

# Summaries for the 2017 Applied Space Environments Conference (ASEC) and the Space Environment Engineering and Science Applications Workshop (SEESAW)

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# ASEC Overview

The Applied Space Environments Conference is a forum for the space environment engineering and applied space science community to discuss the discipline's ability to support current space programs and to identify gaps in knowledge and technology needs required for future exploration goals

- ▶ Theme: Measurements, Modeling, Testing, and Tools
- ▶ The Westin Hotel in Huntsville, Alabama on May 15-19, 2017
- ▶ ~110 conference participants
  - ▶ NASA (multiple Centers, JPL, HQ), AFRL, NRL, LANL, industry, academia
- ▶ Sponsored by USRA, NASA, and NSF
- ▶ 60 Contributed Talks
- ▶ 4 Tutorials
- ▶ 13 Invited Talks

# Presentation Topics

- ▶ Overview
  - ▶ Modeling
  - ▶ Testing
- ▶ Environment
  - ▶ Atomic oxygen
  - ▶ Ionosphere
  - ▶ Meteoroid – orbital debris
  - ▶ Plasma
  - ▶ Radiation
- ▶ Interactions
  - ▶ Neutral atmosphere effects 9
  - ▶ Contamination 1
  - ▶ Hypervelocity 4
  - ▶ Induced potentials (e.g.,  $\mathbf{v} \times \mathbf{B}$ ) 1
  - ▶ Radiation effects 14
  - ▶ Solar array Interaction 3
  - ▶ Space weather 20
  - ▶ Spacecraft charging 12
  - ▶ Other 7

# Tutorials

- ▶ Atomic Oxygen Effects and Contamination
  - ▶ Sharon Miller, NASA
- ▶ Radiation Effects in Electronic Systems
  - ▶ Jonathan Pellish, NASA
- ▶ Spacecraft Charging
  - ▶ Henry Garrett, JPL
- ▶ Orbital Debris and Meteoroid Environments
  - ▶ Mark Matney, NASA

# Radiation

- ▶ 21 papers
  - ▶ 12 modeling
  - ▶ 4 testing
  - ▶ 3 observations
  - ▶ 2 commercial

## Examples:

- ▶ The AE9/AP9 Radiation and Plasma Environment Models – Paul O'Brien
- ▶ Applied Atmospheric, Ionospheric, and Radiation Tools Specify Space Environment Effects for End-user Systems – W. Kent Tobiska
- ▶ New Approach to Total Dose Specification for Spacecraft Electronics – Mike Xapsos

# Space Weather and Plasma

- ▶ 18 papers
  - ▶ 13 modeling
  - ▶ 4 testing
  - ▶ 3 observations
  - ▶ 2 commercial

## Examples:

- ▶ An All-Clear Space Weather Forecasting System Based on Near Real Time Magnetograms – David Falconer
- ▶ Solar Wind Models of Multi-Scale Fluid-kinetic Simulation Suite (MS-FLUKSS) – Tae Kim
- ▶ Magnetic Flux Ropes in the Sun-Earth Environment – Qiang Hu

# MOD

- ▶ 6 papers
  - ▶ 2 modeling
  - ▶ 3 observations
  - ▶ 1 commercial

## Examples:

- ▶ A Status Update on the Southern Argentina Agile Meteor Radar (SAAMER) – Diego Janches
- ▶ Commercially Responsive Precise Tracking of Satellites and Debris in Low-Earth Orbit – Michael Nicolls
- ▶ Optical Orbital Debris Spotter – Christoph Englert

# Future Plans

- ▶ Presentations on-line: <http://sti.usra.edu/asec2017/>
- ▶ Extended abstracts will be published as NASA Technical Memorandum. Anticipated release date in the summer of 2018.

**Next ASEC in 2019 in Pasadena, CA**

# SEESAW Overview

## Space Environment Engineering and Science Applications Workshop

- ▶ Goal: Bring people together and capture needs in road maps
- ▶ Organizing committee: Paul O'Brien, Justin Likar, Mike Xapsos, Eamonn Daly, Veronique Ferlet-Cavrois, Bob Johnston, Janet Barth, and Robert Reed
- ▶ Sponsored by IEEE and NSF
- ▶ Held at NOAA in Boulder 5-8 September 2017
- ▶ Attended by ~70 US & European engineers, scientists, government reps across space environment engineering, science, and effects stakeholders

## Organized by topics:

- ▶ Surface Charging
- ▶ Internal Charging
- ▶ Single Event Effects
- ▶ Total Dose and Displacement Damage
- ▶ Forecast / Nowcast
- ▶ Special Topics

# Charging

## Surface Charging

- ▶ Need an updated community database of materials properties
- ▶ Better / more current statistics on intensity, magnitude, and duration
- ▶ Need studies of charging on more recent vehicles
- ▶ Need a relatively simple metric/indicator for surface charging (e.g., >10 keV electron flux or electron temperature)

## Internal Charging

- ▶ Quick-look tools needs:
- ▶ MEO/LEO specifications need improvement
- ▶ New test procedures for materials
- ▶ Database of material properties w/ temperature coefficients & evolution on orbit
- ▶ Anomaly Database

## Misc

- ▶ Forecast/Nowcast needs for satellite operations, launch, and human spaceflight
- ▶ Aviation overview (Alex Hands)

# Radiation Effects

## Single Event Effects

- ▶ Parts uncertainty is bigger issue than environment uncertainty (also applies to dose)
- ▶ Better calculation tools, esp. w/ training and documentation
- ▶ Quick look need: what is the flux inside the magnetic field (apply cutoffs in real time)
- ▶ Need better trapped protons
- ▶ Improved testing standards

## Total Dose and Displacement Damage

- ▶ Use Xapsos method, published in IEEE/TNS, to combine part & environment uncertainty
- ▶ Dose/damage in thin films - need better & benchmarked tools, models, test facilities, and procedures
- ▶ GREEN (global radiation) model will be implemented in OMERE
- ▶ Design/effects tools – bigger uncertainties than environment
- ▶ Need studies closing the loop between pre-flight prediction & in flight performance

# Future Plans

- ▶ We plan to complete road maps in April, 2018
- ▶ Our goal is to publish a full road map as a NASA Technical Report
- ▶ Summaries will be submitted to Space Weather and to IEEE/NPSS
- ▶ For more information contact Paul O'Brien, [paul.obrien@aero.org](mailto:paul.obrien@aero.org)
- ▶ Briefings are posted on-line,  
<https://cpaess.ucar.edu/meetings/2017/seesaw-presentations>
- ▶ Next SEESAW conference: Toulouse, France late 2018 or early 2019