APPLIED SPACE ENVIRONMENTS

CONFERENCE 2021

Space Weather Solutions

USRA

Jet Propulsion Laboratory
California Institute of Technology

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Logistics

- ASEC 2021 will use the Webex teleconference software, links will be e-mailed to registered participants the week before the conference.
  - Webex can be used through a browser mode or a (free) install of the Webex application on your computer when you first attempt to connect.
  - Microphones and cameras will be enabled for speakers, session chairs, and conveners. All other participants will have microphones and cameras disabled to reduce bandwidth required for the conference and background noise from unmuted microphones.
  - Participants will ask questions using the Webex "chat" feature.
  - Webex will be started 30 minutes before the workshop each day to allow users to call in before the start of the conference.

- Test Webex sessions will be set up on Friday, October 29 to give participants an opportunity to test the connection from your computer:
  - 08:00 – 11:00 AM CDT
  - 04:00 – 06:00 PM CDT

  The Webex links will be e-mailed to registered participants the week before the conference.

- All presentations will be live at the times scheduled on the agenda. There are no pre-recorded presentations and the conference will not be recorded for later use.

- Times in the agenda are US Central Daylight Time (CDT) zone (UTC – 5 hours)

- Please upload your presentation (in PowerPoint or PDF format) to the ExOrdo conference site the week before your talk. The Ex Ordo URL is: https://asec2021.exordo.com

- There is no full ASEC paper required to participate in the conference, your presentation slides are the only materials due before the conference.

- Additional information about the special Virtual Collection of ASEC2021 papers in the Journal of Spacecraft and Rockets will be provided during the conference. Submitting a paper is voluntary and not required to participate in the workshop.

Welcome to ASEC 2021!

As the conveners for this year's conference, we welcome all of you to the Applied Space Environment Conference (ASEC) 2021! The world is beginning to emerge from the restrictions on travel and in-person meetings that were a result of the Covid pandemic but many professional conferences, including the ASEC 2021 this year, are still being held in a virtual format. Regardless, we are greatly encouraged by the strong response to ASEC from the space environment community this year in terms of the many excellent contributed abstracts, tutorials, and keynote addresses that make up the technical agenda as well as the largest number of registered participants to date, over twice the number as ASEC 2019!

ASEC 2021 is the third event organized in the biennial ASEC conference series. The location of the inaugural ASEC event in 2017 was Huntsville, Alabama with the second ASEC event in 2019 moving to Los Angeles, California. The strong response for this year's event—even with the challenges of a virtual format—demonstrates that ASEC continues to meet a communication need for our applied space environments science and engineering community. We plan to continue organizing the conference series on alternate years in the future and hope to see all of you in person for ASEC 2023!

Welcome to ASEC 2021 and enjoy the conference!

ASEC 2021 Conveners

Insoo Jun/JPL

Linda Neergaard Parker/Space Weather Solutions

Joseph Minow/NASA

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Week at a Glance

	MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY
10:00	OPENING	10:00	Tutorial (SPENVIS)	10:00	Spacecraft Charging Simulations and Testing: Charging	10:00	Spacecraft Charging Simulations and Testing: General	10:00	Space Weather Environments Impacts, and Modeling
10:30	Keynotes			10:20		10:20		10:20	
		10:40	Spacecraft Charging Simulations and Testing: General	10:40		10:40		10:40	
11:30	Change over	11:00		11:00		11:00		11:00	
11:40	Spacecraft Charging Simulations and Testing: Charging	11:20		11:20		11:20		11:20	Break
12:00		11:40		11:40	Break	11:40	Break	11:40	Radiation Effects on Humans and Materials
12:20		12:00	Break	12:00	Current and Future Missions	12:00	MMOD Environment, Effects, Testing, and Mitigation	12:00	
12:40		12:20	Space Weather Environments Impacts, and Modeling	12:20		12:20		12:20	
1:00		12:40		12:40		12:40		12:40	
1:20 - 2:00	Lunch	1:00		1:00		1:00		1:00	
2:00	Radiation Effects on Parts and Testing	1:20		1:20		1:20 - 2:00	Lunch	1:20 - 2:00	Lunch
2:20		1:40 - 2:20	Lunch	1:40 - 2:20	Lunch	2:00	Instrument and Measure Techniques	2:00	Space Weather Environments Impacts, and Modeling
2:40		2:20	Atomic Oxygen Environment, Effects, Testing, and Mitigation	2:20	Keynote: HEOMD	2:20		2:20	
3:00		2:40		2:50	Other Space Environments and Effects	2:40		2:40	
3:20	Break	3:00		3:10		3:00		3:00	CLOSING Comments
3:40	Instrument and Measure Techniques	3:20		3:30		3:20			
4:00		3:40		3:50		3:40	Break		
4:20		4:00		4:10		4:00	In-flight Observations and Events		
4:40						4:20			
5:00						4:40			

[Note: All times are US Central Daylight Time, UTC – 5 hours]

Monday

Session M1: Welcome, Opening Remarks, and Keynotes
Chair: Joseph Minow

10:00 – 10:30	01-Welcome and Opening Remarks, ASEC Conveners	Insoo Jun Joseph Minow Linda Neergaard Parker
10:30 – 11:00	**02-Keynote:** NASA Heliophysics: Studying the Vast System Stretching form the Sun to the Earth and Beyond to Untangle the Effects of the Star We Live With	Nicky Fox Director, Heliophysics Division NASA/SMD
11:00 – 11:30	**03-Keynote:** The USSF Gaps, Needs, and Plans for the Space Environment	Joel Mozer Director, Science, Technology, and Research US Space Force
11:30 – 11:40	**Change Over**	

Session M2: Spacecraft Charging Simulations and Testing – Charging I
Chairs: Dale Ferguson, Colby Lemon

11:40 – 12:00	04-Spacecraft Charging and IESD Characterization of Carbon Composite Materials with Multiple Electron Beams	Justin Likar JHU/APL
12:00 – 12:20	05-Electron Beam Tests of Carbon Composite Materials with Conductive Resin for Preventing Spacecraft Charging-Induced ESD	Allen Andersen NASA/JPL
12:20 – 12:40	06-NASA Air Force Spacecraft Charging Analyzer Program Confirmation of GPS Arcing	Dale Ferguson AFRL
12:40 – 01:00	07-Just-In-Time Charging Risk Analysis Service with the H2O2O/PAGER Space Weather Predictions Framework	Julien Forest Artenum
01:00 – 01:20	08-Spacecraft Charging in Sunlight, Physical Mechanisms, Mitigation Techniques	Shu Lai MIT
01:20 – 02:00	**Lunch Break**	

Session M3: Radiation Effects on Parts and Testing
Chairs: Michael Campola, Richard Altstatt

02:00 – 02:20	**09-Invited:** The Europa Clipper Mission - Hardness Assurance through Mission and System Design	Steve McClure NASA/JPL
02:20 – 02:40	10-Current Challenges and Solutions in Nuclear Rocket and Orbital System Design	Tom Jordan EMPC
02:40 – 03:00	11-SIRE2 Toolkit Version 1.80 Update	Zachary Robinson Fifth Gait Technologies

03:00 – 03:20	12-Astronomical Reflectance Spectroscopy (ARS) Characterization of Various Polymer Materials in a Simulated GEO Environment	Jainisha Shah ATC
03:20 – 03:40	**Break**	

Session M4: Instrument and Measurement Techniques I
Chairs: Henry Garrett, Tim Guild

03:40 – 04:00	**13-Invited:** HERMES: NASA's Space Weather Payload for Gateway	William Paterson NASA/GSFC
04:00 – 04:20	14-Considerations for Optical Sweep Rates of Sweeping Langmuir Probes in Space Plasmas	Rachel Conway ERAU
04:20 – 04:40	15-Data Products from the Floating Potential Measurement Unit (FPMU) onboard the International Space Station	Shantanab Debchoudhury ERAU
04:40 – 05:00	16-Adding Triboelectric Charging Parameters to the Spacecraft Charging Materials Database	Charles Buhler NASA/KSC
05:00 – 05:20	17-Comparison of Space Charge Distributions in Polymers Irradiated with Monoenergetic Electrons: Pulsed Electroacoustic Measurements and AF-NUMIT3 Modeling	Zachary Gibson USU
05:20	Adjourn	

Tuesday

Session T1: Tutorial
Chair: Linda Neergaard Parker

10:00 – 10:40	**01-Tutorial:** The SPace ENVironment Information System (SPENVIS): A New Framework	Erwin De Donder Royal Belgium Institute for Space Aeronomy

Session T2: Spacecraft Charging Simulations and Testing – General I
Chairs: Justin Likar, Insoo Jun

11:40 – 10:00	02-Real and Imaginary Permittivity Testing in High-Vacuum and Variable Temperature Settings	Jordan Lee USU
10:00 – 11:20	03-Using a Pulsed Electron Beam to Prevent Charging While Sensing Electric Potentials	Julian Hammerl UCB
11:20 – 11:40	04-Methods for Yield Measurements of Highly Insulating Granular Materials	Tom Keaton USU
11:40 – 12:00	05-Analysis of Extrinsic Factors of Electron Yield with a "Patch" Model	Matthew Robertson USU
12:20 – 12:20	**Break**	

Session T3: Space Weather Environments, Impacts, and Modeling I **Chairs: Yihua Zheng, Shawn Young**		
12:20 – 12:40	**06-Invited:** Cultivating Capabilities for Lunar Extreme Environments	Kevin Somervill NASA/LaRC
12:40 – 01:00	07-A Data-driven Global Magnetosphere Model to Simulate Solar Wind/Earth's Magnetosphere Interaction	Mehmet Yalim UAH
01:00 – 01:20	08-Disentangling Short- and Long-term Variations of the Galactic Cosmic Ray Flux for Future Space Missions	Catia Grimani UUCB
01:20 – 01:40	09-New JPL Website for Natural Space Environment Tools	Luz Maria Martinez Sierra NASA/JPL
01:40 – 02:20	**Lunch Break**	
Session T4: Atomic Oxygen Environment, Effects, Testing, and Mitigation **Chairs: Kim de Groh, Tim Minton**		
02:20 – 02:40	10-Atomic Oxygen Treatment for Multipactor Performance Enhancement of RF Hardware	Cesar Miquel España ESA/ESTEC
02:40 – 03:00	**11-Invited:** Atomic Oxygen Environment and Effects	Sharon Miller NASA/GRC
03:00 – 03:20	12-Atomic Oxygen Density Variations in Sub-LEO Region: SLATS/AOFS Flight Data Analysis	Atsushi Fujita Kobe University
03:20 – 03:40	13-Effect of Direct Atomic Oxygen Exposures on Carbon Nanotube Field Emission Cathode – Comparison of Flight Data and In-Situ Ground-Based Experiment	Kazuki Itatani Kobe University
03:40 – 04:00	14-On the Utility of Coated POSS-Polyimides for Vehicles in Very Low Earth Orbit	Tim Minton UCB
04:00 – 04:20	15-AIAA Journal of Spacecraft and Rockets Virtual Collection of ASEC 2021 Papers	Joseph Minow NASA/LaRC
04:20	Adjourn	

Wednesday

Session W1: Spacecraft Charging Simulations and Testing – Charging II **Chairs: Shu Lai, Wousik Kim**		
10:00 – 10:20	**01-Invited:** Environmental Testing of the Solar Probe Cup	Kenneth Wright STI/USRA
10:20 – 10:40	02-Efficient Computation of Differential Charging Time Scales between Cover Glass and Spacecraft Body in Severe GEO Plasma Environment	Ashish Pandya DDU

10:40 – 11:00	03-Adding Radiation Induced Conductivity Test Capability to the JPL Dynamitron	Nelson Green NASA/JPL
11:00 – 11:20	04-Preliminary Results of Radiation-Induced Conductivity Testing of Europa Clipper Dielectric Materials	Allen Andersen NASA/JPL
11:20 – 11:40	05-Internal ESD Control and Assessment for Europa Clipper Inter-subsystem	Kit P. Frankie Wong Bastion Technologies
11:40 – 12:00	**Break**	
Session W2: Current and Future Missions **Chairs: Terry Onsager, Joseph Minow**		
12:00 – 12:20	**06-Invited:** The Commercial Lunar Payload Services (CLPS)	Darryl Gaines NASA/JSC
12:20 – 12:40	07-Materials Environmental Testing Challenges for ESA's Future Space Missions	Nuno Dias ESA/ESTEC
12:40 – 01:00	08-Advances in Management of Decompression Sickness in Space	Peter Anto Johnson University of Alberta
01:00 – 01:20	09-Understanding Spacecraft Test Environments in JPL's Twenty-Five-Foot Space Simulator	Maxwell Martin NASA/JPL
01:20 – 01:40	10-Experimental and Simulation Studies of the Adhesion of Titan Dust Simulants on Transparent Windows	Jason Benkoski JHU/APL
01:40 – 02:20	**Lunch Break**	
Session W3: Keynote **Chair: Insoo Jun**		
02:20 – 02:50	**11-Keynote:** An Overview of the Human Research Program: Current Focus and Future Directions	Steven Platts Chief Scientist, Human Research Program NASA/SOMD
Session W4: Other Space Environments and Effects **Chairs: Dave Pitchford, Nicole Pothier McGillivray**		
02:50 – 03:10	12-Plume-Surface Interaction: Preliminary Observations from a Physics Focused Ground Test	Wesley Chambers NASA/MSFC
03:10 – 03:30	13-Meteoroid Ejecta of Lunar Secondaries Engineering Model	Anthony DeStefano NASA/MSFC
03:30 – 03:50	14-Lunar Surface Environments Added to the Design Specification for Natural Environments	Aurelio Paez NASA/MSFC
03:50 – 04:10	15-Work Function Matching Passive Lunar Dust Mitigation Coating Preparation for Lunar Flight Opportunities	Sharon Miller NASA/GRC
04:10 – 04:30	16-Theory of Whistler Waves	Antony Soosaleon MGU

04:30 – 04:50	17-Electrolytic Nickel Sublimation Barrier Films for Neutron Sensor Cadmium Shields	Milena Graziano JHU/APL
04:50	Adjourn	

Thursday

Session R1: Spacecraft Charging Simulations and Testing – General III
Chairs: Nelson Green, Jason Vaughn

10:00 – 10:20	01-Space Environment Effects on the Electron Yields of Thermal Control Coatings from the Long Duration Exposure Facility	Trace Taylor USU
10:20 – 10:40	02-Dielectric Breakdown Simulations using Stochastic Tree Model	Gregory Wilson EMA
10:40 – 11:00	03-Building Circuit Models of Internal Electrostatic Discharge Events	James Chinn NASA/JPL
11:00 – 11:20	04-What is Real Conductivity under Radiation?	Wousik Kim NASA/JPL
11:20 – 11:40	05-Touchless Potential Sensing Model for Active Spacecraft Charging Scenario	Alvaro Romero-Calvo UCB
11:40 – 12:00	**Break**	

Session R2: MMOD Environment, Effects, Testing, and Mitigation
Chairs: Anne Bennett, Martin Ratliff

12:00 – 12:20	**06-Invited:** Overview of the National Orbital Debris R&D Plan	Michael Squire NASA/LaRC
12:20 – 12:40	07-Some Unexpected Risks from Lunar Ejecta	Mark Matney NASA/JSC
12:40 – 01:00	08-Predicting the Size of the Largest Particle Fragment in a Debris Cloud Created by an Orbital Debris Impact and its Associated Velocity	William Schonberg MUST
01:00 – 01:20	09-Automated Detection, Location, and Evaluation of Hypervelocity Impacts to Space Vehicles and Structures	Aaron Trott Invocon, Inc.
01:20 – 02:00	**Lunch Break**	

Session R3: Instrument and Measurement Techniques
Chairs: JR Dennison, Todd Schneider

02:00 – 02:20	**10-Invited:** US Air Force Academy (USAFA) Electrostatic Analyzer	Geoff McHarg USAFA
02:20 – 02:40	11-Potential for polSAR Technology to Characterize Martian Terrain Habitability	Peter Anto Johnson University of Alberta

02:40 – 03:00	12-Solar-powered Unmanned Aerial Vehicles for Crater Counting and Prospecting Planetary Bodies	John Christy Johnson University of Alberta
03:00 – 03:20	13-m-NLPs Inference Models Using Simulation and Regression Techniques	Guangdong Liu University of Alberta
03:20 – 03:40	14-Energetic Electron and Photo-electron Emission Impact on Spacecraft Potential	Richard Marchand University of Alberta
03:40 – 04:00	Break	
Session R4: In-flight Observations and Events Chairs: Emily Willis, Linda Parker		
04:00 – 04:20	**15-Invited:** Identifying Minor Debris Strikes in Spacecraft Telemetry: Methods and Applications	Anne Bennett UCB
04:20 – 04:40	16-High Energy Electron Flux Estimates of the Juno Environment Near Jupiter Compared to the JPL GIRE3 Model and the Galileo Data Base	Henry Garrett NASA/JPL
04:40 – 05:00	17-Use of Virtual Reality Environments in Manned Space Missions for Mental Health	John Christy Johnson University of Alberta
05:00	Adjourn	

Friday

Session F1: Space Weather Environments, Impacts, and Modeling II Chairs: Anthony DeStefano, Luz Maria Martinez-Sierra		
10:00 – 10:20	01-Electric Orbit Raising Radiation Environment and Solar Array Degradation	Soufian Yjjou TRAD
10:20 – 10:40	02-An Analysis of the Magnetospheric Specification Model and other Related Models	Shawn Young AFRL
10:40 – 11:00	04-Comparison of JPL and ESP Solar Proton Fluence Models Using the RDSv2.0 Dataset	Brian Xiaoyu Zhu NASA/JPL
11:00 – 11:20	**Break**	
Session F2: Radiation Effects on Humans and Materials Chairs: Kerry Lee, Linda Parker		
11:20 – 11:40	**05-Invited:** Space Radiation Technologies for Human Missions beyond Low-Earth-Orbit	Lisa Simonsen NASA/HQ
11:40 – 12:00	06-New System for Temperature Dependent Radiation Induced Conductivity Measurements	Joshua Boman USU
12:00 – 12:20	07-Development and Preliminary Characterization of a Novel Rotary Cell Culture System for Radiation and Reduced Gravity Cell and Tissue Studies	Achal Duhoon USU

12:20 – 12:40	08-NAIRAS Model Extension to the LEO Environment and New Products for Characterization of Single Event Effects	Chris Mertens NASA/LaRC
12:40 – 01:00	09-Ground testing of the MISSE-16 Materials	Elena Plis GTRI
01:00 – 01:40	**Lunch Break**	
Session F3: Space Weather Environments, Impacts, and Modeling III **Chairs: Michael Xapsos, Erica Worthy**		
01:40 – 02:00	10-Prototype Surface Charging Product for Geostationary Orbit	Terry Onsager NOAA/SWPC
02:00 – 02:20	11-Application of Machine Learning to Investigation of Arcing on Geosynchronous Satellites	Sergey Plis Georgia State University
02:20 – 02:40	12-VTEC Predictability by AfriTEC, IRI-2016, IRI-Plas 2017, and NeQuick-G Ionospheric Models over Africa During Geomagnetic Storm on March 17, 2015	Jean de Dieu Nibigira University of Alberta
02:40 – 03:00	13-Closing Remarks	Insoo Jun Joseph Minow Linda Neergaard Parker
03:00	Adjourn	

Affiliations

AFRL	Air Force Research Laboratory
ATC	Assurance Technology Corporation
DDU	Dharmsinh Desai University
EMA	Electro Magnetic Applications, Inc.
EMPC	Experimental & Mathematical Physics Consultants
ERAU	Embry-Riddle Aeronautical University
ESA	European Space Agency
ESTEC	European Space Research and Technology Centre
GRC	Glenn Research Center
GSFC	Goddard Space Flight Center
GTRI	Georgia Tech Research Institute
HEOMD	Human Exploration and Operations Mission Directorate
HQ	Headquarters
JHU/APL	Johns Hopkins University Applied Physics Laboratory
JPL	The Jet Propulsion Laboratory
LaRC	Langley Research Center
MGU	Mahatma Gandhi University
MIT	Massachusetts Institute of Technology
MSFC	Marshall Space Flight Center
MUST	Missouri University of Science & Technology
NASA	National Aeronautics and Space Administration
NESC	NASA Engineering and Safety Center
SMD	Science Mission Directorate
SOMD	Space Operations Mission Directorate
SWSolns	Space Weather Solutions
TRAD	TRAD Tests & Radiations
UAH	University of Alabama Huntsville
UCB	University of Colorado Boulder
UCF	University of Central Florida
US	United States
USAFA	United States Air Force Academy
USRA	Universities Space Research Association
USU	Utah State University
UUCB	University of Urbino Carlo Bo