

# **IAF Human Spaceflight Symposium 2021**

Held at the 72nd International Astronautical Congress  
(IAC 2021)

Dubai, United Arab Emirates  
25 – 29 October 2021

ISBN: 978-1-7138-4303-0

**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© (2021) by International Astronautical Federation  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2022)

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

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

|                                                                                                                                             |    |
|---------------------------------------------------------------------------------------------------------------------------------------------|----|
| KEYNOTE: NASA’S PLANS FOR HUMAN SPACE EXPLORATION .....                                                                                     | 1  |
| <i>James Free, Kathy Lueders</i>                                                                                                            |    |
| KEYNOTE: HUMAN SPACEFLIGHT WITHIN ESA’S SPACE EXPLORATION<br>PROGRAMME FOR THE NEXT DECADE .....                                            | 2  |
| <i>David Parker, Bernhard Hufenbach, Juergen Schlutz</i>                                                                                    |    |
| JAXA’S INITIATIVE ON HUMAN SPACEFLIGHT PROGRAM FOR ISS AND<br>INTERNATIONAL SPACE EXPLORATION .....                                         | 3  |
| <i>Hiroshi Sasaki, Junichi Sakai, Fumiya Tsutsui</i>                                                                                        |    |
| CREW COMMUNICATION SYSTEM FOR GAGANYAAN.....                                                                                                | 7  |
| <i>Anurag Verma, Rajesh Kumar Singh, Nilesh Desai, Adarsh Jain</i>                                                                          |    |
| GENDER PARITY AND PARASTRONAUTS: ANTICIPATING TRENDS FOR THE 2021 ESA<br>ASTRONAUT SELECTION CRITERIA WITH ANALOG MISSION STUDIES .....     | 12 |
| <i>Leszek Orzechowski, Aleksander Wasniowski, Agata Mintus, Natalia Cwilichowska</i>                                                        |    |
| BACK TO STAY: NASA’S CAMPAIGN TO SUSTAINABLY RETURN HUMANS TO THE<br>MOON.....                                                              | 22 |
| <i>Tara Ruttley, Neysa Call, Patrick Basha, Sam Scimemi, Skyler Hornback, Rhianna Clemons,<br/>Daniel Kennedy, Clara Jones, James Green</i> |    |

## **2.COMMERCIAL HUMAN SPACEFLIGHT PROGRAMMES**

|                                                                                                         |    |
|---------------------------------------------------------------------------------------------------------|----|
| BOEING STARLINER FLIGHT TESTS LESSONS LEARNED BY CHRIS FERGUSON THE<br>BOEING COMPANY, HOUSTON, TX..... | 32 |
| <i>Brett Fischer</i>                                                                                    |    |
| PROTOTYPE PLANS FOR VARIOUS COMMERCIAL SPACECRAFT TRAINING<br>SIMULATORS .....                          | 33 |
| <i>Taichi Yamazaki</i>                                                                                  |    |
| PROBLEMS AND SOLUTIONS THAT ARE PREVENTING MORE WOMEN FROM<br>BECOMING SPACE TOURISTS .....             | 64 |
| <i>Taiko Kawakami, Taichi Yamazaki</i>                                                                  |    |
| ITALIAN ROLE IN THE COMMERCIAL UTILIZATION AND SERVICES OF LEO<br>INTERNATIONAL SPACE STATION .....     | 72 |
| <i>Annamaria Piras</i>                                                                                  |    |
| OUTLINE OF ASTRAX PRIVATE SPACE BUSINESS CREATION EDUCATION AND<br>TRAINING CENTER .....                | 78 |
| <i>Taichi Yamazaki, Manabu Takekawa</i>                                                                 |    |
| THE SINGLE-PERSON SPACECRAFT IS IDEAL FOR COMMERCIAL EVA .....                                          | 96 |
| <i>Brand Griffin</i>                                                                                    |    |

|                                                                                              |     |
|----------------------------------------------------------------------------------------------|-----|
| SPACESHIP TWO: A SUBORBITAL VEHICLE FOR HUMAN SPACEFLIGHT AND<br>MICROGRAVITY RESEARCH ..... | 101 |
| <i>Sirisha Bandla</i>                                                                        |     |

### **3.UTILIZATION & EXPLOITATION OF HUMAN SPACEFLIGHT SYSTEMS**

|                                                                     |     |
|---------------------------------------------------------------------|-----|
| THE NEXT DECADE OF THE INTERNATIONAL SPACE STATION PARTNERSHIP..... | 102 |
| <i>Robyn Gatens, Jacob Keaton</i>                                   |     |

|                                                                                                                                                                                                                                                                  |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| NOVEL WAYS TO USE THE INTERNATIONAL SPACE STATION AS AN EXPLORATION<br>ANALOG: INTERNATIONAL PROGRESS IN PLANNING “ISS4MARS”.....                                                                                                                                | 108 |
| <i>Julie A. Robinson, Thu Jennifer Ngo-Anh, Isabelle Marcil, Boris Shishkov, Keiji Murakami,<br/>Katrin Stang, Kotov Oleg, Vittorio Cotronei, Livio Narici, Vasily Savinkov, Michaela<br/>Girgenrath, Michael C. Waid, Kavin Sato, Sam Scimemi, Robyn Gatens</i> |     |

|                                                             |     |
|-------------------------------------------------------------|-----|
| RESEARCH POTENTIAL OF THE ISS’S NAUKA MODULE.....           | 118 |
| <i>Igor V. Sorokin, Victor Konoshenko, Alexander Markov</i> |     |

|                                                             |     |
|-------------------------------------------------------------|-----|
| LEGACY RACK MODERNIZATION FOR NEW PAYLOAD EXPERIMENTS ..... | 127 |
| <i>Stefan Petschelt</i>                                     |     |

|                                                         |     |
|---------------------------------------------------------|-----|
| POSSIBILITIES FOR JOINT INTERNATIONAL MODULES .....     | 128 |
| <i>Matthew Duggan, Rushan Beglov, Valery Aksamentov</i> |     |

|                                             |     |
|---------------------------------------------|-----|
| COLUMBUS HYBRID PAYLOAD CONFIGURATIONS..... | 132 |
| <i>Stefan Petschelt</i>                     |     |

|                                                                                                                                 |     |
|---------------------------------------------------------------------------------------------------------------------------------|-----|
| FIRST RESULTS FROM THE GERMAN-RUSSIAN ICARUS SYSTEM FOR ANIMAL<br>TRACKING FROM ISS .....                                       | 133 |
| <i>Johannes Wepler, Michail Yu. Belyaev, Wolfgang Pitz, Martin Wikelski, Grigori Tertitski,<br/>Vasily Savinkov, Marc Haese</i> |     |

|                                                                                                                                                                                                                                                                                     |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| REFLECTIONS ON 20 YEARS OF RESEARCH ON THE INTERNATIONAL SPACE<br>STATION.....                                                                                                                                                                                                      | 147 |
| <i>Bryan Dansberry, Kirt Costello, Luchino Cohen, Andreas Schoen, Thu Jennifer Ngo-Anh,<br/>Masaki Shirakawa, Kaoruko Sakamoto, George Karabadzak, Vasily Savinkov, Igor V.<br/>Sorokin, Vittorio Cotronei, Giovanni Valentini, Erin Anthony, Joel Montalbano, Robyn<br/>Gatens</i> |     |

### **4-B6.4.FLIGHT & GROUND OPERATIONS ASPECTS OF HUMAN SPACEFLIGHT - JOINT SESSION OF THE IAF HUMAN SPACEFLIGHT AND IAF SPACE OPERATIONS SYMPOSIA**

|                                                            |     |
|------------------------------------------------------------|-----|
| PARRYING OF CONTINGENCY IN FAST RENDEZVOUS WITH ISS .....  | 159 |
| <i>Rafail Murtazin, Nikita Chudinov, Vladimir Soloviev</i> |     |

|                                                                                                                   |     |
|-------------------------------------------------------------------------------------------------------------------|-----|
| IMPACT 1.0--TASK IMPAIRMENT: A NOVEL APPROACH FOR ASSESSING<br>IMPAIRMENT DURING EXPLORATION-CLASS MISSIONS ..... | 166 |
| <i>William Fernandez</i>                                                                                          |     |

|                                                                                    |     |
|------------------------------------------------------------------------------------|-----|
| ANALYSIS OF THE PLANS OF RESEARCH EXPERIMENTS ON 'PROGRESS' CARGO<br>VEHICLES..... | 173 |
| <i>Michail Yu. Belyaev, Ayukaeva Diana, Tatiana V. Matveeva</i>                    |     |

|                                                                                                                                                                                                                                                                                                   |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| ASINET: THE ITALIAN SPACE AGENCY INFRASTRUCTURE FOR ISS DATA<br>UTILIZATION.....                                                                                                                                                                                                                  | 174 |
| <i>Gabriele Mascetti, Dario Castagnolo, Massimo Calabrese, Marino Crisconio, Marta Albano,<br/>Giovanni Valentini, Valerio Di Tana, Gianni Truscelli, Pietro Camponeschi, Francesco<br/>Cerone, Franco Turchi, Giuseppe Di Costanzo, Simone Simonetti, Simone Simonetti, Simone<br/>Simonetti</i> |     |

|                                                                                |     |
|--------------------------------------------------------------------------------|-----|
| DESIGN OF GROUND SUPPORT SYSTEM FOR CHINA SPACE STATION ORBITAL<br>FLIGHT..... | 178 |
| <i>Peng Ying, Xuzhen Jing, Zhengyan Jing</i>                                   |     |

|                                                                                      |     |
|--------------------------------------------------------------------------------------|-----|
| SPACE CLOUD AS SERVICE : THE NEW SERVICES IN THE NEW SPACE FOR THE<br>MISSIONS ..... | 187 |
| <i>Jamel Metmati</i>                                                                 |     |

|                                                                                                        |     |
|--------------------------------------------------------------------------------------------------------|-----|
| FIRST EXPERIENCE WITH COLUMBUS DMS MODERNIZATION, COL KA OPERATIONS<br>AND IP-BASED COMMUNICATION..... | 190 |
| <i>Florian Bender, Mirjam Boere, Tobias Göttfert, Sven Prüfer, Dieter Sabath, Gerd Söllner</i>         |     |

|                                                                                                                   |     |
|-------------------------------------------------------------------------------------------------------------------|-----|
| STUDYING THE DRIFT OF A CALIBRATED SOLID INSIDE THE PRESSURIZED CABIN<br>OF THE INTERNATIONAL SPACE STATION.....  | 200 |
| <i>Michail Yu. Belyaev, Dmitry Rulev, Sergey Alyamovskiy, Sergey Kudryavtsev, Yuri Batyrev,<br/>Andrey Krylov</i> |     |

|                                                                                                                      |     |
|----------------------------------------------------------------------------------------------------------------------|-----|
| THE PATH TO CREW AUTONOMY - SITUATIONAL AWARENESS IN SCHEDULING AND<br>RESCHEDULING TASKS FOR NOVICE SCHEDULERS..... | 210 |
| <i>Megan Shyr, Tamsyn Edwards, Summer Brandt, Jessica Marquez</i>                                                    |     |

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

|                                                                                    |     |
|------------------------------------------------------------------------------------|-----|
| THE EVOLUTION AND INNOVATION OF THE ASTRONAUT SELECTION PROCESS<br>OVER TIME ..... | 222 |
| <i>Mrityunjai Verma, Vatasta Koul, Umang Jain, Srishti Bansal</i>                  |     |

|                                                                                                                                                                                  |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| MULTI-SEGMENT COSMONAUT TRAINING TECHNOLOGY.....                                                                                                                                 | 233 |
| <i>Oleg Skripochka, Maksim Kharlamov, Andrey Kuritsin, Irina Kutnik, Vladimir Dmitriev,<br/>Nikolai Chub, Oleg Blinov, Dmitrii Petelin, Ekaterina Yurchenko, Evgeniy Andreev</i> |     |

|                                                                                                                                                                                                |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| ASTRONAUT TRAINING ON-BOARD THE INTERNATIONAL SPACE STATION USING A<br>STANDALONE VIRTUAL REALITY HEADSET.....                                                                                 | 241 |
| <i>Stephen Ennis, Flavie Rometsch, Florian Saling, Beate Fischer, Petra Mittler, Lionel Ferra,<br/>Carlo Vizzi, Andrea Emanuele Maria Casini, Maurice Marnat, Cecile Thevenot, Laure Boyer</i> |     |

|                                                                                 |     |
|---------------------------------------------------------------------------------|-----|
| THE COMMERCIAL ASTRONAUTS IN THE NEW SPACE : TRAINING AND<br>REQUIREMENTS ..... | 250 |
| <i>Jamel Metmati</i>                                                            |     |

|                                                                                                                                        |     |
|----------------------------------------------------------------------------------------------------------------------------------------|-----|
| EXOSUIT: A TRAINING SYSTEM FOR FUTURE ASTRONAUTS BASED ON AN<br>EXOSKELETON AND MIXED REALITY.....                                     | 253 |
| <i>Andrés Martín-Barrio, Lorenzo Prat Boubeta, Richard Ballaux, Pierre Letier, Jeremi Gancet,<br/>Olivier Lamborelle, Lionel Ferra</i> |     |

**6-A5.3.HUMAN AND ROBOTIC PARTNERSHIPS IN EXPLORATION - JOINT SESSION OF THE IAF HUMAN SPACEFLIGHT AND IAF EXPLORATION SYMPOSIA**

TESTING ROVERS FOR HUMAN AND ROBOTIC LUNAR EXPLORATION IN THE ESA/DLR LUNA ANALOGUE FACILITY ..... 260  
*Martial Costantini, Juergen Schlutz, Andrea Emanuele Maria Casini, Petra Mittler, Beate Fischer, Flavie Aditya Annick Suzanne Davida Tohotaua Rometsch, Aidan Cowley, Stephen Ennis, Lionel Ferra*

ASTROBEE: MAPPING THE INTERNATIONAL SPACE STATION'S JEM IN SUPPORT OF JAXA'S KIBO ROBOT PROGRAMMING CHALLENGE..... 270  
*Andres Mora Vargas*

MULTI CRITERIA STUDY OF THE EFFECT AND RISKS ON HUMAN PHYSIOLOGY AND PSYCHOLOGY IN AEROSPACE AND THE EFFECT OF THE ROBOTICS ALTERNATIVE IN SPACE COMMUNICATION AND EXPLORATION ..... 271  
*Hadeel Modhish, Saja Alsultan, Noura Alghurayr, Najla Alkhowaiter, Fai Aljuhaiman, Renad Bin Rushud*

NOVEL EXTRAMUSCULAR ASSISTED SPACESUIT GLOVE (EMAG) ENABLED BY SOFT ROBOTIC TECHNOLOGY ..... 288  
*Danielle Carroll, Spencer Dansereau, Siddhi Bhilare, Stephen Robinson*

MULTI-SENSOR FUSION FOR AUTONOMOUS POSITIONING OF ROBOTS IN DEEP SPACE ..... 297  
*Zipei Shuai, Hongyang Yu*

**7.ADVANCED SYSTEMS, TECHNOLOGIES, AND INNOVATIONS FOR HUMAN SPACEFLIGHT**

EXTENDED REALITY APPLICATIONS FOR HUMAN SPACEFLIGHT: THE ESA-EAC XR LAB ..... 298  
*Martial Costantini, Flavie Aditya Annick Suzanne Davida Tohotaua Rometsch, Andrea Emanuele Maria Casini, Aidan Cowley, Stephen Ennis, Christopher Scott, Stephane Ghiste, Jonathan Scott, Lionel Ferra*

THE HUMAN FACTORS OF YOUR CAR AND YOUR VIDEO GAME ARE DESIGNING NEW SPACE MISSIONS ..... 308  
*Anilkumar Dave, Valerio Cometti, Marco Generali, Davide Bonati*

PROSPECTIVE FOR MICROBIAL FUEL ELEMENTS APPLICATION IN BIOLOGICAL LIFE SUPPORT SYSTEMS..... 319  
*Viacheslav Ilyin, Denis Korshunov, Alexandra Korosteleva*

BIO-REGENERATIVE LIFE SUPPORT SYSTEMS FUNCTIONAL STABILITY INDICATORS USING THEORETICAL MODELING ..... 326  
*Curt Holmer*

3D PRINTED SCINTILLATOR FOR RADIATION DETECTION IN SPACE MISSIONS ..... 334  
*Marianna Rinaldi, Miriam Ferrara, Cristian De Santis, Francesca Nanni*

SPACESHIP FR A NEW CONTRIBUTOR TO SPACE EXPLORATION & HUMAN SPACEFLIGHT ..... 335  
*Marcos Eduardo Rojas Ramirez, Alexis Paillet*

|                                                                                                                                                                                                                                                                                                                                                             |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| EXPERIMENTAL INVESTIGATION OF CARBON NANOTUBE DUST MITIGATION<br>SYSTEM FOR HABITAT STRUCTURES .....                                                                                                                                                                                                                                                        | 352 |
| <i>Kavya K. Manyapu, Pablo De Leon, Leora Peltz</i>                                                                                                                                                                                                                                                                                                         |     |
| USING COMPUTATIONAL TECHNIQUES FOR THE OPTIMAL DESIGN OF EVOLVING<br>HABITATS .....                                                                                                                                                                                                                                                                         | 353 |
| <i>Thomas Lagarde</i>                                                                                                                                                                                                                                                                                                                                       |     |
| ADVANCED TACTILE OPERATIONS FROM AN AUGMENTED DUAL-LAYER SPACE<br>GLOVE .....                                                                                                                                                                                                                                                                               | 362 |
| <i>Derek Rath, Madhu Thangavelu</i>                                                                                                                                                                                                                                                                                                                         |     |
| DESIGN OPTIMIZATION AND CONCEPTUAL INTEGRATION OF LUNAR SURFACE<br>EXPLORATION SPACESUIT GLOVES .....                                                                                                                                                                                                                                                       | 363 |
| <i>Savannah Buchner, Peter Brehm, Conner McLeod, Saige Drecksler, Kaitlyn Olson</i>                                                                                                                                                                                                                                                                         |     |
| <br><b><u>8.HUMAN SPACE &amp; EXPLORATION</u></b>                                                                                                                                                                                                                                                                                                           |     |
| PATHWAYS TO SUSTAINABILITY IN LUNAR EXPLORATION ARCHITECTURES .....                                                                                                                                                                                                                                                                                         | 364 |
| <i>Markus Landgraf</i>                                                                                                                                                                                                                                                                                                                                      |     |
| THE FUTURE OF HUMAN EXPLORATION STARTS NOW - SNC'S KEYS TO ENABLING<br>SUSTAINABLE HUMAN SPACE EXPLORATION.....                                                                                                                                                                                                                                             | 366 |
| <i>Neeraj Gupta, Jeffrey Valania, Bret Heaslet</i>                                                                                                                                                                                                                                                                                                          |     |
| HALO, THE FIRST HABITABLE ELEMENT FOR CISLUNAR STATION AND MISSION:<br>ITALIAN ROLE AND CHALLENGES .....                                                                                                                                                                                                                                                    | 367 |
| <i>Annamaria Piras</i>                                                                                                                                                                                                                                                                                                                                      |     |
| HABITAT EXTENSIBILITY TO THE LUNAR SURFACE AND MARS.....                                                                                                                                                                                                                                                                                                    | 373 |
| <i>Amber Rist, Travis Moseman, Matthew Duggan, James Engle, Jim May</i>                                                                                                                                                                                                                                                                                     |     |
| GATEWAY AVIONICS CONCEPT OF OPERATIONS AND COMMAND AND DATA<br>HANDLING ARCHITECTURE.....                                                                                                                                                                                                                                                                   | 379 |
| <i>Svetlana Hanson, Paul Muri</i>                                                                                                                                                                                                                                                                                                                           |     |
| DYNETICS HUMAN LANDING SYSTEM: OVERVIEW AND STATUS OF THE LUNAR<br>SPACE TRANSPORTATION SYSTEM .....                                                                                                                                                                                                                                                        | 380 |
| <i>Andrew Crocker</i>                                                                                                                                                                                                                                                                                                                                       |     |
| MODELING MULTI-AGENT TEAM PROBLEM-SOLVING SKILLS FOR LUNAR BASE<br>CONSTRUCTION .....                                                                                                                                                                                                                                                                       | 388 |
| <i>Aleksandra Stankovic</i>                                                                                                                                                                                                                                                                                                                                 |     |
| SPACEFLIGHT-ASSOCIATED CHANGES IN THE PERIVASCULAR SPACES OF<br>ASTRONAUTS AND COSMONAUTS.....                                                                                                                                                                                                                                                              | 389 |
| <i>Giuseppe Barisano, Farshid Sephrband, Elena Tomilovskaya, Steven Jillings, Ilya Rukavishnikov, Inna Nosikova, Liudmila Litvinova, Alena Rumshiskaya, Victor Petrovichev, Valentin Sinitsyn, Ekaterina Pechenkova, Steven Laureys, Jan Sijbers, Ben Jeurissen, Paul M Parizel, Heather Collins, Meng Law, Alexey Grishin, Donna Roberts, Floris Wuyts</i> |     |
| A MARS 2033 HUMAN FLYBY.....                                                                                                                                                                                                                                                                                                                                | 391 |
| <i>Matthew Duggan, Michael Elsperman, Xavier Simon, Benjamin Donahue, Jim May</i>                                                                                                                                                                                                                                                                           |     |

## **9-GTS.2.HUMAN SPACEFLIGHT GLOBAL TECHNICAL SESSION**

|                                                                                                                                                                               |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| CAREER DESIGN IN SPACE - FROM CHALLENGED TO CHALLENGING .....                                                                                                                 | 398 |
| <i>Ayako Kurono, Haruto Kurono, Taichi Yamazaki</i>                                                                                                                           |     |
| TTETHERNET NETWORK PLATFORM FOR ADVANCED SPACE EXPLORATION<br>AVIONICS ARCHITECTURES .....                                                                                    | 403 |
| <i>David Jelem, Joel Busa, Todd Smithgall, Adrian Girschik</i>                                                                                                                |     |
| CREATION OF A DATABASE OF THE MICROBIOME OF ASTRONAUTS .....                                                                                                                  | 414 |
| <i>Marina Skedina, Viachaslav Ilyin, Zoya Solovieva, Anton Artamonov</i>                                                                                                      |     |
| PRE AND POST-FLIGHT CORTICAL VEIN ENLARGEMENT AND ITS ASSOCIATION<br>WITH SPACEFLIGHT-ASSOCIATED NEURO-OCULAR SYNDROME .....                                                  | 418 |
| <i>Mark Rosenberg, Donna Roberts, Austin Coker, James Taylor, Maria Matheus, Milad Yazdani, Sami Al Kasab, Heather Collins, Chris Blouin</i>                                  |     |
| THE IMPACT OF LONG-DURATION SPACEFLIGHT ON THE HORIZONTAL VESTIBULO-<br>OCULAR REFLEX (HVOR).....                                                                             | 419 |
| <i>Chloë De Laet, Ludmila Kornilova, Dmitrii Glukhikh, Hamish Macdougall, Catho Schoenmaekers, Steven Moore, Leander Wille, Steven Jillings, Floris Wuyts</i>                 |     |
| THE EFFECT OF PREVIOUS SPACEFLIGHT ON OTOLITH-MEDIATED OCULAR<br>COUNTER-ROLL IN COSMONAUTS AFTER LONG DURATION SPACEFLIGHT .....                                             | 425 |
| <i>Catho Schoenmaekers, Ludmila Kornilova, Dmitrii Glukhikh, Gilles Clement, Hamish Macdougall, Steven Moore, Steven Jillings, Chloe De Laet, Leander Wille, Floris Wuyts</i> |     |
| THE PRESENT, PAST AND FUTURE OF SPACE SUITS FOR SPACE TRAVEL .....                                                                                                            | 434 |
| <i>Taichi Yamazaki</i>                                                                                                                                                        |     |
| CONSIDERATION OF THE FUTURE PROSPECTS OF THE SPACE FLIGHT<br>ATTENDANT(SFA) PROFESSION WITH THE EXPANSION OF SPACE TRAVEL<br>MARKETING .....                                  | 435 |
| <i>Chieko Takahashi, Yuko Kirihara, Taichi Yamazaki, Taiko Kawakami</i>                                                                                                       |     |

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

|                                                                                           |     |
|-------------------------------------------------------------------------------------------|-----|
| MBRSC AND ESA COOPERATION FOR THE ESTABLISHMENT OF UAE OPERATIONS<br>SUPPORT CENTRE ..... | 441 |
| <i>Mohammad Alblooshi, Antonio Fortunato</i>                                              |     |
| INTUITIVE ASTRONAUT MANEUVERING UNIT FOR EXTRA VEHICULAR MISSIONS.....                    | 442 |
| <i>Yukta Sharma, Chesler Thomas, Naga Bharath Daka, Manan Malik</i>                       |     |
| COMMERCIAL MANNED MISSION TO THE SURFACE OF VENUS .....                                   | 452 |
| <i>Oleg Aleksandrov</i>                                                                   |     |
| COMMERCIAL PILOTED EXPEDITION TO MARS,PHOBOS AND DEIMOS.....                              | 453 |
| <i>Oleg Aleksandrov</i>                                                                   |     |
| SIRIUS-19 .....                                                                           | 454 |
| <i>Catherine Trainor</i>                                                                  |     |

### **Author Index**