

IAF Space Operations Symposium

Held at the 76th International Astronautical Congress
(IAC 2025)

Sydney, Australia
29 September - 3 October 2025

ISBN: 979-8-3313-2934-1
DOI: <https://doi.org/10.52202/083086>

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© (2025) 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

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

B6.1 GROUND OPERATIONS - SYSTEMS AND SOLUTIONS

Flex-Console - More than Just a Furniture for Space Operations - Experiences from LUNA Project	1
<i>Marcin Gnat, Thomas Müller, Frank Peters, Martin Bauer, Thomas Singer, Uwe Schäfer, Florian Paul, Florian Marks, Manfred Schmid</i>	
Future-Proofing: Evolving Operations to Meet Uncertain Future Mission Needs	13
<i>Gareth Williams, Kevin Marston, Flavio Murolo</i>	
Study on Ground Segment Automation Concepts for Past and Present VLEO Satellite Missions.....	31
<i>Markus Kranz, Frederik Dall'Omo, Sabine Klinkner</i>	
Enhancing Ground Control Facility Maintenance with a Z-DEMATEL and Z-VIKOR Based DSS	43
<i>Alish Nazarov</i>	
Full Functional Test, Data Management, Machine Learning and Automatization of the Cubesat Control Centre: Moving Towards the Operations Phase of an Educational Ground Station.	51
<i>Giorgio Abbate, Serena Campioli, Sabrina Corpino, Fabrizio Stesina, Daniel Alexandru Cazacu, Davide Demoro, Andrea Tomatis, Leonardo Di Nardo</i>	
Challenges, Threats, and Solutions in Enhancing Cybersecurity in Space Mission Ground Operations	62
<i>Mehriban Karimova, Elmar Bashirov, Khayyam Masiyev</i>	
FOGATA – Integrating Optical Ground Stations into Common RF Ground Stations Networks.....	67
<i>Pierre-Alexis Lagadrilliere, Petros Karafillis, Michael Dlubatz, Marcus Knopp, Bijan Nouri, Luis F. Zarzalejo</i>	

B6.2 INNOVATIVE SPACE OPERATIONS CONCEPTS AND ADVANCED SYSTEMS

Advanced Mission Operations and Collaborative Innovation in the Otter CubeSat Mission.....	73
<i>Sacha Tholl, David Krieger, Andreas Ohndorf, Marcus Knopp, Maurice Uteg, Bernd Dachwald</i>	
Contingency Operations Planning and Challenges in the Pinpoint Lunar Landing Sequence of the SLIM Mission.....	84
<i>Satoshi Ueda, Takahiro Ito, Kentaro Yokota, Shin-Ichiro Sakai</i>	
Utilisation of Digital Assistants to Augment Next Generation Mission Operations.....	93
<i>Mahesh Nidugala, Michael Morgan</i>	
Remote Diagnostics of Aerospace Ground and Flight Testing	99
<i>Fabian Zander</i>	
Explainable Decision Support for Conjunction Risk Analysis and the Design of Robust Collision Avoidance Manoeuvres	106
<i>Paul Darm, Ben Parsonage, Callum Wilson, Annalisa Riccardi, Massimiliano Vasile</i>	
Preparing the Ispace Tenacious Rover for the Moon: Mobility, Navigation, and Operator Training in Multi-Site Roving Trials.....	118
<i>Philippe Ludvig, John Walker, Sophia Casanova</i>	

Exploring Scale Model On-Orbit Space Situational Awareness with Event Based Sensors.....	120
<i>David McAfee, Phu Duy Tran, Rounak Manoharan, Vladimir Perejogin</i>	
How to Approach Early Operations in a Challenging Environment.....	128
<i>Angel Milagro, Katherine Gilliam, Krishna Soni, Camille Boucher, Haroon Syed, Janelle Wellons</i>	
OPS-SAT-1 Mission Planning, Scheduling and Automation Concepts of Operations.....	138
<i>Nuno Carvalho, Tim Oerther, Sam Bammens, Maximilian Henkel, David Evans</i>	
Investigation on Boundary Conditions for VLEO Satellite Missions and Their Operational Impact.....	147
<i>Markus Kranz, Frederik Dall'Omo, Sabine Klinkner</i>	

B6.3 MISSION OPERATIONS, VALIDATION, SIMULATION AND TRAINING

Attitude Analysis and Operational Preparations for Deployment of BepiColombo MMO	160
<i>Kentaro Yokota, Taisei Nishishita, Chikako Hirose, Yukiho Ohtsuki, Shin-Ichiro Sakai, Takaaki Kato, Nayu Suzuki, Mizuki Shinano, Kazuyoshi Kono, Naomi Suto, Akira Kawaguchi, Taeko Seki, Miwako Yamashita, Satoru Nakazawa, Tomoaki Toda, Hiroyuki Ogawa</i>	
∂LITE: Differentiable Lighting-Informed Trajectory Evaluation for On-Orbit Inspection	167
<i>Jack Naylor, Raghav Mishra, Nicholas Barbara, Donald G. Dansereau</i>	
REE-CON: Real-Time Extraterrestrial Excavation and Construction Operations Using Space Teams PRO	179
<i>Neil McHenry, Connor Jakubik, Waylon Lee, Matthew Luke Brown, Yotam Freund, Erin Caña, Gregory Chamitoff</i>	
Autonomous Flyby Operations for Comet Interceptor Probe B1: Guidance, Navigation, and Control Strategy.....	189
<i>Takahiro Sasaki, Naoya Ozaki, Masahiro Fujiwara, Ryo Iba, Naoya Sakatani, Kai Ryogo, Yukiho Ohtsuki, Taichi Ito, Shintaro Nakajima, Ryu Funase, Toshihiro Suzuki, Hirotaka Sekine, Akira Hatakeyama, Daiki Tsuzuki, Kota Kakiyama</i>	
Operational Challenges During the Kaust Hyperspectral Cubesat Mission	206
<i>Dario Scilla, Victor Angulo, Naif Alsalem, Matthew McCabe</i>	
How We Lost a Satellite for 48 Hours - First Weeks of HYPE Operations from the Perspective of the Flight Director.	213
<i>Jakub Kopec</i>	
Mission Operation: SANSA HBK Satellite Ground Station, Operations, Verification and Training.	221
<i>Senelisiwe Gladys Magagula, Sindisiwe Charity Sono</i>	
Simulation-Driven Development: Training, Testing, and Mission Planning for Planetary Rovers	226
<i>Stefano Giulianelli, Andrea Delli, Mehrad Yousefi</i>	
Houston, We Have No (Training) Problem: The Role of Computer-Based Training in Satellite Operations	234
<i>Philipp Bonin</i>	
Advanced Training in Advance	241
<i>Michael Schmidhuber, Andreas Ohndorf</i>	

B6.5 LARGE CONSTELLATIONS & FLEET OPERATIONS

Real-Time Collision Avoidance Algorithms for Satellite Constellations Using Deep Learning	246
<i>Yaqoob Alqassab, Ranyah Taha, Maryam Almeer, Mariam Ahmed, Yasmina Tammam</i>	
Dynamic Task Allocation for Heterogeneous Satellite Constellations in Multi-Stage Wildfire Monitoring.....	253
<i>Keqin Zhang, Zhijiang Wen, Liu Yan, Lu Li</i>	
D3QN-Based TT&C Mission Planning Method for Mega-Constellations Under Limited Ground Stations	260
<i>Jiadao He, Rui Xu, Hao Zeng, Bang Wang</i>	
Galileo Constellation Optimisation: Efficient and Autonomous Routine Housekeeping	266
<i>Andrea Maderi, Marvin Barnier, Gustavo Ribeiro, André Bauer</i>	
Blockchain & Quantum Data Processing for Secure Satellite Constellations	272
<i>Samiksha Raviraja</i>	

B6.IP INTERACTIVE PRESENTATIONS - IAF SPACE OPERATIONS SYMPOSIUM

Analyzing Weather Impact on Signal Quality of S Band Ground Station	280
<i>Saiah Bekkar Djelloul Saiah</i>	
Relative RAAAN Shift Using J2 Perturbation with Finite Thrust and Burn Time Constraint	285
<i>Hangeol Kim, Youngbum Song, Jaemyung Ahn</i>	
Robust Control and Path Planning for Modular On-Orbit Assembly by Dual-Arm Space Robots	291
<i>Xiaoyi Wang, Xue Bai, Jiahao Qin, Yifan Wang, Wenchi Zhao, Ming Xu</i>	
Optimal Satellite Task Allocation Using Small Satellite Constellations: Integer Linear Program Based Approach.....	302
<i>Beomjin Gwon, Taeung Hwang, Jeonghwan Go, Jaemyung Ahn</i>	
Responsive RPO for Commercial Application	308
<i>Sho Fujita</i>	
Linguistic Description Generation for Non-Cooperative Spacecraft Time-Series Behaviors Using Transformer Models	320
<i>Pengyu Guo, Kunpeng Wang, Qinglei Hu, Wei Li, Lei Zhu, Dongyu Li</i>	
An Integrated Framework Based on Deep Autoregressive Models for Satellite Telemetry Parameter Forecasting, Imputation and Anomaly Detection	329
<i>Linjian Sun, Zhun Feng, Su Ju, Liu Yurong</i>	
Agentic AI Workflow Analysis for a Robotic Debris Removal Mission	334
<i>Javier Maldonado-Romo, Farah Diya Yasmine, Ridima Sur, Oumaima Nakrimi, Luis Montesinos, Pedro Ponce</i>	
Satellite Parametric Analysis Computing Environment (SPACE) - A Rapid Orbital AI Validation Platform	342
<i>Sam Hall, Peter Moar, Prem Prakash Jayaraman, Ahmed Azim, Michelle Abrigo, Elysia Guglielmo, Nahid Tanjum, Yuganya Perumal, Connor Bett</i>	

Development and Optimization of an Operations Concept for a Dual-LiDAR Component of the Earth Return Orbiter	348
<i>Andre Kupetz, Gregor Jochmann, Juergen Rossmann</i>	
A Reinforcement Learning and Reaction Null-Space Based Obstacle Avoidance Planning Method for Free-Floating Space Manipulators	356
<i>Xinhao Miao</i>	
A Temporal Uncertainty-Oriented Mission Planning Method for Autonomous Deep Space Probes	363
<i>Shizhen Li, Rui Xu, Zhaoyu Li, Shengying Zhu</i>	
Evaluating the Impact of Solar Storms on Satellite Power Systems Using Space Weather Data	371
<i>Yaqoob Alqassab, Yusuf Alqattan, Abdulrahman Mubarak</i>	
A Space Robotics Design Challenge in a High-Fidelity Virtual Environment	385
<i>Alexandr Sein, Neil McHenry, Connor Jakubik, Yotam Freund, Ansh Gupta, Matthew Brown, Greg Chamitoff</i>	
Impact of Mindfulness Application During Analog Space Missions.....	393
<i>Natalia Hazbun, Julio Rezende, Gabriel Matheus Dutra Santos, Danilo Cacavo</i>	
Development and Validation of VERTECS Satellite Ground Station Operation Software for Real-Time Telemetry and Mission Command Execution.....	403
<i>Raihana Shams Islam Antara, Abdulla Hil Kafi, Victor Schulz, Ryo Hashimoto, Yukihiisa Otani, Kei Sano, Kenichi Asami</i>	
Multi-Type, Multi-Satellite Scheduling for Heterogeneous Earth Observation Satellite Constellations	412
<i>Harrison Steyn</i>	
TriGNN-DRL: A Graph Reinforcement Learning-Based Method of Information Dissemination for Mega-Constellation Networks.....	427
<i>Haohua Niu, Yong Li, Weiyu Zhu, Bangchu Zhang, Tao Wu, Zongfu Luo</i>	
Autonomous Space Operation Planner and Scheduler (ASOPS): Architecture and Onboard Implementation in the SeRANIS Mission	438
<i>Francesco Porcelli, Johannes Bachmann, Tom Andert, Roger Förstner</i>	
Advanced Instance Segmentation for Non-Cooperative Spacecraft Components in On-Orbit Servicing: Dataset Synthesis and Hybrid Transformer-CNN Network	447
<i>Zhi Xu, Zhanxia Zhu, Xinyu Fu, Qianlong Li</i>	

B6.IPB INTERACTIVE PRESENTATIONS - IAF SPACE OPERATIONS SYMPOSIUM

Machine Learning Approaches for Antenna Servo Control System Failure Prediction	453
<i>Mrudhula Vijayakumar, Rohinkumar Maheswaran</i>	

B6.LBA LATE BREAKING ABSTRACTS (LBA)

Satellite Manoeuvre Detection and Analyses Based on Ephemerides	474
<i>Wenze Ma, Yang Yang, Qiangyi Huang</i>	
Cologne Manual on Space Traffic Management: A First Step Toward Global STM?	490
<i>Jacqueline Reichhold</i>	

Author Index