

35th IAA Symposium on Space Policy, Regulations and Economics

Held at the 73rd International Astronautical Congress
(IAC 2022)

Paris, France
18-22 September 2022

ISBN: 978-1-7138-7421-8

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© (2022) by International Astronautical Federation
All rights reserved.

Printed with permission by Curran Associates, Inc. (2023)

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

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
Web: www.proceedings.com

TABLE OF CONTENTS

INTERNATIONAL COOPERATION IN USING SPACE FOR SUSTAINABLE DEVELOPMENT: THE “SPACE2030” AGENDA

"Space2030" Agenda: Space Economy's Challenges and SDGs' Opportunities to Tackle Present and Future Global Efforts	1
<i>Antonio Del Mastro, Federico Monaco, Giulia Bordacchini, Vatsala Tewari</i>	
Mapping the Use of Space Data in Development Research	8
<i>Simona Richard, Maria-Gabriella Sarah</i>	
Space for the Sustainable Development Goals: Why Space? Why Now? and What Next?	19
<i>Giulia Costella</i>	
Saving Our Future on Earth Through Our Presence in Space - Recommendations from the Young Generations on the Role of Space for Climate Action	25
<i>Sahba El-Shawa, Giulia Bordacchini, Jordan Stone, Giulia Costella, Milica Milosev, Lisa Lacroix, Ivan Fino, Antonino Salmeri, Giuliana Rotola</i>	
Opportunities and Challenges for Achieving 'Space2030': Insights from the Field of Global Earth Observation Systems	40
<i>Xiao-Shan Yap</i>	
Space for Green Economy, Cooperation and Sustainability	41
<i>Annamaria Nassisi, Pietro Santoriello</i>	
Emerging Trends on Satellite-Based Applications in Healthcare: A Synoptic View	53
<i>Alessandro Paravano, Matteo Viterbo, Paolo Trucco</i>	
The Importance of UN SDGs and ESG Adoption Within Business in the Space Sector	68
<i>Sabrina Alam, Nicolas Peter</i>	
In Search of the European Way for Space: Reconciling Cooperation and Independence in the Implementation of the Space Agenda 2030	81
<i>Valentin Degrange, Amaury Dufay</i>	

THE FUTURE OF SPACE EXPLORATION AND INNOVATION

Alternative Futures for Crewed Space Cooperation After the International Space Station	91
<i>Scott Pace</i>	
The Impact of Changing Policies on Nuclear Space Technology	102
<i>Carissa Christensen, Renata Kommel, Tyler Way, Annika Rollock, Jaclyn Wiley, Jason Hay</i>	
The Global Expert Group on Sustainable Lunar Activities (GEGSLA) Contribution to the International Lunar Governance Definition	112
<i>Giuseppe Reibaldi, Dumitru-Dorin Prunariu, Giuliana Rotola</i>	
ESA's Future Moon Mission Studies	117
<i>Markus Landgraf</i>	

Economic and National Competitiveness Impacts of the Artemis Program	122
<i>Patrick Besha</i>	
The Future of International Cooperation in Space.....	130
<i>Svetla Ben-Itzhak</i>	
NewSpace and Space Exploration: A Comparison Between the USA and Europe Approach to Procurement.....	145
<i>Damini Pantaleon, Nicolas Peter</i>	
Global Legal and Policy Debates Pertaining to Lunar In-Situ Resource Utilisation	155
<i>Rukmini Roy, Mariel Borowitz</i>	
A Framework for Mars Sample Return: Who Gets Access and What Issues Must Be Addressed	169
<i>Ekaterina Seltikova, Angel M. Zarate-Villazon, Anirudh Balaji N S, Bram De Winter, Brenda Garcia Gonzalez, Florence Pauline Basubas, Sahil Bhatia</i>	
What's New in NewSpace: Mapping and Defining NewSpace	182
<i>James Murphy, Nicolas Peter</i>	

ECONOMIC ANALYSIS OF BOTH ACTUAL AND POTENTIAL FUTURE BENEFITS FROM SPACE ACTIVITIES AND APPLICATIONS TO NATIONS AND PEOPLES.

Assessing the Value of the Next Generation Space Projects: State-Of-the-art and New Perspectives	197
<i>Alessandro Paravano, Giorgio Locatelli, Paolo Trucco</i>	
Fostering a Thriving Space Ecosystem in Portugal	210
<i>Manuel Wilhelm, Joan Alabart, Carolina Sá, Sofia Souto, Marta Gonçalves, Hugo Andre Costa, Carolina Rego-Costa</i>	
National Space Innovation Systems : The Indian Framework.....	226
<i>Sagarika Rao Valluri, Andrew J. Aldrin</i>	
Space Based Solar Power: Updates to Economic Feasibility Studies	232
<i>Nikolai Joseph, Jordan Sotudeh</i>	
The Case for Solar Power Satellites Over Terrestrial Renewable Energy Sources.....	241
<i>Alex Ellery</i>	
Open Space : A Review of Policy Making and Privatization of Space Sector in India	242
<i>Siddharth Joshi, Sinchana P Kumar, Eshaan Kashid, Yeshaswini Radhakrishnan</i>	
The Challenges of Low-Cost Satellites for Space Services Ventures in the Developing World- A Focus on Africa	258
<i>Giacomo Primo Sciortino, Gaetano Zarcone</i>	
Statistics and Thematic Satellite Accounts for Measuring the Space Economy	273
<i>Stéphanie Willekens, Claire Jolly, Tina Highfill, Marit Undseth</i>	
Economy Dimension of the Expected Cislunar City	280
<i>Gennaro Russo</i>	
A Data Driven Proposal for Joint Collaboration in Space Exploration	281
<i>Jason Cornelius, Holly Dinkel</i>	

ASSURING A SAFE, SECURE AND SUSTAINABLE ENVIRONMENT FOR SPACE ACTIVITIES

The Cost of Constellations: An Analytical Approach to Implementing Space Traffic Management Policy.....	295
<i>Maggie Allen</i>	
Japan's Approach to Transparency and Confidence-Building Measures on On-Orbit Servicing	308
<i>Kazuto Suzuki, Koichi Kikuchi, Quentin Verspieren</i>	
Space Law for New Space Actors: for Governmental Officials and Beyond	316
<i>Scarlet O'Donnell, Yukiko Okumura</i>	
Strategies in Support of a Safe, Secure and Sustainable Space Environment	326
<i>I. Pessoa-Lopes, Pedro Ataíde Hilário</i>	
Synergy for Outer Space Sustainability: ITU's Role Today and Tomorrow.....	341
<i>Veronique Glaude, Cessy Karina</i>	
The Current State of International Governmental and Commercial Best Practices and Norms of Behaviour in Space.....	354
<i>Peter Martinez</i>	
Role of Emerging Nations in Ensuring Long-Term Space Sustainability	362
<i>Minoo Rathnasabapathy, Danielle Wood, Maya Slavin</i>	
The Role of the Private Section in Establishing and Supporting a Safe, Secure, and Sustainable Space Environment.....	376
<i>Jenny Franulovic</i>	
Corporate Social Responsibility for Space: When Will it Matter, and Why?.....	384
<i>Andrew Garza</i>	
This is Our Space: Contributions from the Young Generations for Sustainable Space Activities	394
<i>Morgane Lecas, Antonio Carlo, Jamila Mendoza, Nicolas Moraitis, Gabrielle Leterre, Brenda Garcia Gonzalez, Trevor Owen, Dhanusshya Raghu, Giuliana Rotola, Antonino Salmeri, Mishti Das</i>	

FINANCIAL VIABILITY AND SUPPLIER MONITORING IN TIMES OF ECONOMIC VULNERABILITY

KEYNOTE: Recalibrating the Space Sector Procurement Practices to Better Prepare After COVID-19.....	406
<i>Nancy C. Wolfson</i>	
An Sme Story in Its Quest for Sustainability Within the Redefinition of the European Space Industrial Landscape.....	407
<i>Hervé Cottard</i>	
European Space SMEs Financial Viability: Insights and Policy Perspectives.....	413
<i>Marleen Willekens, Peter Teirlinck, Simon Dekeyser, Jens Kauffmann, Pablo Marin, Hans Bracquené, Rosario Pavone</i>	
Jena-Optronik GmbH - Dominik Klose.....	429
<i>Dominik Klose, Reinhard Berger</i>	

Analysis of the Commercial Satellite Industry: Key Indicators, Global Trends, and COVID-19 Impact.....	434
<i>Carissa Christensen, Tom Stroup, Nickolas Boensch, Anton Dolgoplov, Cameron Herrera, Therese Jones, Phil Smith, Carie Mullins</i>	

Employment, Supply Chain and SME Support in Private-Driven National Space Program in COVID-19 Crisis.....	439
<i>Mi-Jin Yoo</i>	

How to Remain Resilient During a Worldwide Health Crisis?.....	442
<i>Didier Manzoni</i>	

Managing Compliance and Ethics Risks by Space Agencies in the Context of New Space and Market Volatility.....	444
<i>Philippe Clerc</i>	

INTERACTIVE PRESENTATIONS - 35TH IAA SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS

A Case for Market-Based Emission Control in the Space Industry.....	445
<i>Erin Richardson, Arjun Chhabra, Gabriele D'Eleuterio</i>	

Strategic Intelligence in Conducting the Brazilian Space Program.....	455
<i>Aluisio Camargo, Erik Busnello Imbuzeiro, Leticia Morosino</i>	

Report on African Geospatial and Socio-Economic Progress	465
<i>Manuel Ntumba</i>	

Technological Innovation, Economic Growth and Space2030 Agenda: A Brief Report Based on a Perspective of an Emerging Country	466
<i>Aluisio Camargo, Erik Busnello Imbuzeiro, Renan Almeida, Mylena Arão</i>	

Latin American and Caribbean Space Agency: Challenges and Opportunities	476
<i>Nickté Basurto</i>	

Global Space Strategy – Uniting Towards a Common Objective.....	477
<i>Dharshun Sridharan, Nipuni Silva, Shehan Fernando</i>	

Orbital Debris: from Vicious Circles to Circular Economy Through Compliance and Financial Sustainability	491
<i>Lucien Rapp</i>	

Analysis of Patent Filing Data in the Space Sector: Key Findings and Lessons Learned	515
<i>Tomas Hrozensky, Stephan Speidel, Johannes Schaaf, Nuria Alfageme</i>	

Higher Resolution Restriction Over Israel and Palestine: A Political Retrospective on Democratizing Access to Geospatial Data for Sustainable Development	521
<i>Martin Sarret, Michael Fradley, Alberto Rueda Carazo</i>	

Main Results of the Strategic Alliance Between Brazil and China Within the Cbers Program	522
<i>Bruna Araujo, Michele Cristina Silva Melo</i>	

Brazil's First Steps in the Commercial Space Launch Sector: What Has Been Done in the Past Two Years?	523
<i>Michele Cristina Silva Melo, Thais Pedrosa, Andrea Fellipe Cabello</i>	

The Financing Model for Research and Development Activities in the Brazilian Space Sector	534
<i>Antonio Cristovao Dos Santos, Michele Cristina Silva Melo</i>	
Estimating Copernicus High Priority Candidate Missions Jobs for Europe	535
<i>Elisabetta Lamboglia, Luisa Corrado, Fabio Del Frate</i>	
The Costa Rica Space Agency: A New Paradigm for a Self-Sustainable Public Space Agency	542
<i>Adolfo Chaves Jiménez, Eldon Cadwell, Johan Carvajal-Godinez, María Del Rocío Cerdas Quesada</i>	
Space Diplomacy: Blue Economy for a Green Future.....	543
<i>I. Pessoa-Lopes, Pedro Ataíde Hilário</i>	
Economical Feasibility of Reusable Launch Vehicles for the Limited-Market-size Entities.....	555
<i>Soon-Young Park</i>	
Space Regulations as Instruments of Competitiveness of Launch Countries	563
<i>Amélia Onohara, Lucia Helena Freitas, Michele Cristina Silva Melo, Andrea Cabello</i>	
Public Financing Instruments for Space Investment in Brazil.....	564
<i>Danusa Szymanski, Michele Cristina Silva Melo</i>	
Economic Efficiency of a Mini Upper Stages: Opportunities, Approaches, Solutions.....	565
<i>Georgy Shcheglov, Tamara Ryzhikova, Anatoly Shapovalov</i>	
Current and Future Applications of Earth Observation Data in Administrative, Civil and Criminal Proceedings	572
<i>Ivan Fino, Pietro Santoriello, Giulia De Rossi, Rosa Tarda</i>	
Turning an Admonition into Aspiration: How a Slavery-Free Mars Can Secure the Space Sector's Role as a Major Driver of Sustainable Development	573
<i>Juliana Rinaldi-Semione</i>	
Exploring Megaproject Governance with Regard to Collaboration Through the Case of the International Space Station.....	589
<i>Gabor Tatar</i>	
Quo Vadis Suborbital Rocketry. the Dilemmas and Regulatory Alternatives for the Emerging National Suborbital Laws	602
<i>Katarzyna Malinowska, Bartosz Malinowski</i>	
Space, Defence and Security: Cooperation Between ESA and EU to Enhance Europe's Geopolitical Role	609
<i>Maria Vittoria Prest, Alessandro Bonifazi</i>	
How to Scale Up a Space Company: Regulations and Challenges.....	623
<i>Ana Cristina Galhego Rosa</i>	
How Do Space and Technologie Services Affect the Brazilian Banking System?	624
<i>Fernando Cardoso Boaventura Oliviera, Michele Cristina Silva Melo</i>	
Space and International Cooperation for Equality and Inclusion: Achieving "Space2030" Agenda.....	625
<i>Milica Milosev</i>	
Is There Room to Regulate the Space Sector in Brazil?	626
<i>Andrea Fellipe Cabello, Lucia Helena Freitas, Michele Cristina Silva Melo</i>	

The Brazilian Space Program: An Analysis on Innovation, Space Exploration and Its Socioeconomic Benefits	635
<i>Erik Busnello Imbuzeiro</i>	
Australia’s Space Policies and Strategies to Develop the Space Ecosystem	651
<i>Stephanie Wan</i>	
Two Ships in the Night: U.S. Export Requirements for Commercial On-Orbit Servicing – Analyzing a Case of Mechanical Docking	652
<i>Laura Cummings</i>	
French Views and Actions in Space.....	658
<i>Makena Young</i>	
The Universal National Policy Model for Safe, Secure and Sustainable Space Environment	672
<i>Sumaya Alhajeri</i>	
Mexico and Its Resources for the Preparation of the Next Space Generation.	673
<i>Daniela Fernanda González Chávez</i>	
In Space, if You Win, I Win: The Path to Harnessing Mutual Benefit from Civil Space Activities	680
<i>Scott Schneider</i>	
Policy, Regulatory and Diplomatic Perspectives on Threshold-Based Models for Space Safety and Sustainability	681
<i>Matija Rencelj, Stijn Lemmens, Francesca Letizia, Sara Dalledonne, Clémence Poirier, Sebastien Moranta, Lina Pohl</i>	
Toward the Establishment of a New Space Economy European Legislation: International Perspectives	692
<i>Giulia Bordacchini</i>	
Steering Space Activities for Global Benefits:a Critical Study of the Asia-Pacific Framework for Prospective Space Development	693
<i>Naoko Sugita, David Lit Xian Ho</i>	
Cislunar Space Domain Awareness (SDA).....	705
<i>Francis Humphrey, Mariel Borowitz</i>	
Diagnosis and Construction of Scientific and Technological Capacities for the Development of Space Policies in Developing Countries, Case of Colombia	715
<i>Daniela Bello, Samuel Cadavid</i>	

LATE BREAKING ABSTRACTS

Establishment of Korea’s New Space Agency.....	716
<i>Jong-Bum Kim</i>	

Author Index