted During the NIKE-I Analog Mission in the LunAres Habitat.....	652
<i>Matej Poliacek, Lielka N. C. Huaman, Alexander Huschke, Andres Käosaar</i>	
A Quantitative Human Spacecraft Design Evaluation Model for Assessing Crew Accommodation and Utilization .....	664
<i>Akshat Mohite, Sai P. Bhosale, Vaishnavi Dhamdhere, Tanaya Katke, Samruddhi Bhute</i>	

Advanced Laundry System for Microgravity Environments.....	676
<i>Natausha Chohan, Enrico Trolese</i>	
Design and Manufacture of a Hard Shoulder Joint for the NDX-4 Space Suit .....	683
<i>Hernan D. M. Jimenez, Pablo De Leon</i>	
Design and Sensing of a Bionic Soft Robotic Arm for Improved Services and Maintenance in the Space Station Cabin.....	690
<i>Ke Ma, Taihe Huang, Yuwen Zhao, Hui Wang, Jie Zhang, Jianing Wu, Jinxiu Zhang</i>	
ESA PANGAEA: A European Contribution to Training Astronauts in Planetary Geology.....	698
<i>Francesco Sauro, Samuel Payler, Matteo Massironi, Riccardo Pozzobon, Hiesinger Harald, Carolyn Van Der Bogert, Nicolas Mangold, Charles Cockell, Jesus Martinez-Frias, Käre Kullerud, Leonardo Turchi, Igor Drozdovskiy, Loredana Bessone, Pierre-Antoine Tesson</i>	
Innovative Sustainable Construction for Mars Colonization Through In-Situ Resource Utilization (ISRU) .....	703
<i>Aagam Jain, Ravi K. Varma, G. K. Prahsant, Rabhya Gupta, Asma Betteka</i>	
Physiological and Task Loading Evaluation of Citizen Astronauts Performing Side Hatch Egress of an Orion Mock-Up and Life Raft Ingress.....	710
<i>Erik Seedhouse</i>	
HELIOS - Human Exploration Launch and In-Orbit Support Infrastructure: A Concept Study .....	716
<i>Mark Hempsell, Bob Parkinson, Richard Osborne</i>	
Inherent Sensing Method of Inchworm-Inspired Soft Robot for Space Station Tubular Inspection .....	725
<i>Ziyue Zhao, Zongfu Luo</i>	
Space Analogs: Recording, Comparing and Improving .....	736
<i>Argyro Tsilia, Konstantinos-Alketas Oungrinis</i>	
Space for All. Preliminary Considerations for Accessible Missions. ....	757
<i>Irene Di Giulio, Ryan Anderton, Nicol Caplin, Stephen Harridge, Peter Hodgkinson, Mike Miller-Smith, Marco Narici, Ross Pollock, Carmen Possnig, Jörn Rittweger, Thomas Smith, Neil Tucker</i>	
Tandem System for Future Commercial ExtraVehicular Activity .....	764
<i>Rowan M. O'Reilly</i>	
Testing and Validation of Innovative eXtended Reality Technologies for Astronaut Training in a Partial-Gravity Parabolic Flight Campaign .....	776
<i>Florian Saling, Andrea E. M. Casini, Andreas Treuer, Martial Costantini, Leonie Bensch, Tommy Nilsson, Lionel Ferra</i>	
The Intersection of Cognitive Performance and Space Tourism Propensity in a VR-Simulated Microgravity Environment .....	785
<i>Matteo Gatti, Rocco Palumbo, Alberto Di Domenico, Irene Ceccato, Giulia Prete, Nicola Mammarella</i>	
Tool for Real-Time Monitoring and Analysis of the Exercise in the ICE Environment.....	798
<i>Miroslav Rozložník</i>	
A Reduced Gravity Simulator at the Space Analog for the Moon & Mars (SAM) Terrestrial Habitat Analog, Biosphere 2 .....	802
<i>Kai Staats, Trent Tresch, Bindhu Oommen, Matthias Beach, Luna Powell</i>	

Analysis of Astronaut Training Methods and Techniques .....	815
<i>Natalia I. Vargas-Cuentas, Elmer C. Casapia, Romildo G. S. Cuadros, Rivaldo C. D. Aquino, Honorio A. Alanoca, Avid Roman-Gonzalez</i>	
Web-Interface for Rover Teleoperation to Investigate the Impact of Extreme Environments .....	820
<i>Elena López-Contreras, Raphaëlle N. Roy, Vsevolod Peysakhovich</i>	
Measurement of Changes in Behavior and Vital Sign Due to Lighting in a Limited Space.....	827
<i>Karin Yoshino, Masaki Takahashi</i>	
Sustainable Life Beyond Earth. A Design Driven Living Lab to Create New Human Experiences in the Space Habitat.....	834
<i>Laura Succini, Elia Sindoni, Lucia Grizzaffi, Veronica Pasini</i>	
Comparing Metallic, Inflatable, and Composite Habitat Primary Structure Modules.....	843
<i>Matthew Ziglar, Kojo Sarkodie</i>	
Critical Analysis of Mobility and Safety Challenges in Contemporary Space Suit Design .....	854
<i>Kiran Mankame, Sungwoo Song, Saira O. Williams, Nicholas Florio, Mohan Muvala</i>	
Towards Efficient Space Transportation: Exploring Lunar Kinetic Launch Systems.....	868
<i>Javier A. Garcia, Francesco Pajero, Bianca Guerrini, Mikhail Maximchuk</i>	
Areas of Opportunity for Incorporation of Artificial Intelligence Applications to Deep Space Human Spaceflight.....	879
<i>Oscar Ojeda, Laura D. R. Diaz, Jackelynne Silva-Martinez, Camilo A. Zorro</i>	
Modeling and Optimizations of Flight Scheme for China Manned Lunar Exploration Mission using MBSE Integrated Simulations.....	893
<i>Suquan Ding, Yang Zhao</i>	
Advancing Analogue Space Suit Technology: The Design of the ICEE Suit.....	896
<i>Charlotte Pouwels, Eleonora Zanus, Marc Heemskerk, Aditi Sathe, Mykyta Kliapets, Lucie Rácková</i>	
Advancements in Waste Management for Sustainable Human Spaceflight Missions .....	901
<i>Cristina N. Rappis, Stefano Carosio, Giorgio Musso, Stefano Ellero, Issa Mouawad</i>	

## **LATE BREAKING ABSTRACTS (LBA)**

Microgravity as the Next Great Science Laboratory: Enabling the Next Generation of Research Astronauts Through Suborbital Flight .....	915
<i>Shawna Pandya, Kellie Gerardi, Norah Patten, Aaron Persad, Jason Reimuller</i>	
Protocol on the Use of Artificial Intelligence During Space Analog Missions.....	920
<i>Julio Rezende, Julietth F. C. Venegas, Riyabrata Mondal, Natalia Hazbun</i>	

## **Author Index**