

2022 IEEE Aerospace Conference (AERO 2022)

**Big Sky, Montana, USA
5-12 March 2022**

Pages 1-877



**IEEE Catalog Number: CFP22AAC-POD
ISBN: 978-1-6654-3761-5**

**Copyright © 2022 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP22AAC-POD
ISBN (Print-On-Demand):	978-1-6654-3761-5
ISBN (Online):	978-1-6654-3760-8
ISSN:	1095-323X

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
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

50 Years of Spaceflight with Fourier Transform Spectrometers (FTS) Designed at NASA GSFC	1
<i>Conor A. Nixon, Shahid Aslam, John C. Brasunas, Donald E. Jennings</i>	
Service Management & Orchestration of 5G and 6G Non-Terrestrial Networks.....	21
<i>Brian Barritt, Wes Eddy</i>	
Venus High Temperature Motor and Rotary Percussive Drill for Pneumatic Acquisition of Samples	32
<i>Kris Zacny, Jeffery L. Hall, Jameil Bailey, Bernice Yen, Fredrik Rehnmark, Evan Cloninger, Jerry Moreland, Kris Sherrill, Joseph Melko, Leah M. Nakley, Jacob Tims, Raymond Zheng</i>	
Soil Moisture Active Passive: Flying a Spacecraft from Home	44
<i>Masashi Mizukami, Mark D. Garcia, Fannie C. Chen, Robert Fogg, Vincent S. Hung, Charles E. Kirby, Keven I. Uchida, Robert R. Wing</i>	
Deterrence of Cycles in Temporal Knowledge Graphs	55
<i>Seif Azghandi</i>	
Thermal Design of the Thermal Infrared Spectrometer (TIRS) Instrument on PREFIRE	64
<i>Ian M. McKinley, Gregory D. Allen, Rogelio Rosas, Andres Andrade</i>	
Domain Adaptation for 6-DoF Pose Estimation: Deep Learning with Uncertainty	73
<i>Shintaro Hashimoto, Daichi Hirano, Haruhiko Higuchi, Kohei Fujimoto, Miki Ito, Seita Iizuka, Yohei Sugimoto, Ryan Proffitt, Yusuke Kobayashi, Naoki Ishihama</i>	
Dynamic Resource Management Algorithm Reconfiguration for Multibeam Satellite Constellations.....	85
<i>Sergi Aliaga, Juan Jose Garau-Luis, Edward Crawley, Bruce Cameron</i>	
Attitude Control of Hansa-3 Aircraft with Perturbation Using Sliding-Mode Controller	98
<i>Prabhjeet Singh, Salahuddin, Dipak K. Giri, Ajoy K. Ghosh</i>	
OMIA: MH-60R Helicopter Desktop Crew Trainer & Software Change Experimentation Tool	107
<i>Robert Richards, Bart Presnell</i>	
3D Printing CubeSat Parts with Power and Data Transfer Functionalities with Two Blends of PEEK.....	114
<i>Michal Siemaszko, Dawid Piastowski, Wojciech Namiotko, Daniel Dudenko, Jacek Krywko, Ugo Lafont</i>	
OPS-SAT Spacecraft Autonomy with TensorFlow Lite, Unsupervised Learning, and Online Machine Learning.....	123
<i>Georges Labreche, David Evans, Dominik Marszk, Tom Mladenov, Vasundhara Shiradhonkar, Tanguy Soto, Vladimir Zelenevskiy</i>	
Power Converter Design for the Europa Lander Motor Controller	140
<i>Ben Cheng, Gary Bolotin, Don Hunter, Malcolm Lias</i>	
On the Maximum Likelihood Non-Data-Aided Phase Error Detector for 16-APSK	147
<i>Michael Rice, Bryan Redd, Autumn Twitchell</i>	
How Do We Get Robots to Take Self-Portraits on Mars? - Perseverance-Ingenuity and Curiosity Selfies.....	156
<i>Vandi Verma, Joseph Carsten, Michael Ravine, Megan R. Kennedy, Kenneth S. Edgett, Amy Culver, Nicholas Ruoff, Nathan Williams, Luther Beegle</i>	

The 2033 Crew Mars Flyby Mission	170
<i>Benjamin Donahue, Matt Duggan</i>	
Automated Training and Deployment of Machine-Learning Models for Anomaly Detection in Telemetry	186
<i>Kedar Naik, Andrew Palmer, John Kenworthy</i>	
Radiation Test and in Orbit Performance of MpSoC AI Accelerator	199
<i>Leenie Buckley, Aubrey Dunne, Gianluca Furano, Maris Tali</i>	
A European Roadmap to Leverage RISC-V in Space Applications	208
<i>Gianluca Furano, Stefano Di Mascio, Alessandra Menicucci, Claudio Monteleone</i>	
Radiation-Hardened SpaceVPX FPGA Module.....	215
<i>Elaine Cox, Tony Nelson, Rob Merl, Paul Graham</i>	
Radiation-Tolerant, High-Power Density GaN Drop-On Point-of-Load Converters	221
<i>Noah Martin, Thomas Cook, Alan George, Brandon M. Grainger</i>	
Target Detection on Hyperspectral Images Using MCMC and VI Trained Bayesian Neural Networks	232
<i>Daniel Ries, Jason Adams, Joshua Zollweg</i>	
The Importance of a Risk Management Process for Structuring the Conversation	241
<i>Gerald A. Klein, Robin L. Dillon</i>	
Compact Permanent Magnet Hexapole ECR Ion Thruster.....	251
<i>Kuo-Yi Chen, Bei-Jing Zhong</i>	
Cold Survivable Electronics Motor Control Law Implementation	260
<i>Malcolm Lias, Sunant Katanyoutanant, Gary Bolotin, Donald Hunter, Ben Cheng</i>	
Space Scientific Instrument Taxonomy (SSIT) Version 2.0	267
<i>Nichols F. Brown</i>	
Radar Back End for NASA/ISRO Synthetic Aperture Radar (NISAR) Instrument	285
<i>Momin Quddus, Brian Custodero, Barry Volain, Brandon Wang, Scott Shaffer, Bruce Krohn, Nelson Huang, Ben Tsoi, Steve Tseng</i>	
SpaceFOM: An Interoperability Standard for Space Systems Simulations.....	300
<i>Edwin Z. Crues, Daniel E. Dexter, Bjorn Moller, Alberts Falcone, Alfredo Garro</i>	
Digital Lunar Exploration Sites (DLES)	310
<i>Edwin Z. Crues, Samuel J. Lawrence, Paul Bielski, Andrew Britton Jacobs, Jonathan Schlueter, Amy Jagge, Cory Foreman, Chris Raymond, Nick Davis</i>	
Investigation of Mirror Satellite Concept to Provide Augmented Lighting for Dim Space-Based Objects.....	323
<i>Daniel Dombrowski, Collin Gwaltney, Major Robert Bettinger</i>	
Understanding Degradation and Heat Losses in the MMRTG and an Improved Analysis of F1 on Curiosity	338
<i>Christopher E. Whiting, Chadwick D. Barklay, B. Allen Tolson</i>	
The Johns Hopkins University Applied Physics Laboratory's Earned Value Management Surveillance Program - Benefits to JHU/APL and Its Sponsors.....	347
<i>William Liggett, Howard Hunter, Andy Soukup</i>	

Exported Forces of Tactical Cryocoolers	360
<i>Mason A. Mok, Ian M. McKinley, Jose I. Rodriguez</i>	
A Method for Incorporating Quartz Crystal Microbalance Thermo-Gravimetric Assessment Data in Contamination Modeling	374
<i>John R. Anderson</i>	
Structure- Integrated Antennas for Solar Sails	382
<i>Nicolas Appel</i>	
A Model-Based Systems Engineering Journey to Developing a Concept of Operations (ConOps)	391
<i>Jeffrey Cohen, Mary Susan Kaetzer, Sarah Lumpkins, David Rubin, Kerry McGuire</i>	
Identifying Biosignatures on Planetary Surfaces with Laser-Based Mass Spectrometry	405
<i>Peter Wurz, Marek Tulej, Rustam Lukmanov, Valentine Grimaudo, Salome Gruchola, Kristina Kipfer, Coenraad De Koning, Nikita Boeren, Loraine Schwander, Peter Keresztes Schmidt, Niels F. W. Ligterink, Andreas Riedo</i>	
Challenges in Explaining Source Code Quality Assessment.....	421
<i>Jeremy Ludwig, Devin Cline</i>	
Methodology to Model Effect of Thermal Barriers on Downstream Heat Rates	428
<i>Christa Humbert, Peter Clarke</i>	
On the Observability of Spacecraft Navigation Using Landmarks.....	434
<i>Evan M. Ward, Roshni J. Patel</i>	
Reinforcement Learning-Based Anomaly Detection for PHM Applications	448
<i>Samir Khan, Takehisa Yairi, Shinichi Nakasuka, Seiji Tsutsumi</i>	
Obtaining System Knowledge Early to Build Cost and Schedule Estimating Confidence.....	455
<i>Patrick K. Malone</i>	
Testing of Louver Operability After Spacecraft Launch Distortions	470
<i>Tony Licari, Sean Reilly, Steve Krach</i>	
Live Detection of Foreign Object Debris on Runways Detection Using Drones and AI	481
<i>Adam Parker, Felipe Gonzalez, Peter Trotter</i>	
Dynamic Characterizations of 650 V, 900 V and 1200 V SiC MOSFETs Under Low Temperatures	494
<i>Yuqi Wei, Md Maksudul Hossain, Alan Mantooth</i>	
Ingenuity Mars Helicopter: from Technology Demonstration to Extraterrestrial Scout	502
<i>Theodore Tzanetos, Mimi Aung, J. Balaram, Havard Fjrer Grip, Jaakko T. Karras, Timothy K. Canham, Gerik Kubiak, Joshua Anderson, Gene Merewether, Michael Starch, Mike Pauken, Stefano Cappucci, Matthew Chase, Matthew Golombek, Olivier Toupet, Marshall C. Smart, Stephen Dawson, Erick Blandon Ramirez, Johnny Lam, Ryan Stern, Nacer Chahat, Joshua Ravich, Robert Hogg, Benjamin Pipenberg, Matthew Keennon, Kenneth H. Williford</i>	
Time Smearing in Space-Based 3D Synthesis Imaging	521
<i>Cornelis Vertegaal, Hamid Reza Pourshaghghi, Stefan Wijnholds, Mark Bentum</i>	
A Matching-Based Method for Anomaly Verification in Spacecraft Telemetry.....	529
<i>Tianyu Li, Mary Comer, Edward Delp, Sundip R. Desai, Richard H. Foster, Moses W. Chan</i>	

Preparing the Mars Relay Network for the Arrival of the Perseverance Rover at Mars.....	537
<i>Roy Gladden, Aseel Anabtawi, Dustin Buccino, Jared Call, Neil Chamberlain, Harvey Elliott, Paul Fieseler, Kenneth Fujii, Kamal Oudrhiri, Eve Pereira, Chloe Sackier, Emma Young, Micheal Haggard, Evan Srnka</i>	
Practical Interstellar Probe Concepts: Mission Study Results	556
<i>James Kinnison, Alice Corcoros, David Napolillo, Doug Mehoke, Gabe Rogers, Fazle Siddique, Amanda Haapala-Chalk, Wayne Schlei, David Copeland, Reza Ashtari</i>	
Error Correction System Based on COTS Microcontrollers Working in Redundancy	572
<i>Rodrigo M. Franca, Erico L. Marques, Tiago S. Da Silva, Vanderlei C. Parro</i>	
Performance Testing a New Medium Accuracy Star Tracker	580
<i>Stephen Lutgring, Emil Tchilian</i>	
An Integrated Software Architecture for Solar Cruiser Mission Design and Navigation.....	588
<i>Jason Everett, Andy Heaton, Aaron Houin, Kyle Miller</i>	
Analytic and Computational Guidance Strategies for the Second-Stage Mars Ascent Vehicle	597
<i>Sheril Kunhippurayil, Matthew W. Harris</i>	
Locally Optimal Trajectories from Low Lunar Orbit to Near Rectilinear Halo Orbits	610
<i>Matthew W. Harris</i>	
Assessing Mars Curiosity Rover Wheel Damage.....	616
<i>Arturo Rankin, Nikunj Patel, Evan Graser, Jiun-Kai Freddy Wang, Kimberly Rink</i>	
The Necessity of Deduction for Efficient and Effective System Concept Formulation	635
<i>Alfred Nash</i>	
Direct Measurement of Neutral Gas During Hypervelocity Planetary Flybys	642
<i>Rico G. Fausch, Peter Wurz, Bjorn Cotting, Urs Rohner, Marek Tulej</i>	
Mantis Within a Multi Robot Team for Lunar Exploration and Construction Tasks	654
<i>Wiebke Brinkmann, Leon C. Danter, Tobias Stark, Alexander Dettmann, Matteo De Benedetti, Shashank Govindaraj, Irene Sanz Nieto, Alexandru But, Francisco Javier Colmenero, Enrique Heredia, Mercedes Alonso</i>	
Successive Interference Cancellation for Asynchronous Signal Collision in Space-Based AIS	669
<i>Shunsuke Uehashi, Yasunori Nouda, Masatake Hangai, Takeo Ohgane</i>	
MMX Rover Simulation - Robotic Simulations for Phobos Operations	676
<i>Fabian Buse, Antoine Pignede, Jean Bertrand, Sebastien Goulet, Sandra Lagabarre</i>	
A Concept of Operations for an Interstellar Probe Mission	690
<i>Kimberly Ord, Nickalaus Pinkine</i>	
Single Event Functional Interrupts During the Cruise and EDL Phases of the Mars 2020 Mission	699
<i>Gregory F. Dubos, Mallory Lefland, Magdy Bareh, Keith Comeaux</i>	
Finding Success in Concept Development: How NOT to Design a Small Satellite Mission	712
<i>Alex Austin, Alfred Nash</i>	
Polarimeter to UNify the Corona and Heliosphere (PUNCH): Science, Status, and Path to Flight	719
<i>Craig Deforest, Ronnie Killough, Sarah Gibson, Alan Henry, Traci Case, Matthew Beasley, Glenn Laurent, Robin Colaninno, Nick Waltham</i>	

Genetic Programming + Multi-Agent Reinforcement Learning: Hybrid Approaches for Decision Processes	730
<i>Natalie Fitch, Daniel Clancy</i>	
Reinforcement Learning Heuristics for Aerospace Control Systems	740
<i>Preston K. Robinette, Benjamin K. Heiner, Umberto Ravaoli, Nathaniel Hamilton, Taylor T. Johnson, Kerianne L. Hobbs</i>	
Deep Rapid Class Augmentation a Progressive Learning Approach for Deep Neural Networks	752
<i>Hanna Witzgall</i>	
Reducing Co-Occurrence Bias to Improve Classifier Explainability and Zero-Shot Detection	760
<i>Hanna Witzgall, Weicheng Shen</i>	
A Low-Cost Airborne Surrogate Test Satellite for Space Control Network Ground Station Testing	768
<i>Blake Morgan, John Hamm, Joshua Judy, Christopher Johnson, Kyle McLeod, Shawn Kern, Chiawei Lee, Wendy Chiado, Ben Liang, Taylor Angle</i>	
Optimization of Conceptual Design of Air Breathing Hypersonic Vehicle	778
<i>Kanishka Deepak, Aaditya U Wangikar, G R Chathura, Sanmukh Sharad Khadtare, Anagha G Rao, Yatin Yogesh, Mukesh M, M V Srisha Rao</i>	
A Responsive Design and Evaluation Laboratory for Space Pointing and Tracking Systems	790
<i>Greg Bonn, Melissa Dick, Mike Newman, David T Ellis</i>	
High Resolution System for Rapid Broadband Battery Impedance Measurements	800
<i>Bryce Hill, Jon P. Christophersen, John Morrison</i>	
Mapping Earth's Dust-EMITting Regions from the ISS with the EMIT Imaging Spectrometer.....	806
<i>Bogdan V. Oaida, Amruta Yelamanchili, Christopher Wells, David R. Thompson, Robert O. Green, Matthew W. Bennett, Didier Keymeulen, Thang Pham, Daniel P. Poe, Lena Siskind, Charlene Ung</i>	
Advances in Secure 5G Network for a Nationwide Drone Corridor	818
<i>Arupjyoti Bhuyan, Ismail Guvenc, Huaiyu Dai, Mihail L. Sichitiu, Simran Singh, Ali Rahmati, Sung Joon Maeng, Ender Ozturk, Md Moin Uddin Chowdhury</i>	
Mars 2020 Entry, Descent, and Landing System Software Implementation	826
<i>Mallory Lefland, Aaron Stehura</i>	
CloudSat ACT-TWO, Design, Analysis and Results	839
<i>Heidi Hallowell, Ian Gravseth, Brian Pieper</i>	
Integrated Design Results for the MSR SRC Mars Ascent Vehicle	858
<i>Darius Yaghoubi, Shawn Maynor</i>	
First 210 Solar Days of Mars 2020 Perseverance Robotic Operations - Mobility, Robotic Arm, Sampling, and Helicopter	878
<i>Vandi Verma, Frank Hartman, Arturo Rankin, Mark Maimone, Tyler Del Sesto, Olivier Toupet, Evan Graser, Steven Myint, Kevin Davis, Douglas Klein, Justin Koch, Sawyer Brooks, Philip Bailey, Heather Justice, Marco Dolci, Hiro Ono</i>	
Autonomous Asteroid Characterization Through Nanosatellite Swarming.....	898
<i>Nathan Stacey, Kaitlin Dennison, Simone D'Amico</i>	

Dependency of Surface Temperature on Coolant Mass Flow and Heat Flux in Rocket Combustion Chambers.....	919
<i>Pascal H. Kringe, Chris Burger, Jorg R. Riccius, Evgeny Zametaev, Michael Oswald, Andreas Gernoth, Sebastian Soller, Marcus Lehmann, Stefanie Reese</i>	
The Earth in Living Color - NASA's Surface Biology and Geology Designated Observable.....	932
<i>David S. Schimel, Benjamin Poulter</i>	
Feasibility Assessment of Technical Limitations and Challenges to Deployment of a Nuclear-Powered Extrusion System on the Martian Surface	938
<i>Mark Juszczak, Enrico Fumagalli</i>	
Diversity Schemes and Coherent Combining in Digital Receivers	947
<i>Yefim S. Poberezhskiy</i>	
CPEG: A Convex Predictor-Corrector Entry Guidance Algorithm.....	967
<i>Kevin Tracy, Zachary Manchester</i>	
Ultra-Fine Pointing for Nanosatellite Telescopes with Actuated Booms	977
<i>Kevin Tracy, Zachary Manchester, Ewan Douglas</i>	
Verification of a Radio-Frequency Generator Model in a Full-wave 3D EM Simulation.....	985
<i>Yannik Rover, Chris Volkmar</i>	
ESTCube-2: the Experience of Developing a Highly Integrated CubeSat Platform	995
<i>Janis Dalbins, Kristo Allaje, Iaroslav Iakubivskiy, Joosep Kivastik, Roberts Oskars Komarovskis, Mathias Plans, Indrek Sunter, Hans Teras, Hendrik Ehrpais, Erik Ilbis, Mart Noorma, Andris Slavinskis, Maido Merisalu, Pekka Janhunen</i>	
Relative Flash LiDAR Aided-Inertial Navigation Using Surfel Grid Maps.....	1011
<i>Bangshang Liu, Vasko Sazdovski, Klaus Janschek</i>	
A Methodology for Developing a Verifiable Aircraft Engine Controller from Formal Requirements	1026
<i>Matt Luckcuck, Marie Farrell, Oisín Sheridan, Rosemary Monahan</i>	
Distributed Aperture System Field of View Investigation	1038
<i>Benjamin Naumann, Ross Elder, Spenser McIntyre, Brijen Patel, Michael Macchia, Ryan Reed, Michael Kopriva, Chiawei Lee, Thomas Schnell, Patrick Highland</i>	
Europa Clipper Mission: System Integration Review Report.....	1051
<i>Ben Bradley, Carolyn Brennan, Brent Buffington, Hayden Burgoyne, Jennifer Dooley, Jordan Evans, Winston Jackson, Kevin Kloster, Brett Smith, Erisa Stille, Joe Stehly, Steve Vernon, Kendra Cook</i>	
A Modular Framework for Integrating and Visualizing Telemetry for Mars 2020 Rover Mechanism Operations	1066
<i>Kyle Kaplan, Kevin Davis, Douglas Klein, Justin Schachter, Ben Wolsieffer</i>	
Interstellar Object Encounter Trade Space Exploration	1081
<i>Benjamin P. S. Donitz, Declan Mages, Damon Landau, Jack V. Maydan, Julie Castillo-Rogez, Davide Farnocchia</i>	
Passive Acoustic Ranging for Helicopter Altimetry on Mars, Venus, and Titan	1096
<i>Jadesola Aderibigbe, Lin Yi</i>	
Automated Onboard Mission Planning for Robust and Flexible Rover Operations.....	1103
<i>Thomas Cunningham, David A. Spencer</i>	

The Sun Radio Interferometer Space Experiment (SunRISE) Mission	1122
<i>Justin Kasper, T. Joseph W. Lazio, Andrew Romero-Wolf, James P. Lux, Tim Neilsen</i>	
Safe Reinforcement Learning Benchmark Environments for Aerospace Control Systems.....	1140
<i>Umberto J. Ravaioli, James Cunningham, John McCarroll, Vardaan Gangal, Kyle Dunlap, Kerianne L. Hobbs</i>	
Ontologies to Support Space Traffic Management Awareness	1160
<i>Carlos C. Insaurralde, Erik Blasch</i>	
Night Sky Testing of the Lunar Flashlight Star Tracker.....	1170
<i>David Sternberg, Kevin Lo, John Baker</i>	
A Comparative Analysis of Energy Management Strategies for a Fuel-Cell Hybrid Electric System UAV	1183
<i>Mohamed S. Elkerdany, Ibrahim M. Safwat, Ahmed Medhat M. Youssef, Mohamed M. Elkhatib</i>	
Assessing Cost Drivers for Mars Small Spacecraft Missions.....	1193
<i>Charles D. Edwards, Samuel R. Fleischer, Alex Austin, Nathan J. Barba, Patrick Bjornstad, Ryan C. Woolley, Jairus M. Hihn, Anto Kolanjian, Michael Saing, Robert Lock</i>	
A Stochastic Grammar Approach to Predict Flight Phases of a Hypersonic Glide Vehicle.....	1205
<i>Emily R. Bartusiak, Hanxiang Hao, Michael A. Jacobs, Nhat X. Nguyen, Moses W. Chan, Mary L. Comer, Edward J. Delp</i>	
Sub-Pixel Localization of Objects Using Multiple Spectral Bands.....	1220
<i>Mridul Gupta, Sriram Baireddy, Jonathan Chan, Mitchell Krouss, Greg Furlich, Paul Martens, Moses W. Chan, Mary L. Comer, Edward J. Delp</i>	
Decentralised Multi-UAV Cooperative Searching Multi-Target in Cluttered and GPS-Denied Environments.....	1235
<i>Xiaolong Zhu, Fernando Vanegas, Felipe Gonzalez</i>	
Flight Rule Design, Implementation, Verification, and Validation for the Psyche Mission	1245
<i>Shaheer Khan, Deep Mukherji, Christopher Lawler, Andrew Kruger, Vicken Voskanian, Maria Schellpfeffer, Farah Alibay, Nari Hwangpo, Tim Weise</i>	
A Flat Architectural Wall Approach to Electrical Integration and Test for GK2A and GK2B	1256
<i>Jung-Su Choi, Navoung Lee, Yee-Jin Cheon, Seung-Won Cho, Hyung-Wan Kim, Ja-Chun Koo, Jae-Dong Choi, Yeonho Jeong, Taejin Chung</i>	
A Comparison of Gate Detection Algorithms for Autonomous Racing Drones	1266
<i>Arti Schmidt</i>	
Toolchain for a Mobile Robot Applied on the DLR Scout Rover	1279
<i>Antoine Pignede, Walter Schindler, Roy Lichtenheldt, Bernhard Thiele, Manuel Schutt, Dennis Franke</i>	
The Psyche Planning Software Subsystem: Creating a Robust Toolset for a Discovery-Class Mission	1294
<i>Christopher R. Lawler, Shaheer A. Khan, Maria L. Schellpfeffer, Sarah H. Bairstow, Carolyn A. Ortega, Flora Ridenhour, Nora Alonge, David A. Seal, Vicken Voskanian, Keshav Ramanathan</i>	

MMX Rover Locomotion Subsystem - Development and Testing Towards the Flight Model.....	1313
<i>Stefan Barthelmes, Thomas Bahls, Ralph Bayer, Wieland Bertleff, Markus Bihler, Fabian Buse, Maxime Chalon, Franz Hacker, Roman Holderried, Viktor Langofer, Roy Lichtenheldt, Sascha Moser, Kaname Sasaki, Hans-Jurgen Sedlmayr, Juliane Skibbe, Leon Stubbig, Bernhard Vodermayer</i>	
Autonomous Navigation Performance of Cislunar Orbits Considering High Crosslink Measurement Errors.....	1326
<i>Erdem Turan, Stefano Speretta, Eberhard Gill</i>	
CosmoScout VR: A Modular 3D Solar System Based on SPICE.....	1337
<i>Simon Schneegans, Moritz Zeumer, Jonas Gilg, Andreas Gerndt</i>	
Modifying Ionic Liquid Ion Source Performance with Lithium Salt Mixtures	1350
<i>Madeleine R. Schroeder, Amelia R. Bruno, Paulo C. Lozano</i>	
URSim - A Versatile Robot Simulator for Extra-Terrestrial Exploration	1362
<i>Marco Sewtz, Hannah Lehner, Yunis Fanger, Jan Eberle, Martin Wudenka, Marcus G. Muller, Tim Bodenmuller, Martin J. Schuster</i>	
Off-Design Mission Performance Prediction for Unmanned Aerial Vehicles Based on Machine Learning	1376
<i>Tim Klaproth, Mirko Hornung</i>	
Use of Cokriging for Thermal Analysis in Small Satellites	1389
<i>Anastasios Kontaxoglou, Seiji Tsutsumi, Samir Khan, Toshihiro Shibukawa, Shinichi Nakasuka</i>	
Artificial Potential Field Guidance for Capture of Non-Cooperative Target Objects by Chaser Swarms	1400
<i>Jessica Cutler, Markus Wilde, Ashley Rivkin, Brian Kish, Isaac Silver</i>	
Adapting Commercial 5G Terrestrial Networks for Space.....	1412
<i>Oscar Somerlock, Avinash Sharma, Gregory W. Heckler</i>	
Interstellar Probe: Telecommunications Design Trades	1419
<i>Reza Ashtari, David Copeland, James Kinnison, Ralph McNutt</i>	
Trajectory-Based Generic Chassis Control Framework for the MMX-Rover.....	1430
<i>Walter Schindler, Rainer Krenn</i>	
Electrical Ground Support Equipment for the Sampling Caching System of the Mars 2020 Rover	1446
<i>Fernando Mier-Hicks, Alessandro Buscicchio, Torkom Pailevanian, Michael Elsdon, Allen Sirota, Eric Aguilar, Sawyer Brooks, Dan Levine</i>	
Modeling Ionizing Radiation for Spaceflight Dynamic Radioisotope Power Systems	1458
<i>Michael B. R. Smith, Mathew W. Swinney, Carl E. Sandifer</i>	
Artemis Deep Space Habitation: Enabling a Sustained Human Presence on the Moon and Beyond.....	1468
<i>Paul Kessler, Tracie Prater, Tiffany Nickens, Danny Harris</i>	
Improved Target Localization in Multistatic Radar Using Least Squares Method.....	1480
<i>Reena Mamgain, Jyotsna Bapat</i>	
Automated Test and Acceptance System for Battery Cells and Battery Packs for the Development of Highly-Efficient Battery Packs for Small Spacecraft.....	1488
<i>Bennet D. Schwab, Thomas N. Woods, James P. Mason</i>	

Lessons for Future In-Space Telerobotic Servicing from Robotic Refueling Mission.....	1500
<i>Zakiya Tomlinson, William Gallagher, Justin Cassidy, Brian Roberts, Kristen Facciol, Joseph Easley</i>	
NASA's Lunar Trailblazer Mission: A Pioneering Small Satellite for Lunar Water and Lunar Geology	1517
<i>Bethany L. Ehlmann, Rachel L. Klima, Calina C. Seybold, Andrew T. Klesh, Mitchell H. Au, Holly A. Bender, C. Lee Bennett, Diana L. Blaney, Neil Bowles, Simon Calcutt, Djuna Copley-Woods, James L. Dickson, Karim Djotni, Kerri Donaldson Hanna, Christopher S. Edwards, Rory Evans, Emily Felder, Robert Fogg, Robert O. Green, Gary Hawkins, Martha House, Samuel Islas, Gregory Lantoine, Sue Linch, Thomas McCaa, Ian McKinley, Trevor F. Merkley, Jasper K. Miura, Carle M. Pieters, Wil Santiago, Elena Scire, Richard Sherwood, Katherine Shirley, Chris Smith, Michael Sondheim, Peter Sullivan, Jon Temples, David R. Thompson, Kristian I Waldorff, Walton R. Williamson, Tristram J. Warren, Joshua L. Wood, Shannon Zareh</i>	
Design & Testing of Redundant Radar Altimeters for Reentry Vehicle Using Commercial Hardware	1531
<i>Eric Cain, Jennifer Snelling</i>	
Autonomous On-Board Planning for Earth-Orbiting Spacecraft.....	1538
<i>Adam Herrmann, Hanspeter Schaub</i>	
Spacecraft Time-Series Online Anomaly Detection Using Extreme Learning Machines	1547
<i>Sriram Baireddy, Moses W. Chan, Sundip R. Desai, Richard H. Foster, Mary L. Comer, Edward J. Delp</i>	
Space Applications of a Trusted AI Framework: Experiences and Lessons Learned	1556
<i>Lukas Mandrake, Gary Doran, Ashish Goel, Hiro Ono, Rashied Amini, Martin S. Feather, Lorraine Fesq, Philip Slingerland, Lauren Perry, Benjamin Bycroft, James Kaufman</i>	
CHESS: Measuring the Dynamics of Composition and Density of Earth's Upper Atmosphere with CubeSats.....	1576
<i>Rico G. Fausch, Gregor Moeller, Markus Rothacher, Nicolas Martinod, Tristan Trebaol, Alfonso Villegas, Jean-Paul Kneib, Francois Corthay, Marcel Joss, Francois Tieche, Marek Tulej, Peter Wurz</i>	
Making Or Breaking a Rover- Systems Engineering Parameters On-Board the Mars 2020 Perseverance Rover	1589
<i>Rebekah Sosland Siegfriedt, Emily Bohannon, Andre Girerd, Ian Trettel, Brian Roth</i>	
Nonlinear Model Predictive Control for Agile Guidance of Fixed-Wing sUAS.....	1603
<i>C. Alexander Hirst, John J. Bird, Christopher Reale, Eric Frew</i>	
Spacecraft Scale Magnetospheric Protection from Galactic Cosmic Radiation	1614
<i>John Slough</i>	
Airborne Visible/Infrared Imaging Spectrometer 3 (AVIRIS-3).....	1633
<i>Robert O. Green, Michael E. Schaepman, Pantazis Mouroulis, Sven Geier, Lucas Shaw, Andreas Hueini, Michael Bernas, Ian McKinley, Christopher Smith, Rami Wehbe, Michael Eastwood, Quentin Vinckier, Elliott Liggett, Sander Zandbergen, David Thompson, Peter Sullivan, Charles Sarture, Byron Van Gorp, Mark Helmlinger</i>	

NASA's Strategic Analysis Cycle 2021 (SAC21) Human Mars Architecture.....	1643
<i>Michelle A. Rucker, Douglas A. Craig, Laura M. Burke, Patrick R. Chai, Michael B. Chappell, Bret G. Drake, Stephen J. Edwards, Stephen Hoffman, Andrew C. McCrea, Douglas J. Trent, Patrick A. Troutman</i>	
Semantic Segmentation of Low Earth Orbit Satellites Using Convolutional Neural Networks.....	1653
<i>Julia Yang, Jacob Lucas, Trent Kyono, Michael Abercrombie, Andrew Vanden Berg, Justin Fletcher</i>	
The Mars Ingenuity Helicopter - A Victory for Open-Source Software	1666
<i>Timothy Canham</i>	
Expression for the Probability of Correlation Error in Data Fusion	1677
<i>P. Willett, P Braca, L. Millefiori, S. Marano, W. Blair, P. Miceli, M. Kowalski, T. Ogle</i>	
The Mission System Architecture for Planned SPHEREx Operations.....	1687
<i>Oleg V. Sindi, Eric B. Rice, Shannon E. Mihaly</i>	
Project MADMEN: Proposed Analogue Fidelity Comparison to ALIEN Martian Mission	1699
<i>Madelyn Hoying, Benjamin Kazimer, Alexander Evans, Burton Carbino, Karli Sutton, Rebecca McCallin, Garrett Craig, Anelise McGee</i>	
On the Operational Challenges of Coordinating a Helicopter and Rover Mission on Mars.....	1709
<i>Farah Alibay, Justin Koch, Vandt Verma, Keri Bean, Olivier Toupet, Daniel Petrizzo, Brendan Chamberlain-Simon, Robert Lange, Robert Hogg</i>	
Quantification Method for Assessment of Asteroid Resource Accessibility	1726
<i>Kevin I. Alvarado, Michael C. F. Bazzocchi</i>	
FPP: A Modeling Language for F Prime.....	1736
<i>Robert L Bocchino, Jeffrey W. Levison, Michael D. Starch</i>	
A Model-Based Approach for Europa Lander Mission Concept Exploration	1751
<i>Myra Lattimore, Robert Karban, Marie Piette Gomez, Emilee Bovre, Glenn E. Reeves</i>	
Refueling Orbital Navigator for Active Debris Removal, and Asset Relocation, Recovery and Repair	1764
<i>John Slough</i>	
Actuator and Motor Control End-To-End V&V on the Mars 2020 Rover	1784
<i>Luke Walker, Jesse Austin, Andrew Kennett, Davis Born</i>	
Simulations for the Performance of the Wide Field Instrument on the Roman Space Telescope	1802
<i>Benjamin Cromey, Robert Vonhandorf, Joeseeph Sullivan</i>	
Deep Learning-Based Eye Gaze Estimation for Military Aviation	1809
<i>L R D Murthy, Pradipta Biswas</i>	
Psyche Project Implementation During the COVID Pandemic	1817
<i>Jennifer Maxwell, Travis Imken, Robert Mase, David Oh, Melody Safavizadeh, Benjamin Solish, Noah Warner, Lindy T. Elkins-Tanton, Peter Lord</i>	
Towards a Semi-Autonomous Robotic Exploration of a Lunar Skylight Cavity	1832
<i>Roland U. Sonsalla, Steffen Planthaber, Raul Dominguez, Alexander Dettmann, Florian Cordes, Benjamin Huelsen, Christopher Schulz, Patrick Schoeberl, Sebastian Kasperski, Henning Wiedemann, Frank Kirchner</i>	

Development of the Navigational System for a Multi-Spectral Imaging Nano-Satellite	1852
<i>Ayush Mehta, Amay Sareen, Aaryav Mishra</i>	
Hybrid Planning to Minimize Platform Disturbances During In-Orbit Assembly Tasks	1867
<i>Ismael Rodríguez, Jean-Pascal Lutze, Hrishik Mishra, Peter Lehner, Máximo A. Roa</i>	
Data-Driven Security Verification for Autonomous Debris Removal in Space	1878
<i>Saurav Sthapit, Gregory Epiphaniou, Carsten Maple</i>	
The Impact of Message Encryption on Teleoperation for Space Applications	1886
<i>Carsten Maple, Gregory Epiphaniou, Waleed Hathal, Ugur Ilker Atmaca, Al Tariq Sheik, Haitham Cruickshank, Gregory Falco</i>	
Challenges and Opportunities of Computer Vision Applications in Aircraft Landing Gear	1896
<i>Joy Au, David Reid, Andrew Bill</i>	
Applying MBSE to Data Handling System Design of a Small Satellite Platform for Multiple Missions	1906
<i>Thomas Firchau, Michael Jetzschmann, Falk Nohka</i>	
Impact of Level of Autonomy on Space Systems Sizing and System-Of-Systems Metrics	1916
<i>Cesare Guariniello, Derek Carpenter, Joshua Fitch, Daniel A. Delaurentis</i>	
The Impacts of Heating Actuators in Extremely Cold Space Environments	1926
<i>Justin Scheidler, Erik Stalcup, Erica Montbach</i>	
Multi-Timescale Sensor Fusion and Control	1934
<i>Sarah Kitchen, Joseph Paki</i>	
Pre-Launch Calibration of the HYPSON-1 Cubesat Hyperspectral Imager	1941
<i>Marie Boe Henriksen, Elizabeth Frances Prentice, Tor Arne Johansen, Fred Sigernes</i>	
Infrared Image Generator of Artificial Space Object for Verifying Relative Navigation in Rendezvous	1950
<i>Naoki Okada, Moeko Hidaka, Hideyo Negishi, Yu Nakajima, Takahiro Sasaki, Toru Yamamoto</i>	
An Efficient Search Scheme for Using Weak Stability Boundary in a Backup Scenario of NRHO Transfer	1957
<i>Yuki Matsumoto, Ryo Nakamura, Daisuke Goto, Junji Kikuchi, Moeko Hidaka, Satoshi Ueda</i>	
Accelerated Radiation Test on Quantized Neural Networks Trained with Fault Aware Training	1966
<i>Giulio Gambardella, Nicholas J. Fraser, Ussama Zahid, Gianluca Furano, Michaela Blott</i>	
Updated Human Mars Ascent Vehicle Concept in Support of NASA's Strategic Analysis Cycle 2021	1973
<i>Douglas J. Trent, Herbert D. Thomas, Michelle A. Rucker</i>	
Reinforcing Penetration Testing Using AI	1986
<i>Alessandro Confido, Evridiki V. Ntagiou, Marcus Wallum</i>	
CubeSat Formations for Monitoring Hurricanes	2001
<i>Pardhasai Chadalavada, Atri Dutta</i>	
Characterizing Spectral Response in Thermal Environments, the HYPSON-1 Hyperspectral Imager	2013
<i>Elizabeth Frances Prentice, Marie Boe Henriksen, Tor Arne Johansen, Fermín Navarro Medina, Alejandro Gomez San Juan</i>	

Formal Property Verification of a Remote Memory Access Protocol IP-Core	2023
<i>Kai Borchers, Thomas Firchau</i>	
A Mathematical Model for the Analysis of Jet Engine Fuel Consumption During Aircraft Take-Off.....	2032
<i>Francisco Velásquez-Sanmartín, Xabier Insausti, Marta Zárraga-Rodríguez, Jesus Gutierrez-Gutierrez</i>	
Implementing Low-Density Parity-Check Codes in the Mars Relay Network.....	2042
<i>Neil Chamberlain, Steve Allen, Kenneth Andrews, Harvey Elliott, Roy Gladden, Jon Hamkins, Igor Kuperman, Ricardo Mendoza</i>	
Refined Astrometry on Board a CubeSat	2057
<i>Boris Segret, Youssoupha Diaw, Valery Lainey</i>	
Development of a Multi-Purpose SDR Payload for the HYPSO-2 Satellite	2072
<i>Roger Birkeland, Gara Quintana-Diaz, Evelyn Honore-Livermore, Torbjorn Ekman, Fernando Aguado Agelet, Tor A. Johansen</i>	
The Deep Atmosphere Venus Investigation of Noble Gases, Chemistry and Imaging (DAVINCI) Mission: Flight System Design Technical Overview	2083
<i>Michael Sekerak, Richard Saylor, Colby Goodloe, Arlin Bartels, Steven Tompkins, Michael Amato, David Everett, Sun Hur-Diaz, Kyle Hughes, Matthew Garrison, Chetan Sayal, Stephanie Getty, Giada Arney, Natasha Johnson, James Garvin, Darren Wade, Brian Sutter, Cavan Cuddy, Timothy Linn, Michael McGee</i>	
In-Orbit Interference Measurements and Analysis in the VDES-band with the NorSat-2 Satellite	2094
<i>Gara Quintana-Diaz, Roger Birkeland, Lars Loge, Even Andersen, Anton Bolstad, Torbjorn Ekman</i>	
DOCKS Propagator: An Open-Source Adaptive Time-Step Trajectory Propagator for CubeSat Missions	2102
<i>Rashika Jain, Harshul Sharma, Boris Segret</i>	
Surface Biology and Geology (SBG) Thermal Infrared (TIR) Free -Flyer Concept.....	2114
<i>Ralph R. Basilio, Simon J. Hook, Simona Zoffoli, Maria Fabrizia Buongiorno</i>	
TruSat: Building Cyber Trust in Collaborative Spacecraft Networks	2123
<i>David Koisser, Daniel Fischer, Marcus Wallum, Ahmad-Reza Sadeghi</i>	
Scheduling PNT Service Requests from Non-Dedicated Lunar Constellations	2135
<i>Samantha Niemoeller, Jeremy Frank, Roland Burton, Richard Levinson, Nicholas Cramer</i>	
Manned Spacecraft Propulsion Through Direct Conversion of Nuclear Energy.....	2152
<i>John Slough</i>	
Validation of the Mars 2020 Fault Protection Design: Navigating the Infinity of the Off-Nominal.....	2165
<i>Jessica Clark, Mary Lam, Lauren Ducharme, Alexander Lumnah, Chaz Morantz</i>	
Metrics for Flight Operations: Application to Europa Clipper Tour Selection	2173
<i>Duane Bindschadler, Nari Hwangpo, Marc Sarrel</i>	
Artemis: An Overview of NASA's Activities to Return Humans to the Moon	2185
<i>Steve Creech, John Guidi, Darcy Elburn</i>	

Deep Space Atomic Clock Technology Demonstration Mission Results.....	2192
<i>Todd Ely, John Prestage, Robert Tjoelker, Eric Burt, Angela Dorsey, Daphna Enzer, Randy Herrera, Da Kuang, David Murphy, David Robison, Gabriella Seal, Jeffrey Stuart, Rabi Wang, Jill Seubert</i>	
Development of a Loop Antenna Deployment System for TEM-Based Subsurface Mars Water Detection	2212
<i>Patrick McGarey, Kalind Carpenter, Daniel Nunes, Nathan Barba, Raju Manthena, Seth Krieger, Mariko Burgin, Louis Giersch, Robert Grimm, Vlada Stamenkovic</i>	
Analysis of Satellite Drag Coefficients Based on Physical and Orbital Specifications.....	2223
<i>Houman Hakima, Michael C. F. Bazzocchi, Benjamin Almstrom</i>	
Mid-Air Helicopter Delivery at Mars Using a Jetpack.....	2234
<i>Jeff Delaune, Jacob Izraelevitz, Samuel Sirlin, David Sternberg, Louis Giersch, L. Phillippe Tosi, Evgeniy Skliyanskiy, Larry Young, Michael Mischna, Shannah Withrow-Maser, Juergen Mueller, Joshua Bowman, Mark S Wallace, Havard F. Grip, Larry Matthies, Wayne Johnson, Matthew Keennon, Benjamin Pipenberg, Harsh Patel, Christopher Lim, Aaron Schutte, Marcel Veismann, Haley Cummings, Sarah Conley, Jonathan Bapst, Theodore Tzanetos, Roland Brockers, Abhinandan Jain, David Bayard, Art Chmielewski, Olivier Toupet, Joel Burdick, Morteza Gharib, J. Balaram</i>	
Systems Engineering and Design of a Martian Launch Vehicle with a Human Crew	2254
<i>Mahima Soota, Bhanu Madiraju Swaroop, Atharva Pawar, Rishin Aggarwal</i>	
Flight Test Comparison of Three Air Vehicles Flying Urban Air Mobility Mission Trajectories	2265
<i>Brian A. Kish, Markus Wilde, Isaac Silver, Brooke Wheeler, Alexandra Cleveland, Kristjana Reppen</i>	
Risk-Reduction Autonomy Implementation to Enable NASA Artemis Missions.....	2274
<i>Fernando Figueroa, Lauren Underwood, Jonathan Morris, Mark Walker, Rane Brown</i>	
Satellite Maneuver Detection Using Machine Learning and Neural Network MethodsBehaviors	2287
<i>Nicholas Perovich, Zachary Folcik, Rafael Jaimes</i>	
Orbital Trade Study for the PREFIRE Mission.....	2306
<i>Brian J. Drouin, Brian Kahn, Boon Lim, Aronne Merrelli, Ethan Nelson, Greg Quinn, Fred Nagle, Tristan L'Ecuyer</i>	
The Space Digital Dome: Autonomous Defense of Space Vehicles from Radio Frequency Interference.....	2313
<i>Gregory Falco, Nathaniel G. Gordon, Adam Byerly, Andrew Grotto, Josh Siegel, Sebastian Zanlongo</i>	
The Atmosphere Observing System (AOS): A Core Component of NASA's Earth System Observatory (ESO).....	2321
<i>Deborah Vane, Vickie Moran, Jeff Piepmeier, Scott Braun, Dalia Kirschbaum, Charles Trepte, Marie Ivanco</i>	
High-Precision Hardware Oscillators Ensemble for GNSS Attack Detection.....	2328
<i>Marco Spanghero, Panos Papadimitratos</i>	
The Environment-Vulnerability-Decision-Technology Framework for Decision Support in Indonesia	2339
<i>Seamus Lombardo, Steven Israel, Danielle Wood</i>	

A Model-Based Approach to Risk Management for RVSAT-1: A Student Nano-satellite Project - Using SysML.....	2354
<i>Shashank Nagabhushan, Akash Kumar Singh, S Suresh Gowda</i>	
Towards an Integrated Fault Tolerant Control for ESTCube-2 Attitude Control System	2361
<i>Ikechukwu Ofodile, Hans Teras, Andris Slavinskis, Gholamreza Anbarjafari</i>	
Nickel Accounting for the Psyche Spacecraft	2372
<i>Emma Bradford, Michael Kokorowski, David Lawrence, Joe Cullinan</i>	
Robust Network Protocols for Large Swarms of Small UAVs	2378
<i>Thomas Stahlbuhk, Patricia Deutsch, Devin Kelly, David Cipolle, Tak Wong, Will Bartlett, Kenta Hood</i>	
S-Band Network Analysis and Strategies for LEO Multi-CubeSat Science Missions	2396
<i>Ethan Abele, Serhat Altunc, Obadiah Kegege, Behnam Azimi, Kevin Lynaugh, Sabit Ekin, John O'Hara</i>	
Analysis of CFDP Performance for the MMS Mission CIDP	2406
<i>Paul B. Wood, Andrew Schaub</i>	
Sunspot Groups Detection and Classification on SDO/HMI Images Using Deep Learning Techniques.....	2414
<i>Luigi Palladino, Evridiki Ntagiou, Johannes Klug, Judit Palacios, Ralf Keil</i>	
Autoloader: Cargo Handling Software for Navy and Marine Aircraft	2424
<i>Jeremy Ludwig, Bart Presnell</i>	
Fuzzy Logic Model-Less 3-DOF Flight Controllers	2429
<i>Manuel Ayala, Oscar Gonzalez</i>	
Experiment for Space Radiation Analysis, Energetic Charged Particle Sensor: A Charged Particle Telescope with Novel Sensors for Measuring Earth's Radiation Belts.....	2440
<i>Jonathan Barney, Orlando Garduno, Caleb Roecker, Martin Kroupa, Michael Holloway, Richard Schirato, Carlos A. Maldonado, Daniel Arnold, Brian A. Larsen, Zachary Miller, Karl Smith, Daniel Wakeford</i>	
Emulation of Core Flight System Applications for Flight Software Development and Validation.....	2447
<i>Cody Wheeler, Peter Berg, Mason Ricks, Ashley Jinright, Chandler Millar, Tristan Lane</i>	
MBSE Applications for the MSR SRC Mars Ascent Vehicle	2457
<i>Isabeta Rountree</i>	
Planetary Rover Localisation Via Surface and Orbital Image Matching.....	2471
<i>Valerio Franchi, Evridiki Ntagiou</i>	
Applying Model-Based Ontology Coverage Analysis to Mission Architectures	2485
<i>Yaniv Mordecai, Aleksandra Markina-Khusid, Greg Quinn, Edward F. Crawley</i>	
Validation of the Use of Polychromatic Laser System for Satellite Power Beaming.....	2503
<i>Michael Sanders, Jin S. Kang</i>	
Improving Automatic Target Recognition (ATR) Performance with Electro Optics (EO) and Infrared (IR) Sensor Fusion.....	2511
<i>Hai-Wen Chen, Ravi Kapadia</i>	

Track Initiation for a Multiple Hypothesis Tracker with ML-PMHT	2527
<i>Steven Schoenecker, John Grimes</i>	
Reconstruction of the NuSTAR PSF Using Single-Laser Metrology.....	2534
<i>Hannah P Earnshaw, Kristin K Madsen, Karl Forster, Brian W Grefenstette, Murray Brightman, Andreas Zoglauer, Fiona Harrison</i>	
Differential Drag Maneuvers for 6U CubeSat Separation: Enabling Space Based Radio Interferometry Observation from Small Satellite Platforms	2542
<i>William V. Skelton, Allan T. Weatherwax, Mary Knapp, Philip J. Erickson, Dylan F. Goff</i>	
Ssdev-Ecat: A Configurable Motion Control Server for Mars 2020 Hardware Testbeds	2553
<i>Dan Levine, Travis Brown, Kyle Edelberg, Wyatt Ubellacker, Sawyer Brooks, Chris Assad, Dennis Wai, Daniel Loret De Mola Lemus, Jeff Biesiadecki</i>	
Robotics Verification and Validation Strategies for Perseverance Rover Sampling and Caching	2559
<i>Julie Townsend, Douglas Klein, Sawyer Brooks</i>	
Future of Mars Rotorcraft - Mars Science Helicopter	2572
<i>Theodore Tzanetos, Jonathan Bapst, Gerik Kubiak, Luis Phillipe Tosi, Sam Sirlin, Roland Brockers, Jeff Delaune, Havard Fjær Grip, Larry Matthies, J. Balaram, Shannah Withrow-Maser, Wayne Johnson, Larry Young, Benjamin Pipenberg</i>	
A Novel High-Performance Mission-Enabling Multi-Purpose Radioisotope Heat Source	2588
<i>Michael J. Durka, Jean-Pierre Fleurial, Sarah E. Wielgosz, Shane P. Riley, Matthew M. Barry, David F. Woerner, Brian Barstow, Fivos Drymiotis, Bill J. Nesmith</i>	
Test as You Fly: Using Flight Telemetry in the Mars 2020 Uplink Simulation & Validation Process	2598
<i>Pegah Pashai, Matthew Hurst, Elyse Fosse, Steven Myint, Nick Rossocheva</i>	
Feedback-Directed Random Sequence Generation for Verifying Spacecraft Flight Rule Violations	2607
<i>Shubhodeep Mukherji, Shaheer Khan, Vicken Voskanian, Laura Su</i>	
Considerations for Developing an Integrated Earth Science/Climate Portfolio	2615
<i>Robert Bitten, Stephen A. Shinn, Francesco Bordi</i>	
Cross-Cutting Flight Infrastructure Improvements on M2020	2626
<i>Andre Girerd, Stephen Kuhn, Brian Roth, Dan Gaines, Steve Scandore, David Cummings, Ricardo Mendoza, Mallory Lefland, Magdy Bareh, Rebekah Siegfriedt, Matthew Lenda, Biren Shah, Kevin Reich, Emily Bohannon</i>	
Mars 2020 Perseverance Rover SHERLOC Instrument Isolation System	2641
<i>Elizabeth Duffy, Brian Franz, Matthew Orzewalla, Greg Mathy, David Parsons, Louise Jandura, Robert Moeller, Todd Krafchak</i>	
Perseverance Rover Robotic Arm and Turret Mounted Instruments Surface Commissioning	2656
<i>Philip Bailey, Douglas Klein, Torsten Zorn, Thirupathi Srinivasan, Ethan W. Schaler, Sawyer Brooks, Luther Beegle, Marco Dolci, Christina Hernandez, Michael Sondheim, Megan R. Kennedy, Kenneth S. Edgett</i>	
Simulating Mars: Enabling Testing of the Perseverance Rover Sampling and Caching Subsystem on Earth	2676
<i>Jeffrey Megivern, Elizabeth Duffy, Michael Lashore, Ian Colwell, Kristopher Wehage, Marcello Gori, Junggon Kim</i>	
Bayesian Rules of Thumb: Robust Uncertainty Quantification in Early Project Cost Estimation	2691
<i>Samuel R. Fleischer, Melissa A. Hooke</i>	

On-Board Absolute Localization Based on Orbital Imagery for a Future Mars Science Helicopter.....	2699
<i>Roland Brockers, Pedro Proenca, Jeff Delaune, Jessica Todd, Larry Matthies, Theodore Tzanetos, J. Bob Balaram</i>	
Juno Gravity Science: Five Years of Radio Science Operations with Ka-Band Uplink.....	2710
<i>Dustin Buccino, Daniel Kahan, Oscar Yang, Marzia Parisi, Elias Barbini, Kamal Oudrhiri</i>	
A Comparative Rover Mobility Evaluation for Traversing Permanently Shadowed Regions on the Moon	2721
<i>Clyde Webster, William Reid</i>	
Mars 2020 Entry, Descent, and Landing as Observed by Radio Science Techniques at UHF and X-Band Frequencies	2736
<i>Dustin Buccino, Kamal Oudrhiri, Daniel Kahan, Clement Lee, Elias Barbini, Walid Maiid, Norman Lay, Melissa Soriano, Lisa Mauger, Susan Finley, Peter Illott, Chloe Sackier, Roy E. Gladden</i>	
Perseverance Rover Corer Railizer Mechanism Development for Drill Feed and Stabilization	2749
<i>Mieszko Salamon</i>	
Perseverance Rover Collision Model for a Range of Autonomous Behaviors	2758
<i>Vandi Verma, Justin Huang, Philip Bailey, Joseph Carsten, Douglas Klein</i>	
Microfluidic Inorganic Conductivity Detector for Europa (MicroICE) Using Capacitive Coupling	2776
<i>Chinmayee Govinda Raj, Cambrie Salyards, Mohamed Odeh, Amanda Stockton</i>	
Icy Moon Penetrator Organic Analyzer (IMPOA) Impact Test Results.....	2789
<i>Michael Cato, Chinmayee Govinda Raj, Nicholas Speller, Zachary Duca, Amanda Stockton, Jungkyu Kim, Philip Putman, Jason Epperson</i>	
Real-Time Segmentation of Desiccation Cracks Onboard UAVs for Planetary Exploration.....	2800
<i>Julian Galvez-Serna, Nicolas Mandel, Juan Sandino, Fernando Vanegas, Nam Ly, David Timothy Flannery, Felipe Gonzalez</i>	
Resolution-Adaptive Quadrees for Semantic Segmentation Mapping in UAV Applications	2812
<i>Nicolas Mandel, Juan Sandino, Julian Galvez-Serna, Fernando Vanegas, Michael Milford, Felipe Gonzalez</i>	
Subscale Prototype and Hangar Test Flight of a Venus Variable-Altitude Aerobot	2829
<i>Jacob Izraelevitz, Michael Pauken, Siddharth Krishnamoorthy, Ashish Goel, Carolina Aiazzi, Leonard Dorsky, James Cutts, Jeffery L. Hall, Caleb Turner, Tim Lachenmeier</i>	
Methods for Evaluation of Human-In-the-Loop Inspection of a Space Station Mockup Using a Quadcopter	2840
<i>Hannah Weiss, Ansh Patel, Matthew Romano, Brandon Apodoca, Prince Kuevor, Ella Atkins, Leia Stirling</i>	
Uncertainty Propagation in Pre-Flight Prediction of Unmanned Aerial Vehicle Separation Violations	2852
<i>Matteo Corbetta, Katelyn Jarvis, Portia Banerjee</i>	
Mathematical Techniques for Near Field Radiation Pattern Characterization of Digital Arrays	2863
<i>Thomas G. Williamson, Paul Simmons, Jacob Houck, Daniel Leatherwood, Jason Whelan, Walter Disharoon, Drew Kerr</i>	
SPEED+: Next-Generation Dataset for Spacecraft Pose Estimation Across Domain Gap	2870
<i>Tae Ha Park, Marcus Märtens, Gurvan Lecuyer, Dario Izzo, Simone D'Amico</i>	

Model-Based Fault Detection with Uncertainties in a Reusable Rocket Engine	2885
<i>Noriyasu Omata, Seiji Tsutsumi, Masaharu Abe, Daiwa Satoh, Tomoyuki Hashimoto, Masaki Sato, Toshiya Kimura</i>	
A Preliminary Investigation Using Aerogravity Assist Trajectories to Mercury	2893
<i>Divinaa Burder</i>	
Telecommunications RF Tool for NASA's Europa Clipper Mission	2901
<i>Ramon Pena, Matthew W. Cox, Michael R. Reid</i>	
Lessons Learned from the Implementation of the Psyche Fixed Price Contract with Maxar.....	2913
<i>Neil Dahya, Mark Brown, Dan Goebel, Mike Knopp, Maxwell Martin, Darren Michaels, Afsheen Vaid, Bonnie Theberge, Peter Lord, Steve Scott, Julie Wolf</i>	
Artemis Removable-Canister Waste Accumulation System & Handler (ARC-WASH): A Portable Modular Space Lavatory	2934
<i>Syamantak Payra, Joseph A. Paradiso</i>	
Explainable Symptom Detection in Telemetry of ISS with Random Forest and SpecTRM	2946
<i>Shota Iino, Hideki Nomoto, Yasutaka Michiura, Takayuki Hirose, Miki Sasaki, Sayaka Ishizawa, Takashi Fukui, Yukako Ishitsuka, Yasuo Itabashi, Hiroharu Shibayama, Masaru Wada</i>	
Online Multi-Resolution Fusion of Space-borne Multispectral Images	2955
<i>Haoqing Li, Bhavya Duvvuri, Ricardo Borsoi, Tales Imbiriba, Edward Beighley, Deniz Erdogmus, Pau Closas</i>	
Application of Intelligent Spacecraft Structures for Impact Detection.....	2967
<i>Randy Rose, Michael Koets, Sidney Chocron, Robert Grimm</i>	
Fuel-Efficient Distributed Path Planning for Spacecraft Formation Flying	2974
<i>Hermann K. Sipowa, Jay W. McMahon</i>	
Autonomous Mapping of Desiccation Cracks Via a Probabilistic-Based Motion Planner Onboard UAVs.....	2982
<i>Juan Sandino, Julian Galvez-Serna, Nicolas Mandel, Fernando Vanegas, Felipe Gonzalez</i>	
Reducing Object Detection Uncertainty from RGB and Thermal Data for UAV Outdoor Surveillance	2996
<i>Juan Sandino, Peter A. Caccetta, Conrad Sanderson, Frederic Maire, Felipe Gonzalez</i>	
The Mk-7 Gravity Loading Countermeasure Skinsuit: Evaluation and Preliminary Results	3012
<i>Rachel Bellisle, Ciarra Ortiz, Allison Porter, Alvin Harvey, Katya Arquilla, Caroline Bjune, James Waldie, Dava Newman</i>	
Robust Relative Trajectory Design Considering Passive Abort Safety Under Sensor Failure Situation	3023
<i>Takahiro Sasaki, Moeko Hidaka, Ryo Nakamura, Toru Yamamoto</i>	
Mission Planning for Trident: Discovery Proposal to Neptune's Moon, Triton	3033
<i>Priyanka Sharma, Christopher R. Lawler, Karl L. Mitchell, Ben K. Bradley, Mark J. Rokey, Try Lam, Damon F Landau, Brian Woods, Ryan Riley, Louise Prockter</i>	
Proximity Operation and Automated Docking on HTV-X: Guidance, Navigation, and Control Strategy.....	3053
<i>Takahiro Sasaki, Moeko Hidaka, Yuki Tomita, Yuri Hachiya, Yoshinori Kondo, Ryo Nakamura, Toru Yamamoto</i>	

Influence of Field Topology on Magnetically Shielded Hall Thruster Plume Divergence.....	3063
<i>Peter Thoreau, Justin Little</i>	
Autonomous Trajectory Guidance Under Uncertain Dynamical Environment Using State Transition Tensors.....	3071
<i>Masahiro Fujiwara, Ryu Funase</i>	
Time-Transfer from Terrestrial GPS for Distributed Lunar Surface Communication Networks	3082
<i>Sriramya Bhamidipati, Keidai Iiyama, Tara Mina, Grace Gao</i>	
LUMIO: A CubeSat to Monitor Micro-Meteoroid Impacts on the Lunar Farside	3097
<i>Stefano Speretta, Erdem Turan, Angelo Cervone, Alessandra Menicucci, Francesco Topputo, Vittorio Franzese, Carmine Giordano, Gianmario Merisio, Pierluigi Di Lizia, Mauro Massari, Demetrio Labate, Alessio Taiti, Giuseppe Pilato, Eric Bertels, Agne Paskeviciute, Katarzyna Woroniak, Detlef Koschny, Johan Vennekens, Roger Walker</i>	
GNSS Aided Radar Inertial Odometry for UAS Flights in Challenging Conditions.....	3105
<i>Christopher Doer, Jamal Atman, Gert F. Trnmmer</i>	
Multipath Estimating Techniques Performance Analysis.....	3115
<i>Corentin Lubeigt, Lorenzo Ortega, Jordi Vila-Valls, Laurent Lestarquit, Eric Chaumette</i>	
The Development of the Hybrid Dynamics Simulation System for Rendezvous and Docking: SATDyn	3121
<i>Hiroyuki Okamoto, Hiroki Kato</i>	
Orchestrating Tool Chains for Model-Based Systems Engineering with RCE	3130
<i>Jan Flink, Robert Mischke, Kathrin Schaffert, Dominik Schneider, Alexander Weinert</i>	
Efficient and Accurate Methods for Computing the Gravitational Field of Irregular-Shaped Bodies	3139
<i>Hermann Meißenhelger, Matthias Noeker, Tom Andert, Rene Weller, Benjamin Haser, Ozgur Karatekin, Birgit Ritter, Max Hofacker, Larissa Balestrero Machado, Gabriel Zachmann</i>	
An Ility Calculation for Satellite Software Validation	3156
<i>Mason Brown, Sharmistha Dey, Gervase Tuxworth, Jomelson Co, Peter Bernus, Paulo De Souza</i>	
Robust and Gain-Scheduled Flight Control of Fixed-Wing UAVs in Wind and Icing Conditions.....	3176
<i>Ruben Kleiven, Kristoffer Gryte, Tor Arne Johansen</i>	
Free Floating and Rotation Floating Approaches for Control of Space Robots: A Comparative Study.....	3188
<i>Raunak Srivastava, Roshan Sah, Kaushik Das</i>	
A Lévy Flight Based Probabilistic Motion Planning for UAVs in Constricted Environments	3200
<i>Shubham Shukla, Lokesh Kumar, Titas Bera, Ranjan Dasgupta</i>	
Feedback Strategies for Hypersonic Pursuit of a Ground Evader	3208
<i>Yoonjae Lee, Efstathios Bakolas, Maruthi R. Akella</i>	
NASA's Artemis Human Landing Systems.....	3215
<i>Lisa Watson-Morgan, Lakiasha Hawkins, Bill Jacobs, Tara Polsgrove, Don Krupp, Thomas Percy, Joseph Vermette</i>	
Space Radiation Environment Considerations for the Interstellar Probe Mission.....	3222
<i>Justin Likar, Jamie Porter, Michelle Donegan, Jim Kinnison, Pontus Brandt, Ralph McNutt, Michael Paul, Kirby Runyon, Amanda Haapala, Alice Cocoros, Fazle Siddique</i>	

A Computationally Efficient UAV Exploration Strategy for Uncertain Complex Environments.....	3238
<i>Mohit Ludhiyani, Arup Kumar Sadhu, Titas Bera, Ranjan Dasgupta</i>	
Compressed CO ₂ Hard Rock Drill for Mars.....	3246
<i>A Scott Howe, Kristopher Sherrill, Donald Ruffatto, Luis Phillipe C Tosi, Jesse Tarnas, Brian H Wilcox</i>	
The Mars 2020 Ground Data System Architecture	3261
<i>Guy Pyrzak, Robert Puncel, Marsette A Vona, Reynaldo Lopez-Roig</i>	
Science Operations Planning and Implementation for the OSIRIS-REx Mission, Part 2: Toolkit.....	3281
<i>Sara S. Balram-Knutson, Diane Lambert, Edward Audi, Tami Becker, William V. Boynton, David Dean, Heather L. Enos, Mike Fitzgibbon, Ingrid Galinsky, Rose Garcia, Andrew Gardner, Damian Hammond, Karl Harshman, Carl W. Hergenrother, John N. Kidd, Michael Loveridge, Joshua V. Nelson, Anjani T. Polit, Sanford Selznick, Mathilde Westermann, Zoe Zeszut, Dante S. Lauretta, Saadat Anwar, Scott Dickenshied, Paul Wren</i>	
Balancing Predictive and Reactive Science Planning for Mars 2020 Perseverance	3300
<i>Sarah M Milkovich, Kathryn M Stack, Vivian Z Sun, Kimberly Maxwell, Rachel Kronyak, Sara L. Schnadt, Kimberly Steadman, Nicole Spanovich</i>	
Control of Flow Separation using Fluidic Oscillators on a NACA 0015 Aerofoil.....	3312
<i>Arpit Chaudhary, Kamal Poddar</i>	
Flight Software Dictionary Development for the Mars2020 Rover	3321
<i>Matt Muszynski, Elyse Fosse, Andrew Plave, Guy Pyrzak</i>	
Robotic Arm Design and Analysis Repository (RADAR)	3335
<i>Justin Jenkins, Marco Dolci, Curtis Collins, Paulo Younse</i>	
Helicopter and Rover Operations on Mars Using the Robot Sequencing and Visualization Program (RSVP)	3344
<i>Justin Koch, Garrett Johnson, Nicholas Wiltsie, Frank Hartman, Farah Alibay, Jeng Yen</i>	
Modeling, Estimation, and Bounds for Precision Two-Way Time Transfer and Ranging	3353
<i>Patrick Bidigare, Charlie Obranovich, David Raeman, Dan Chang, D. Richard Brown</i>	
Updated Architecture Robustness in NASA's Moon to Mars Capability Development.....	3362
<i>Alexander Burg, Eric McVay, David Reeves</i>	
MBSE Utilization for Additive Manufactured Rocket Propulsion Components.....	3374
<i>Shreyas Lakshmiapuram Raghu, Mason Tudor, L. Dale Thomas, Gang Wang</i>	
Preparations for the Launch, Cruise, and Orbital Operations Phases of the Psyche Mission.....	3388
<i>Travis Imken, William Hart, Kristina Larson, Sarah Bairstow</i>	
Development and Testing of a Sample Handling System for In-Situ Lunar Geochronology with KArLE.....	3402
<i>J. Tighe Costa, Caleb T. Lang, Patrick Corrigan, Jack W. Emery, Luke A. Thomson, Nathan A. Jensen, Hunter T. Rideout, Stephen Indyk, Bernice Yen, Kris Zacny, Matthew Mullin, Fanny Cattani, Erich Frese, Paul Stysley, Barbara A. Cohen</i>	
A Deep Learning Neural Network Approach to Missile Systems Using Liquid Propulsion.....	3414
<i>Noel Cervantes, Mark Carpenter, Roy Hartfield</i>	
Solid State Sample Handling with Amplified Piezo Actuators	3428
<i>J. Tighe Costa, Albert Ridilla, Luke Sanasarian, Kris Zacny</i>	

Survey, Evaluation, and Advancement of Sample Sensing Techniques for Future Missions	3441
<i>J. Tighe Costa, Luke Sanasarian, Vishnu Sanigepalli, Sherman Lam, Leo Stolov, Joseph Palmowski, Robert Kancans, Luis Phillipe Tosi, Eric Roberts, Kristopher Kriechbaum</i>	
The JEANNE Habitat Design for a 2033 Crewed Mars Mission	3458
<i>Neil McHenry, Abdurrahman Ozturk, Poonampreet K. Josan, Karlie B. Nixon, Renee F. Abbott, Veronica C. Aguayo, Collette N. Gillaspie, Jorge L. Aja Giordano, Bonnie Dunbar, Gregory Chamitoff, Ana Diaz-Artilles</i>	
Performance Study of YOLOv5 and Faster R-CNN for Autonomous Navigation Around Non-Cooperative Targets.....	3482
<i>Trupti Mahendrakar, Andrew Ekblad, Nathan Fischer, Ryan White, Markus Wilde, Brian Kish, Isaac Silver</i>	
Science Operations Planning and Implementation for the OSIRIS-REx Mission, Part 1: Process	3494
<i>Anjani T. Polit, Sara S. Balram-Knutson, Edward Audi, Tammy Becker, William V. Boynton, David Dean, Kristofer Drozd, Heather L. Enos, Michael Fitzgibbon, Ingrid Galinsky, Rose Garcia, Andrew Gardner, Karl Harshman, Carl W. Hergenrother, John N. Kidd, Diane Lambert, Joshua V. Nelson, Sanford Selznick, Mathilde M. Westermann, Zoe Zeszut, Dante S. Lauretta</i>	
Architecture Framework Standardization for Satellite Software Generation Using MBSE and F Prime	3511
<i>Michael Halvorson, L. Dale Thomas</i>	
Soft-Robotic, Propellant-Free Servicers for LEO Spacecraft.....	3531
<i>Jay W. McMahan, Hermann K. Sipowa, Matthew Givens, Jana Cuberovic</i>	
Design and Flight Test Validation of an AI-Based Longitudinal Flight Controller for Fixed-wing UASs	3546
<i>Mozammal Chowdhury, Shawn Keshmiri</i>	
Flying a Helicopter on Mars: How Ingenuity's Flights Were Planned, Executed, and Analyzed.....	3558
<i>Havard Fjær Grip, Dylan Conway, Johnny Lam, Nathan Williams, Matthew P. Golombek, Roland Brockers, Michael Mischna, Martin R. Cacan</i>	
Software-Defined Corner Reflector for Satellite SAR Systems	3575
<i>Alex Piccioni, Roberto Alesii, Fortunato Santucci, Fabio Graziosi</i>	
Expert-Informed Autonomous Science Planning for In-Situ Observations and Discoveries	3582
<i>Jay McMahon, Nisar Ahmed, Morteza Lahijanlian, Peter Amorese, Taralicin Deka, Karan Muvvala, Trevor Slack, Shohei Wakayama</i>	
Solar Energy Harvesting for a Land-To-Recharge Tiltrotor Micro Aerial Vehicle.....	3593
<i>Stephen J. Carlson, Christos Papachristos</i>	
The Potential of Virtual Reality for Aerospace Applications	3601
<i>Johanna Pirker</i>	
Heliophysics Environmental & Radiation Measurement Experiment Suite (HERMES): A Small External Payload for Gateway with Big Challenges	3609
<i>Joe Burt, Mark Goans, John Blackwood, Kristen Brown</i>	
Mission Operations Cost Estimation Tool (MOCET) 2021/2022 Capability Updates.....	3620
<i>Marc R. Hayhurst, Brian W. Wood, Cindy L. Daniels, Lissa M. Jordin, Washito A. Sasamoto, Waldo J. Rodriguez</i>	

ESCAPE Mission Implementation Overview: Exploring the Stellar Drivers of Exoplanet Habitability	3632
<i>Bryce Unruh, Tom Patton, Brian Fleming, Kevin France, Tim Hellickson, Connie Spittler</i>	
Determining Spacesuit Reach and Range of Motion (ROM) Using 3D Photogrammetric Motion Capture	3641
<i>Dillon C. Hall, Maddie M. Haas, Bonnie J. Dunbar</i>	
Design of Rigid-Flex PCB Robotics Leveraging Validated Finite Element Simulations.....	3657
<i>John Bell, Kalind Carpenter, Laura Redmond, Jean-Pierre De La Croix</i>	
A Framework for Evaluating PHM Models	3670
<i>Shashvat Prakash, Antoni Brzoska, Joseph Ensberg</i>	
NASA's EGS Program Technology Demonstrations and Risk Reduction for Sustainable Surface Operations	3679
<i>Philip J. Weber, Nancy P. Zeitlin, Zachary M. Cameron, Breana P. Staton, Ashish S. Patel</i>	
Real-World Testing of LiDAR-Inertial Based Navigation and Mapping for Precision Landing	3690
<i>Timothy P. Setterfield, Robert A. Hewitt, Po-Ting Chen, Corey L. Marcus, Nikolas Trawny</i>	
Surface Systems Capability Gaps for Enabling NASA's Sustainable Lunar Operations.....	3700
<i>Barbara L. Brown, Philip J. Weber, Angela G. Krenn, Mark E. Lewis, Nancy P. Zeitlin</i>	
Experimental Results of Autonomous Microrover Exploration and Mapping of an Analog Planetary Pit	3710
<i>Jordan Ford, Khaled Sharif, William L. Red Whittaker, Warren Chuck Whittaker, Heather Jones, Uland Wong</i>	
Near-Earth Object Surveyor Overview	3720
<i>Tom Hoffman, Yuanming Liu, Mark Lysek, Alexander Murray, Erik Nilsen, Pavani Peddada, Mark Rokey, Mar Vaquero, Amy Mainzer, Andre Wong, Timothy Sayer, Paul Snider, Michael Veto</i>	
Sheaf Theoretic Models for Routing in Delay Tolerant Networks	3736
<i>Robert Short, Alan Hylton, Jacob Cleveland, Michael Moy, Robert Cardona, Robert Green, Justin Curry, Brendan Mallery, Gabriel Bainbridge, Zander Memon</i>	
High Altitude Platform Station (HAPS) to Satellite Channel Models for 6G Networks	3755
<i>Cansu Palanci, Funda Akleman, Gunes Karabulut Kurt</i>	
A Survey of Mathematical Structures for Lunar Networks	3765
<i>Alan Hylton, Robert Short, Jacob Cleveland, Olivia Freides, Zander Memon, Robert Cardona, Robert Green, Justin Curry, Sriram Gopalakrishnan, Devavrat Vivek Dabke, Brittany Story, Michael Moy, Brendan Mallery</i>	
Low-Shot, Semi-Supervised, Uncertainty Quantification Enabled Model for High Consequence HSI Data	3782
<i>Kathryn Gray, Daniel Ries, Joshua Zollweg</i>	
New Horizons for a Practical and Performance-Optimized Solar System Internet	3790
<i>Alan Hylton, Jacob Cleveland, Rachel Dudukovich, Dennis Iannicca, Nadia Kortas, Blake Lafuente, John Nowakowski, Daniel Raible, Robert Short, Brian Tomko, Adam Wroblewski</i>	
3D Cloud-RAN Functional Split to Provide 6G Connectivity on Mars	3805
<i>Stefano Bonafini, Claudio Sacchi, Fabrizio Granelli, Riccardo Bassoli, Frank H. P. Fitzek, Koteswararao Kondepu</i>	

ReachBot: A Small Robot for Large Mobile Manipulation Tasks	3818
<i>Stephanie Schneider, Andrew Bylard, Tony G. Chen, Preston Wang, Mark Cutkosky, Mathieu Lapotre, Marco Pavone</i>	
Modeling and Experimental Investigation of Bubbly Flows in Liquid Metal for CNTP	3830
<i>Jacob Keese, Ben Campbell, Mitchell Schroll, D. Keith Hollingsworth, Robert Frederick, L. Dale Thomas, William Walters</i>	
Self-Powered Microgravity Resistance Exercise with Soft Pneumatic Exoskeletons	3847
<i>Aislinn Marcee, Emma Treadway</i>	
BOWIE-M: Process to Develop the Next-Generation ESPA-Class Weather Sounding Microwave Radiometer	3857
<i>Sean Geiger, Todd Pett, Carlos Ocampo, Michael S. Davis, Stephen C. Bennett</i>	
Mapping Life Support System Functions and Technologies to Commercial Spaceflight Applications.....	3865
<i>David Klaus, Kaitlyn Hauber</i>	
Mission Performance Assessment of Multimode Propulsion for Satellite Servicing Applications.....	3875
<i>Giusy Falcone, Daniel L. Engel, Marta Cortinovis, Charles N. Ryan, Joshua L. Rovey, Zachary R. Putnam, Steven Berg, Michael Lembeck</i>	
The Experiment for Space Radiation Analysis: A 12U CubeSat to Explore the Earth's Radiation Belts.....	3894
<i>Carlos A. Maldonado, Jonathan Deming, Brooke N. Mosley, Keith S. Morgan, Justin McGlown, Anthony Nelson, Phil A. Fernandes, Martin Kroupa, Kim Katko, Markus P. Hehlen, Daniel Arnold, Jonathan Barney, Claira Safi, Michelle Pyle, Ted Schultz, Dan Reisenfeld, Ruth Skoug, Angus Guider, Michael Holloway, Heidi Morning, Erik Krause, Benigno Sandoval, Darrel Beckman, Zach Miller, Rob Merl, Paul S. Graham, Thaddeus Peter White, Zephram Tripp, Brad Hoose, Caleb Roecker, Alexei Klimenko, Richard Dutch, Kevin Kaufeld, Elaine Cox, Quinn Cole, Chuck Clanton, Peter Bloser, Brian A. Larsen, Tom Fairbanks, Jeff George, John Michel, Eric L. Alpine, Casey Kelby, Brent F. Abbott</i>	
Exploring the Clouds of Venus: Science Driven Aerobot Missions to Our Sister Planet	3909
<i>James Cutts, Kevin Baines, Leonard Dorsky, William Frazier, Jacob Izraelevitz, Siddharth Krishnamoorthy, Michael Pauken, Mark S. Wallace, Paul Byrne, Sara Seager, Colin Wilson, Joseph O'Rourke</i>	
Landing Gear Design, Fabrication, and Testing for the Ingenuity Mars Helicopter	3929
<i>Sara A. Langberg, Jeremy D. Tyler, Benjamin T. Pipenberg, Matthew T. Keennon, Peter Zwaan</i>	
Toward Autonomous Localization of Planetary Robotic Explorers by Relying on Semantic Mapping	3942
<i>Kamak Ebadi, Kyle Coble, Dima Kogan, Deegan Atha, Russell Schwartz, Curtis Padgett, Joshua Vander Hook</i>	
Introducing Tropical Geometric Approaches to Delay Tolerant Networking Optimization	3952
<i>Jacob Cleveland, Alan Hylton, Robert Short, Brendan Mallery, Robert Green, Justin Curry, Devavrat Vivek Dabke, Olivia Freides</i>	

Surface Biology and Geology (SBG) Visible to Short Wavelength Infrared (VSWIR) Wide Swath Instrument Concept	3963
<i>Robert O. Green, Amit Sen, John C. Pearson, Pantazis Mouroulis, Saagar Patel, Peter Sullivan, Thomas Werne, Michael Brenner, Ian McKinley, Elliott Liggett, Jose Rodriguez, Michael Eastwood, Susan. T. Smith, Ernesto Diaz, Matthew Bennett, Randy Pollock, Marc Walch</i>	
Topographical Landmarks for Ground-Level Terrain Relative Navigation on Mars	3973
<i>Joshua Vander Hook, Russell Schwartz, Kamak Ebadi, Kyle Coble, Curtis Padgett</i>	
Vapor Compression Refrigeration System for Space Exploration	3979
<i>Rahul Chhajed, Alberto R Gomes, Sanket Phalak, Subrata Shannigrahi, Sanjesh Kumar Pathak, Abhay Naik, Stephen L. Caskey, Anthony Skipworth, Leon P. M. Brendel, E. A. Groll</i>	
Implementing Achromatic Diffractive Waveplate Optics with Thin, Uniformly Birefringent Layers.....	3991
<i>David E. Roberts, Justin Sigley, Olena Ouskova, Andrii Pshenichnii, Nelson V. Tabiryan, Garreth Ruane, Eugene Serabyn</i>	
Design and Flight Testing of a Rocket-Launched Folding UAV for Earth and Planetary Exploration Applications.....	3999
<i>Samantha D'Arcy, Felipe Gonzalez</i>	
Going to Extremes: Architecting Holographic Microscopes for Extreme Environments	4014
<i>J. Kent Wallace, Randall Bartos, Chris Walch, Alex Ramirez</i>	
Europa Clipper Payload Verification and Validation: Avionics-Instrument Interface Test Campaign	4020
<i>Alyssa Ralph, Raul Largaespada, Laura Jones-Wilson, Leticia Montanez</i>	
Conceptual Design of a Mars Rotorcraft for Future Sample Fetch Missions	4039
<i>Benjamin T. Pipenberg, Sara A. Langberg, Jeremy D. Tyler, Matthew T. Keennon</i>	
Analysis of the Potential Benefits from Using Quantum Computing for Aerospace Applications	4053
<i>Dominic Rosch-Grace, Jeremy Straub</i>	
Differential Ranging Experiments with NASA's High-Gain Deep Space Network Antennas	4059
<i>Victor Vilnrotter, Kar-Ming Cheung</i>	
X-Band GaN SSPA for Near Earth and Deep Space Missions.....	4067
<i>Justin R. Dennison, Sheng Cheng, Avinash Sharma, John Lehtonen, Neil Dalal, Robert Wallis, Daniel Matlin</i>	
It's Time for Focused in Situ Studies of Planetary Surface-Atmosphere Interactions	4076
<i>Serina Diniega, Nathan Barba, Louis Giersch, Brian Jackson, Alejandro Soto, Don Banfield, Mackenzie Day, Gary Doran, Colin M. Dundas, Michael Mischna, Scot Rafkin, Isaac Smith, Rob Sullivan, Christy Swann, Timothy Titus, Ian Walker, Jacob Widmer, Devon Burr, Lukas Mandrake, Nathalie Vriend, Kaj Williams</i>	
Suborbital Drop Test to Demonstrate Autonomous Payload Recovery from Low Earth Orbit.....	4095
<i>Tyler Kunsu, John Bradford, Ben Leon</i>	
Lessons Learned from the Implementation of DOORS for the SUDA Instrument on Europa Clipper	4104
<i>Wendy Frank, Sally Haselschwardt, Sean Lev-Tov</i>	
Commercially Available Imaging Payloads for CubeSat Earth Observation Missions.....	4115
<i>Hannah Tomio, Albert Thieu, Amelia Gagnon, Sophia K. Vlahakis, Shreeyam Kacker, Joe Kusters, Kerri Cahoy</i>	

Simulation Builder, Analysis, and Development (SimBAD) Toolkit for Human Spaceflight Operation Training Using the SpaceCRAFT Simulation Platform	4134
<i>William Young, Connor Jakubik, Patrick Zhong, Neil McHenry, Gregory Chamitoff</i>	
Biophilic Design of the ISS Crew Quarters to Improve Cognitive and Physiological Health Measures.....	4147
<i>Audrey Firth, Aditya Jayadas</i>	
Testing Mars 2020 Flight Software and Hardware in the Surface System Development Environment	4157
<i>Sawyer Brooks, Todd Litwin, Jeffrey Biesiadecki, Neil Abcouwer, Tyler Del Sesto, Michael McHenry, Steven Myint, Philip Twu, Dennis Wai</i>	
Docking the Mars 2020 Perseverance Robotic Arm	4170
<i>Sawyer Brooks, Julie Townsend, Curtis Collins, Joseph Carsten, Matthew Frost, Jason Reid, Matthew Robinson, Antonia Warner</i>	
COCPIT: Collaborative Activity Planning Software for Mars Perseverance Rover	4182
<i>Ivy Deliz, Andrea Connell, Chet Joswig, Jessica J. Marquez, Bob Kanefsky</i>	
A Survey of Near-Earth Asteroids for Low-Thrust Round-Trip Missions	4195
<i>Ruida Xie, Andrew G. Dempster</i>	
Signature-Aware RF Exploitation (SNARE) Fingerprinting Using Deep Learning to Identify UAVs.....	4206
<i>Hossein Jafari, Erik Blasch, Khanh Pham, Genshe Chen</i>	
Adaptive Navigation for Lunar Surface Operations Using Deep Learning and Holographic Telepresence	4218
<i>Neil McHenry, Lauren Brady, Jaime Vives-Cortes, Erin Cana, Israel Gomez, Manuel Carrera, Kevin Mayorga, Javid Mustafa, Gregory Chamitoff, Ana Diaz-Artiles</i>	
Submodular Optimization Via Reinforcement Learning for Active Control of Sensor Networks	4226
<i>Denis Garagic, Robert Ravier, Jacob Peskoe, Travis Galoppo, Peter Zulch</i>	
Paraffin & Beeswax Spaceflight Experiments for Improved Understanding of Centrifugal Casting.....	4234
<i>Keith Javier Stober, M. Regina Apodaca M., Danielle Wood</i>	
CHEATA: Ceres Human Exploration and Transport Architecture	4242
<i>Jessica Todd, Chloe Gentgen, Benjamin C Martell, Rachel Bellisle, Allison Porter, Jeffrey Hoffman</i>	
“Just Do It” Mission Operations Training in a COVID World	4253
<i>Theresa Rosette</i>	
Assessment of Depth Data Acquisition Methods for Virtual Reality Mission Operations Support Tools.....	4263
<i>Alexandra Forsey-Smerek, Cody Paige, Ferrous Ward, Don Derek Haddad, Lindsay Sanneman, Jessica Todd, Jennifer Heldmann, Darlene Lim, Dava Newman</i>	
In-Flight Demonstration of Enhanced-Low-Dose-Rate-Sensitivity (ELDRS) in Bipolar Junction Transistors	4277
<i>A. R. Benedetto, H. J. Barnaby, Cheyenne Cook, Michael J. Campola, Anna Tender</i>	
Machine Learning Based Relative Orbit Transfer for Swarm Spacecraft Motion Planning.....	4283
<i>Alex Sabol, Kyongsik Yun, Muhammad Adil, Changrak Choi, Ramtin Madani</i>	

Evolution and Analysis of Psyche's End-To-End Information System Architecture	4294
<i>Robert R. Moore, Richa Sirohi</i>	
Received Power Characterization of Terrestrial Cellular Signals on High Altitude Aircraft.....	4310
<i>Zaher M. Kassas, Ali A. Abdallah, Joe Khalife, Chiawei Lee, Juan Jurado, Steven Wachtel, Jacob Duede, Zachary Hoeffner, Thomas Hulsey, Rachel Quirarte, Runxuan Tay</i>	
Modeling and Characterization of Electrospray Propellant-Surface Interactions.....	4318
<i>Ximo Gallud Cidoncha, Paulo C. Lozano, Rafid Bendimerad, Elaine M. Petro, Sebastian K. Hampl</i>	
Hardware Development for Joint Sparse Decentralized Heterogeneous Data Fusion for Target Estimation.....	4329
<i>Dan Shen, Mengqing Guo, Genshe Chen, Ruixin Niu, Peter Zulch, Erik Blasch</i>	
Design of a Low-Cost, Submersible, Digital Holographic Microscope for in Situ Microbial Imaging	4341
<i>Alex Ramirez, Tyler Burch, James Kent Wallace</i>	
First Results of Differential Doppler Positioning with Unknown Starlink Satellite Signals	4348
<i>Mohammad Neinavaie, Zeinab Shadram, Sharbel Kozhaya, Zaher M. Kassas</i>	
Visual Odometry Thinking While Driving for the Curiosity Mars Rover's Three-Year Test Campaign: Impact of Evolving Constraints on Verification and Validation	4362
<i>Mark Maimone, Nikunj Patel, Anna Sabel, Alexandra Holloway, Arturo Rankin</i>	
Building a Lifeboat: MSL's Uplink and Installation Campaign to Restore a Failing Backup Computer.....	4372
<i>Alexandra Holloway, Nick Peper, Aseel Anabtawi, Jackson Quade, Dj Byrne</i>	
Multi-Scale and Multi-Reference Longitudinal Guidance Logic for UAS.....	4381
<i>Jeffrey Xu, Shawn Keshmiri</i>	
Testing and Evaluating the Impact of Illumination Levels on UAV-Assisted Bridge Inspection	4389
<i>Edward Mahama, Ali Karimodini, Mubbashar A. Khan, Tara L. Cavalline, Rodward L. Hewlin, Elizabeth Smith, Abdollah Homaiifar</i>	
Artificial Intelligence Fusion of Information for Aerospace (AIFIA) Systems.....	4397
<i>Erik Blasch, Dan Shen, Genshe Chen, Carlos C. Insaurralde, Ruixin Niu</i>	
Adapting the Hatley-Pirbhai Method for the Era of SysML and Digital Engineering	4405
<i>Mark W. Maier</i>	
The Lunar Cosmic-Ray and Neutron Spectrometer: Phase-A Design and Technology Studies	4417
<i>Martin J. Losekamm, Liesa Eckert, Thomas Poschl</i>	
Prospects for Very Long-Range Mars Rover Missions	4427
<i>Larry Matthies, Andrew Kennett, Laura Kerber, Abigail Fraeman, Robert C. Anderson</i>	
Lunar Rover Localization Using Craters as Landmarks.....	4438
<i>Larry Matthies, Shreyansh Daftry, Scott Tepsuporn, Yang Cheng, Deegan Atha, R. Michael Swan, Sanjna Ravichandar, Masahiro Ono</i>	
An Open Source Simulator for Next Generation Satellite Broadband Traffic Management.....	4455
<i>Roberto Puddu, Vlad Popescu, Maurizio Murrioni</i>	
Gaussian Process Regression Method for Costing SmallSat Bus Capabilities.....	4461
<i>Melissa Hooke, Sam Fleischer, Alfred Nash, Alex Austin</i>	

Power Consumption Management System (PCMs) in Wired Networks Using Adaptive Genetic Algorithm	4468
<i>Rajkumar Choudhary, Suresh Perinpanayagam</i>	
Incorporating Pedestrian Movement in Computational Models of COVID-19 Spread During Air-travel.....	4476
<i>Yuxuan Wu, Sirish Namilae, Anuj Mubayi, Matthew Scotch, Ashok Srinivasan</i>	
NASA-ISRO Synthetic Aperture Radar (NISAR) Mission: System Integration & Test.....	4484
<i>Pamela Hoffman, Wendy Edelstein, Domitilo Arenas, Scott Shaffer, Rakesh Bhan, Daniel Kahn, Jeffery Waldman, Scott Nowak, Victor Mora, Peter Xaypraseuth, Bobak Ferdowsi</i>	
Contamination Control Approach to Mitigating Radiation Induced Outgassing on Europa Clipper	4501
<i>Daniel Fugett, Carlos Soares, Anthony Wong, John Anderson, Valentina Ricchiuti, William Hoey</i>	
Reconstructed Performance of the Mars 2020 Parachute Decelerator System.....	4510
<i>Ian G. Clark, Clara O'Farrell, Chloe V. Sackier, Chris Karlgaard, Carlie H. Zumwalt, David W. Way</i>	
Should've Could've: Progress in the Systems Engineering of the Mars2020 On-Board Planner	4530
<i>Stephen Kuhn</i>	
Closed Loop GNC Testing Trade on the Psyche Mission	4545
<i>Benjamin Solish, Abigail Couto, William Hart</i>	
Ray Tracing Techniques for the Characterization of Lunar Communication Architectures	4553
<i>Thomas Montano, George Bussey</i>	
Regenerative ECLSS and Logistics Analysis for Sustained Lunar Surface Missions	4560
<i>Chel Stromgren, Callie Burke, Jason Cho, William Cirillo, Andrew Owens, David Howard</i>	
Landing Site Selection with a Variable-Resolution SLAM-Refined Map	4570
<i>Corey L. Marcus, Timothy P. Setterfield, Robert A. Hewitt, Po-Ting Chen</i>	
Ensemble Kalman Update for Inference of Spatial Uniformity of Emission Across an Electrospray Array.....	4582
<i>Oliver Jia-Richards, Paulo C. Lozano</i>	
Europa Clipper Payload Verification and Validation: Test and Analysis Program Design.....	4590
<i>Laura Jones–Wilson, Paige Cooley, Alyssa Ralph, Raul Largaespada, Dennis Lee</i>	
Assurance Equations: A Cost and Criticality Model for Optimizing Quality Assurance Surveillance	4607
<i>Steven L. Cornford, Alex Wheeler, Martin S. Feather, Jeannette F. Plante</i>	
Integration of Inlet and Combustor Subsystem Models into a TBCC Engine Performance Model	4620
<i>Charles Krouse, Brian Connolly, Emilio Gordon</i>	
Planning for a Martian Road Trip - The Mars2020 Mobility Systems Design.....	4630
<i>Richard Rieber, Michael McHenry, Philip Twu, Michael M. Stragier</i>	
Informative Path Planning to Explore and Map Unknown Planetary Surfaces with Gaussian Processes	4648
<i>Ashten Akemoto, Frances Zhu</i>	

VERITAS (Venus Emissivity, Radio Science, InSAR, Topography, and Spectroscopy): A Discovery Mission.....	4660
<i>Sue Smrekar, Scott Hensley, Rick Nybakken, Mark S. Wallace, Dragana Perkovic-Martin, Tung-Han You, Daniel Nunes, John Brophy, Todd Ely, Eric Burt, M. Darby Dyar, Joern Helbert, Barry Miller, Jonathan Hartley, Piet Kallemeyn, Jennifer Whitten, Luciano Iess, Marco Mastrogiuseppe, Marwan Younis, Pau Prats, Marc Rodriguez, Erwan Mazarico</i>	
A Swift Approach to a Flexible Instrument Processor	4680
<i>Andre Jongeling, William Walsh, Carl Spurgers, Michael Kilzer, Michael Pugh, M. Michael Kobayashi, Jeremiah Gayle, David Hawkins, Igor Kuperman</i>	
Safety and Mission Assurance Technical Authority for the Mars 2020 Project.....	4690
<i>Mark L. Underwood, Cathleen M. Harris</i>	
Assessment of Crew Time for Maintenance and Repair Activities for Lunar Surface Missions	4700
<i>Chel Stromgren, Chase Lynch, Jason Cho, William Cirillo, Andrew Owens</i>	
Integrating Provenance-Awareness into the Space Debris Processing System BACARDI	4710
<i>Martin Stoffers, Michael Meinel, Benjamin Hofmann, Andreas Schreiber</i>	
Dynamics and Control of Helical Arrays in Low Earth Orbit	4722
<i>Riccardo Apa, Marco B. Quadrelli, Robert M. Beauchamp</i>	
Modeling, Dynamics and Control of a Variable Topology Tethered Space System	4742
<i>Mattia Pastori, Francesco Braghin, Marco B. Quadrelli, Robert Beauchamp</i>	
Ultrasonic Altimeter for Titan Landers	4762
<i>Timothy Brubaker, Jarrett Wehle, John Youssef, Chris Monaghan, Steven Zhan, Ralph Lorenz</i>	
Model Based Systems Engineering (MBSE) Applied to Fault Detection Analysis of Vehicle Subsystems	4777
<i>Nabeel Mahmood, Selcuk Cimalay, Dimitri N. Mavris</i>	
Blockchain-Enabled Redundant Fractionated Spacecraft System	4788
<i>Mariana Alves, Justine Veirier D'Aiguebonne, Thibault Gateau, Jerome Lacan</i>	
Processing of Thermal Satellite Images Using MATLAB	4801
<i>Kanishk Ujjwal, Shraddha Meda Sheshadri, Deeksha Sabhari, Aarushi Dhanuka, Aprajita Singh</i>	
Real-Time Techniques for Fault Detection on Railway Door Systems.....	4811
<i>Minoru Shimizu, Suresh Perinpanayagam, Bernadin Namooano</i>	
Reliable GNSS Joint Position and Attitude Estimation in Harsh Environments Through Robust Statistics	4820
<i>Andrea Belles, Daniel Medina, Paul Chauchat, Jordi Vila-Valls</i>	
How to Build a Rover: An Overview of the Mars 2020 Mission's Vehicle System Testbed	4829
<i>Christopher Matthes, Matthew Stumbo, Justin Foley, Terence Dang, Jose Trujillo Rojas</i>	
Reliability Analysis and Failure Mitigation Strategies for the PROVE Pathfinder CubeSat Payload.....	4841
<i>Louis Timperley, Lucy Berthoud</i>	
Comparing Spectro-Radiometer Instruments for a Satellite Mission to Detect Chemical Warfare Agents.....	4859
<i>Gary Sutlieff, Lucy Berthoud, Andrei Sarua</i>	

HERMES Radio: Energy and Spectral Efficient Transmitter Architectures for Small Satellites	4872
<i>Visweswaran Karunanithi, C. J. M Chris Verhoeven, Cicero S. Vaucher</i>	
Multi-Target Custody Via Distributed Multiple-Model Multiple-Hypothesis Tracking	4882
<i>Craig Carthel, Stefano Coraluppi, Brandon Bale, Nick Pioch, Joseph Durek</i>	
Identifying Space Threats for SpaceAware Resilience- A Spacecraft and Satellite Service Resilience Model.....	4893
<i>Lucy Berthoud, Simon Agass</i>	
Assessing Ceres' Past and Current Habitability.....	4902
<i>John R. Brophy, Julie Castillo-Rogez, Raul Polit Casillas</i>	
The Lunar Lab Initiative.....	4917
<i>Michael Interbartolo, William O'Neill, Molly Bannon, Robert Howard, Brett Montoya, Harry L. Litaker, Jackie Black</i>	
Forging the Forge: Executing a Renewed Initiative in Concept Engineering at NASA JSC	4931
<i>Molly Bannon, William O'Neill, Michael Interbartolo, Jacquelyne Black</i>	
Human Mars Mission Surface Power Impacts on Timeline and Traverse Capabilities.....	4941
<i>Michael B. Chappell, Stephen Hoffman, Omar Bekdash</i>	
Information Services Architecture Within Unmanned Aircraft System (UAS) Traffic Management (UTM)	4951
<i>Kristin Cropf, Jason Glaneuski, Mark Strout, Patrick Sheridan, Dylan Hasson, Chris Flynn</i>	
Automating Surface Attitude Positioning and Pointing Operations for Mars 2020	4961
<i>Leilani Trautman, Jim Montgomery, Farah Alibay, Tony Vanelli, Tara Estlin, Anais Zarifian</i>	
Mars 2020 Perseverance Rover Surface Operations Commissioning Phase Overview.....	4970
<i>Robert Lange, Luke Walker, Matt Lenda, Chaz Morantz, Torsten Zorn, Farah Alibay, Lauren Ducharme, Justin Koch</i>	
Lunar Communications Services with Emphasis on Commercialization	4990
<i>John Ware, Faramaz Davarian</i>	
A Wisdom of Crowds Approach to Supervised Learning Ensembles Using FPGAs.....	5000
<i>John C. Porcello</i>	
Benchmarking and Testing of Qualcomm Snapdragon System-On-Chip for JPL Space Applications and Missions.....	5008
<i>Zaid Towfic, Dennis Ogbe, Joe Sauvageau, Douglas Sheldon, Andre Jongeling, Steve Chien, Faiz Mirza, Emily Dunkel, Jason Swope, Mehmet Ogut, Vlad Cretu, Chris Pagnotta</i>	
Operations for Autonomous Spacecraft.....	5020
<i>Rebecca Castano, Tiago Vaquero, Federico Rossi, Vandi Verma, Ellen Van Wyk, Dan Allard, Bennett Huffmann, Erin M. Murphy, Nihal Dhamani, Robert A. Hewitt, Scott Davidoff, Rashied Amini, Anthony Barrett, Julie Castillo-Rogez, Mathieu Choukroun, Alain Dadaian, Raymond Francis, Benjamin Gorr, Mark Hofstadter, Michel Ingham, Cristina Sorice, Iain Tierney</i>	
Proactive Approaches for Engine Health Management and a High Value Example.....	5040
<i>Chris Hickenbottom</i>	

Plan for On-Orbit Demonstration of the Deployable Optical Receiver Array.....	5046
<i>Daniel Jacobs, Judd Bowman, Michelle Patterson, Michael Horn, Christopher McCormick, Matthew Adkins</i>	
Nancy Grace Roman Space Telescope Observatory Implementation and Challenges	5054
<i>Lisa M. L. Bartusek, Jody L. Davis, Melissa F. Vess</i>	
Implementation of a Multiple Target Tracking Filter on an Adiabatic Quantum Computer	5068
<i>Timothy M. McCormick, Bryan R. Osborn, R. Blair Angle, Roy L. Streit</i>	
Engineering Design of a Thruster-Pointing Mechanism (TPM-250) for Deep Space and IOS Nanosats	5082
<i>Emilia Wegrzyn, Aitor Estarlich, Artur Fouto, Alberto Garbayo</i>	
Comparison Between UAV IoT Solutions with and Without Satellite Backhaul Link	5096
<i>Aya Moheddine, Fabio Patrone, Mario Marchese</i>	
Design and Model Predictive Control of a Mars Coaxial Quadrotor	5104
<i>Akash Patel, Avijit Banerjee, Bjorn Lindqvist, Christoforos Kanellakis, George Nikolakopoulos</i>	
Mars Terrain Segmentation with Less Labels	5115
<i>Edwin Goh, Jingdao Chen, Brian Wilson</i>	
Comprehensive Assessment of Orbital Robotics, Space Application Simulation/Machine Learning, and Methods of Hardware in the Loop Validation	5125
<i>Marco Peterson, Minzhen Du, Bryant Springle, Jonathan Black</i>	
Visual Modeling System for Optimization-Based Real-Time Trajectory Planning for Autonomous Aerial Drones	5138
<i>Skye McEowen, Daniel Sullivan, Dan Calderone, Michael Szmuk, Oliver Sheridan, Behcet Acikmese, Benjamin Chasnov</i>	
Gravity Poppers: Hopping Probes for the Interior Mapping of Small Solar System Bodies.....	5147
<i>Benjamin Hockman, Jacopo Villa, Andrew French, Steven Chesley, Daniel J. Scheeres, Jay McMahan</i>	
Development of a Deployable Optical Receive Aperture.....	5173
<i>Uriel S. Escobar, Jose E. Velazco, Sean E. Cornish, Andy R. Klaib, Julia M. Arnold, Daniel Jacobs, Judd Bowmen, Lin Yi</i>	
Reconstructed Performance of the Mars InSight Lander's Supersonic Parachute & Comparison with the Phoenix Lander.....	5181
<i>Clara O'Farrell, Ian G. Clark, Chris Karlgaard</i>	
(Explainable) Artificial Intelligence in Aerospace Safety-Critical Systems.....	5195
<i>Sujitra Sutthithatip, Suresh Perinpanayagam, Sohaib Aslam</i>	
Meeting a Planetary Launch Window in a Pandemic	5207
<i>Matthew Garrison, Dennis Reuter, Amy Simon, James Simpson, Elizabeth Matson, Teresa Null, Chanel Duncan, Zachary Dolch</i>	
Enabling a Larger Deep Space Mission Suite: A Deep Space Network Queuing Antenna for Demand Access	5215
<i>Marc Sanchez Net, Jay Wyatt, Rebecca Castano, Stephen A. Townes, T. Joseph W. Lazio, Benjamin K. Malphrus, Jeffrey A. Kruth, Chloe Hart, Emily Mattle</i>	

Benefits and Challenges of CCSDS File Delivery Protocol as Applied to Europa Clipper	5228
<i>Marc A. Sarrel, Duane L. Bindschadler, Joel Signorelli, Deane E. Sibol, Andrew Calloway, Joshua Albers</i>	
Validation of Optimal Control Design Tool for Dedicated Avionic in Active Debris Removal Mission	5243
<i>Michaël Juillard, Jean-Paul Kneib</i>	
Understanding Sustainability in the Human Exploration Campaign	5255
<i>Luis Carrio, Christine M. Edwards, Adam Marcinkowski, Tim Cichan</i>	
Realtime Wideband Modem in the Cloud - Technology and Economics.....	5274
<i>Eugene Grayver</i>	
Smart Cities - Automatic Power Lines Inspection.....	5284
<i>Rodrigo Kuntz Rangel, Andre Laurindo Maitelli, Vilmar Antonio Rodrigues, Darwin Rafael Goncalves Valente</i>	
Thermal Control System Architecture and Technology Challenges for a Lunar Surface Habitat.....	5298
<i>R. Gregory Schunk, Stephanie D. Babiak, Brian W. Evans</i>	
Beam-To-Satellite Scheduling for High Throughput Satellite Constellations Using Particle Swarm Optimization.....	5306
<i>Nils Pachler, Edward F. Crawley, Bruce G. Cameron</i>	
Providence - A Deep Learning Framework for Time-to-Event Prediction.....	5315
<i>Stephen Fox, Elizabeth Zimmerman, Tynan Daly, Michael O'Keeffe, Wim Verleyen</i>	
Down-Selection of Four Common Habitat Variants	5325
<i>Robert L. Howard</i>	
Internal Architecture of the Common Habitat	5342
<i>Robert L. Howard</i>	
Functional Volume Assessment of an Early Version of the Mars Transit Habitat	5353
<i>Robert L. Howard, Callie Burke</i>	
Optimization Framework for Minimal Conjunction Satellite Constellation Design and Post-Mission Disposal Trajectories	5366
<i>Philippe B. S. Clifton, Hang Woon Lee, Akihiko Honda, Shoji Yoshikawa, Koki Ho</i>	
Autonomous Balloon Technology: Automated Methods for Rapid Balloon Inflation and Launching	5377
<i>Arun Bishop, Nicholas M. Hennigan</i>	
Orbital Exploration of Phobos by a Nano-Satellite Using Solar Electric Propulsion.....	5386
<i>Shuba Murthy, Amay Sareen, Effy Oommen John, Prajwal Jayaraman, Mohamed Hussain S</i>	
Improving Touchless Respiratory Monitoring Via LiDAR Orientation and Thermal Imaging	5397
<i>Md Siddat Bin Nesar, Karis Trippe, Ryan Stapley, Bradley M. Whitaker, Bryce Hill</i>	
Improving Computational Efficiency of Prognostics Algorithms in Resource-Constrained Settings	5405
<i>Katelyn J. Jarvis, Christopher Teubert, Wendy A. Okolo, Chetan S. Kulkarni</i>	
Fault Detection and Performance Monitoring of Propellers in Electric UAV	5416
<i>Rajendra P Palanisamy, Chetan S. Kulkarni, Matteo Corbetta, Portia Banerjee</i>	

Intelligent Anomaly Detection of Robot Manipulator Based on Energy Consumption Auditing	5422
<i>Seong Hyeon Hong, Tristan Kyzer, Jackson Cornelius, Feraidoon Zahiri, Yi Wang</i>	
Aircraft Antenna Pointing with COTS Components	5433
<i>Bruce McGuffin</i>	
Space Launch System (SLS): Artemis I, Evolution, and Capability	5443
<i>Terry D. Haws, Jacob Bartkiewicz, Michael E. Fuller</i>	
Development of a System Level Optimization Tool to Facilitate Preliminary Design of the SLS BOLE Solid Rocket Motor	5452
<i>Brad Roe, David Griffin, Reid Young, Jonathan Thorne, Terry Haws</i>	
Lunar Campaign Optimization Using Machine Learning	5462
<i>Jacob Bartkiewicz, Terry D. Haws, Michael E. Fuller</i>	
RadPC@Scale: A Novel Approach to the RadPC Single Event Upset Mitigation Strategy	5470
<i>Justin Williams, Colter Barney, Zachary Becker, Jake Davis, Chris Major, Brock Lameres</i>	
Viability of Small Dimension Crew Quarters for Surface Habitation	5477
<i>Harry L. Litaker, Robert L. Howard</i>	
Fiber Optic Sensor System for Defect Classification Using Novel Physics Based Modelling and Data Driven Approach.....	5490
<i>Anish Gorantiwar, Arash Nouri, Behzad Moslehi, Feraidoon Zahiri, Rajvardhan Nalawade, Vahid Sotoudeh, William Price, Saied Taheri</i>	
Fault and Attack Detection and Diagnosis by Analysis of Electrical Waveforms of Power Networks.....	5502
<i>Stephen J. Coshatt, Bowen Yang, Jin Ye, Wenzhan Song, Feraidoon Zahiri, James Hill</i>	
Prognosis: Challenges, Precepts, Myths and Applications.....	5511
<i>George Vachtsevanos, Feraidoon Zahiri</i>	
Multi-Mission Terrain Classifier for Safe Rover Navigation and Automated Science	5524
<i>Deegan Atha, R. Michael Swan, Annie Didier, Zaki Hasnain, Masahiro Ono</i>	
Imaging X-Ray Polarimetry Explorer (IXPE) - Ready for Flight	5537
<i>William D. Deininger, William Kalinowski, Michael Head, Colin Peterson, Spencer Antoniak, Rondal Mize, Martin C. Weisskopf, Brian Ramsey, Stephen L. O'Dell, Allyn Tennant, Paolo Soffitta, Francesco Santoli, Ettore Del Monte, Michele Pinchera, Alessio Trois, Darren Osborne</i>	
Cubesats/Smallsats/Nanosats/Picosats/Rideshare(sats) in 2022: Making Sense of the Numbers	5553
<i>Michael Swartwout</i>	
Towards a National Space Program: An Australian Perspective.....	5563
<i>Frederick Menk, Aaron Pereira, Jose Velasco, Ed Kruzins, Phil Bland</i>	
Resilient Machine Learning in Space Systems: Pose Estimation as a Case Study	5571
<i>Anita Khadka, Saurav Sthapit, Gregory Epiphaniou, Carsten Maple</i>	
Test and Evaluation of Reinforcement Learning Via Robustness Testing and Explainable AI for High-Speed Aerospace Vehicles	5580
<i>Ali K. Raz, Sean Matthew Nolan, Winston Levin, Kshitij Mall, Ahmad Mia, Linas Mockus, Kris Ezra, Kyle Williams</i>	

Two- Level Targeter Convergence Study for Collinear Libration Point Spacecraft Formations	5594
<i>Donna Jennings, Henry Pernicka</i>	
Next Generation Phased Arrays for Deep Space Communications.....	5605
<i>Aaron Pereira, Ed Kruzins, Said Al Sarawi, Derek Abbott, Frederick Menk, Okan Yuversedyan, Bryan Schwitter, Tony Fattorini</i>	
Direct to Earth Communications Using MFSK Tones During M2020 Entry, Descent, and Landing	5623
<i>Lisa Mauger, Melissa Soriano, Stephen Rogstad, Susan Finley, Jan Tarsala, Chloe Sackier, Peter Illott, Dustin Buccino, Kamal Oudrhiri</i>	
L3VIN: Lunar-Laser-Lab for Volatiles INvestigation. a CLPS-compatible in Situ Lunar Instrument	5632
<i>Evan Eshelman, Pablo Sobron, Kirby Simon, Nina Webb, Daniel Van Hoesen, Owen Pochettino, Alian Wang, Bradley Jolliff</i>	
Comparison Between Time and Frequency-Domain Processing of Anemometer Data.....	5642
<i>Jack E. McCrae, Santasri R. Bose- Pillai, Benjamin Wilson, Trevor Cross, Melissa Beason, Steven T. Fiorino, Kevin Lieb</i>	
Explainability Tools Enabling Deep Learning in Future In-Situ Real-Time Planetary Explorations.....	5648
<i>Daniel Lundstrom, Alexander Huyen, Arya Mevada, Kyongsik Yun, Thomas Lu</i>	
Performance and Business Case Impact Assessment for Launch Systems Utilizing RDRE Propulsion.....	5656
<i>John Bradford, Sam Bornstein, Hayden Magill</i>	
Adapting a Trusted AI Framework to Space Mission Autonomy	5668
<i>Philip Slingerland, Lauren Perry, James Kaufman, Benjamin Bycroft, Erik Linstead, Lukas Mandrake, Gary Doran, Ashish Goel, Martin S. Feather, Lorraine Fesq, Hiro Ono, Rashied Amini</i>	
The Design of Autonomous Robotic Technologies for Lunar Launch and Landing Pad (LLP) Preparation.....	5688
<i>Jekan Thangavelautham, Yinan Xu</i>	
Operational Tools and Data Management for OSIRIS-REx Optical Navigation	5701
<i>Leilah K. McCarthy, John Y. Pelgrift, Erik J. Lessac-Chennen, Eric M. Sahr, Brian T. Carcich, Coralie D. Adam, Derek S. Nelson, Robert W. Gaskell, Dante S. Lauretta</i>	
Multicarrier Navigation and Authentication: Control-Engineering and Bio-Inspired Approaches	5714
<i>Khanh D. Pham</i>	
Satellite High-Speed On-Board Data Handling: from a Wizardlink Equivalent Transceiver to a Full SpaceFibre Interface.....	5724
<i>Pietro Nannipieri, Luca Fanucci, Gainmarco Dinelli, Luca Dello Sterpaio, Antonino Marino</i>	
ICU4SAT: A General-Purpose Reconfigurable Instrument Control Unit Based on Open Source Components.....	5732
<i>Pietro Nannipieri, Gianluca Giuffrida, Lorenzo Diana, Silvia Panicacci, Luca Zulberti, Luca Fanucci, Hector Gerardo Munoz Hernandez, Michael Hubner</i>	
GEOSCAN: Global Earth Observation Using Swarm of Coordinated Autonomous Nanosats.....	5741
<i>Changrak Choi, Anthony B. Davis</i>	

Multi-Robot Assembly Scheduling for the Lunar Crater Radio Telescope on the Far-Side of the Moon	5751
<i>Preston Culbertson, Saptarshi Bandyopadhyay, Ashish Goel, Patrick McGarey, Mac Schwager</i>	
ASIC Flow for Space Radiation Tolerant Components on Commercial Process Technologies - Part 1 Library Validation	5760
<i>Jean Yang-Scharlotta, Steven M. Guertin, Lawrence T. Clark, Clifford S. Young-Sciortino, Jim D. Butler, Mohammad Mojarradi, Harald Schone</i>	
ASIC Flow for Space Radiation Tolerant Components on Commercial Process Technologies - Part 2 Application to High Performance Computing Requirements	5770
<i>Steven M. Guertin, Lawrence T. Clark, Jean Yang-Scharlotta, Clifford S. Young-Sciortino, Jim D. Butler</i>	
Phase Screen Generation Methods for Simulating Light Propagation Through non-Kolmogorov Turbulence.....	5781
<i>Jason Salmanowitz, Noah R. Van Zandt</i>	
Point to Point Reactionless Path Planning of Dual Robotic Arms	5789
<i>Gaurav Sharma, B. K. Rout</i>	
Development of a Hardware-In-The-Loop Testbed for Rotating Synthetic Aperture Telescopes	5805
<i>Alejandro D. Cabrales Hernandez, Evan L. Kramer, Rebecca A. Masterson</i>	
DC Load Flow Models for the Electric Power System of Wide Body All Electric Aircraft	5821
<i>Mona Ghassemi, Ashkan Barzkar</i>	
Optimal Electric Power System Architectures for Wide Body All Electric Aircraft.....	5829
<i>Mona Ghassemi, Mohammadreza Saghafi</i>	
Robust Vision-Based Multi-spacecraft Guidance Navigation and Control Using CNN-Based Pose Estimation.....	5838
<i>Jonathan Becktor, William Seto, Aditya Deole, Saptarshi Bandyopadhyay, Niyousha Rahimi, Shahriar Talebi, Mehran Mesbahi, Amir Rahmani</i>	
GeoMask : Foreign Object Debris Instance Segmentation Using Geodesic Representations	5848
<i>Rasna A. Amit, C. Krishna Mohan</i>	
Federated Learning: Dataset Management for Airport Object Representations Using Remote Sensing Images.....	5857
<i>Rasna A. Amit, C. Krishna Mohan</i>	
Implementation and Validation of Shadow Dynamics Algorithm for Satellites	5871
<i>Gaurav Sharma, Prateen Kumar, Arvind Sundaram Iyer</i>	
6-DoF Pose Estimation of Uncooperative Space Object Using Deep Learning with Point Cloud.....	5879
<i>Shaodong Zhang, Weiduo Hu, Wulong Guo</i>	
An Elegant Solution for a Deceptively Simple Filter Wheel Assembly.....	5886
<i>Jacques Laramée</i>	
Distributed Sample Processing System Using SpaceFibre for High Bandwidth Frontier Radio Applications.....	5894
<i>Michael Cerabona, Ed Pulaha, Avinash Misra</i>	

Dynamics of Tethered Space-Robot Swarm for Active Debris Removal.....	5904
<i>Aniket Sharma, Nandan K Sinha</i>	
How to Deploy a 10-Km Interferometric Radio Telescope on the Moon with Just Four Tethered Robots.....	5912
<i>Patrick McGarey, Issa A. Nesnas, Adarsh Rajguru, Matthew Bezkrorny, Vahraz Jamnejad, Jim Lux, Eric Sunada, Lawrence Teitelbaum, Alexander Miller, Steve W. Squyres, Gregg Hallinan, Alex Hegedus, Jack O. Burns</i>	
Harris-Lovassy N-Dimensional Rule of Combination	5920
<i>Daniel Harris, Peter Lovassy, Darin Dunham</i>	
COMPACT KNN V2: Analogy-Based Cost Estimation Model for CubeSats	5928
<i>Melissa Hooke</i>	
Small Modular Launch Vehicle Multidisciplinary Design Optimization	5937
<i>Fredy M. Villanueva</i>	
Recent Advances in the Pan-STARRS Search for Near-Earth Objects.....	5945
<i>Richard J Wainscoat, Kenneth Chambers, Robert Weryk, Yudish Ramanjooloo, Mark Huber, Eugene Magnier</i>	
Self-Attending Task Generative Adversarial Network for Realistic Satellite Image Creation.....	5951
<i>Nathan Toner, Justin Fletcher</i>	
Vision-Based Spacecraft Relative Pose Estimation in Variable Lighting Conditions.....	5960
<i>Evan L. Kramer, William E. Parker, Rebecca A. Masterson</i>	
Comparing Performance of Coded Communications Over Fading Channels Between the Lunar South Pole & Earth.....	5972
<i>Dariusz Divsalar, Marc Sanchez Net, Kar-Ming Cheung</i>	
Finite Element Analysis of Si and SiC Power Modules for Accurate Reliability Assessment.....	5983
<i>Jeny Sunil, Sohaib Aslam, Suresh Perinpanyagam, Andrew Wileman</i>	
4D Flight Trajectory Prediction Based on ADS-B Data: A Comparison of CNN-GRU Models	5993
<i>Hesam Shafiqi, Amelia Regan</i>	
Decoding the Descent Dynamics of the Huygens Probe	6005
<i>Ralph D. Lorenz</i>	
20 Years of Tier-Scalable Reconnaissance: Adoption of a Game-changing Mission Paradigm	6019
<i>Wolfgang Fink, James M. Dohm, Mark A. Tarbell, Trent M. Hare, Victor R. Baker</i>	
Visualizing Multi-Process CPU Utilization Using CUSP	6032
<i>Mark W. Maimone</i>	
Dynamic Wildfire Boundary Tracking with Radial Basis Function Based Guidance Law	6040
<i>Licheng Feng, Jay Katupitiya</i>	
A High Voltage Tethered Power System for Planetary Surface Applications.....	6050
<i>Ansel Barchowsky, Ahmadreza Amirahmadi, Kyle Botteon, Gregory Carr, Curtis Jin, Patrick McGarey, Shelly Sposato, Summer Yang</i>	
Study the Effect of Tri-Axis Vibration Testing Over Single-Axis Vibration Testing on a Satellite	6058
<i>Narendra Nath, Guglielmo S Aglietti</i>	

Evaluation of a Distributed Kalman Filter for Autonomous Satellite Navigation Using DASEE..... 6068
Eric D. Yuan, Jon Neff, Jeffrey Won

Onboard Hyperspectral Image Classification Via Transfer Learning for Communication-Limited
Spacecraft..... 6077
Justin S. Goodwill, James P. Mackinnon, Kristy Sakano, Christopher M. Wilson

Author Index