



Space Power Workshop

April 26–29, 2022
Virtual Event



Day 1, Tuesday, April 26:

Note: all times are Pacific Daylight Time (UTC-7)

8:00 *Introduction & Housekeeping Remarks*

8:05 *Welcome Address*

Dr. Wayne Goodman, Executive Vice President
The Aerospace Corporation

Keynote Speaker:

8:10 *Power for Space Exploration*

Dr. Lindsay Millard, Principal Director for Space
Office of the Under Secretary of Defense for Research and Engineering

Plenary Session Speaker:

8:35 *Powering Mars Exploration*

Hoppy Price, Chief Engineer, Mars Exploration Program
NASA/Jet Propulsion Laboratory

Power Systems Architecture:

9:00 *NASA's Technology Goals for Lunar Surface Power*

John Scott, NASA Johnson Space Center

9:20 *Assessment of Analog Electronics for Lunar Power Hibernation*

Richard Oeftering, NASA Glenn Research Center

9:40 *A Modular, High-Power, Radiation-Hardened, DC-DC Converter with Decentralized Control*

Anton Quiroz, Apogee Semiconductor & Alex Hanson, University of Texas at Austin

10:00 *Atomic Planar Power for Lightweight Exploration*

E. Joseph Nemanick, The Aerospace Corporation

10:20 Break

Power Management and Distribution (PMAD) - Power System Design and Analytical Techniques:

10:30 *Aerospace's Experience with GaN Power*

Christopher Le, The Aerospace Corporation



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10:50 *Verify End-of-Life Reliability and Performance of Hybrid DC-DC Converters for Space PMAD*
Chris Hart, IR HiRel, an Infineon Technologies Company

11:10 *Crossing the Death Valley of Technology Development*
Dong Tan, Northrop Grumman

11:30 *Improve Satellite System Efficiency with Super-Junction Rad Hard FETs*
Oscar Mansilla, IR HiRel, an Infineon Technologies Company

11:50 *PMAD Workshop*

12:50 Lunch

Advanced Concepts:

1:20 *Regenerative Fuel Cell Systems for Lunar Surface Applications*
Jessica Cashman, NASA Glenn Research Center

1:40 *Demonstrating the Thermoradiative Diode: Generating Electrical Power Through Radiative Emission*
Ned Ekins-Daukes, UNSW Sydney

2:00 *Cell Self-Discharge Monitor for Li-Ion Batteries during Operation using Machine Learning*
Albert Zimmerman, The Aerospace Corporation

2:20 *3 MeV Proton Irradiation Study of Ultra-Thin GaAs Solar Cells*
Larkin Sayre, University of Cambridge

2:40 *Conclusion of Day 1*



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Day 2, Wednesday, April 27:

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8:00 *Introduction & Housekeeping Remarks*

Plenary Session Speaker:

8:05 *Caltech Space Solar Power Project*

Dr. Harry Atwater, Professor and Chair, Engineering and Applied Science Division
California Institute of Technology

Energy Generation I – Multijunction Solar Cells:

8:30 *Production and Development Status of Spectrolab 3J and 4J Space Cells*

Mitchell Bennett, Spectrolab, Inc.

8:50 *AZUR SPACE Enabling Technologies for Space Applications - 3G, 4G and Beyond*

Torsten Torunski, AZUR SPACE Solar Power GmbH

9:10 *Qualification, Production, and Program Status of SolAero's Inverted Metamorphic and Upright Ge Solar Cells*

John Hart, SolAero Technologies Corporation

9:30 *Multi-Junction Thin Film Photovoltaics for Space Power Generation*

Randy Ellingson, The University of Toledo

9:50 **Break**

Energy Generation II – Modules and Arrays Designs:

10:00 *Novel Integration of PVA String Blocking Function*

Emanuele Ferrando, SpaceTech GmbH

10:20 *Space Power Modules: Flex Arrays*

Phil Luc, Spectrolab, Inc.

10:40 *Sparkwing: Small Sat Solar Arrays from a Catalogue*

Jos de Hoog, Airbus Defence & Space Netherlands

11:00 *Deployable Solar Array Developments at Opterus*

Thomas Murphey, Opterus Research and Development, Inc.



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11:20 *Energy Generation Workshop*

12:20 Lunch

Energy Generation III – Reliability and Characterization:

12:50 *Large-Area, Solar Panel Testing Using LED Solar Simulation for 3J, 4J, 5J and 6J Cell Technologies*
Casey Hare, Angstrom Designs

1:10 *DragonSCALES - Space Grade Si Solar Cells & Modules Qualification and Production Status*
Murat Okandan, mPower Technology

1:30 *High Altitude Flight Results using Selenium, A PV Measurement Ecosystem*
Don Walker, The Aerospace Corporation

1:50 *Repeatability and Performance of Commercial, High-Altitude, Balloon Flights for Solar Cell Calibration*
Scott Ireton, Angstrom Designs

2:10 *Conclusion of Day 2*

Day 3, Thursday, April 28:

Note: all times are Pacific Daylight Time (UTC-7)

8:00 *Introduction & Housekeeping Remarks*

Plenary Session Speaker:

8:05 *Rechargeable Lithium Metal Batteries – Possible for - 80C?*
Y. Shirley Meng, Ph.D., Laboratory for Energy Storage & Conversion, Pritzker School of Engineering, University of Chicago, Argonne Collaborative Center for Energy Storage Science (ACCESS)

Energy Storage I – Space Battery Level Topics:

8:30 *The Use of COTS Lithium-ion Batteries for NASA JPL Missions*
Marshall Smart, Jet Propulsion Laboratory, California Institute of Technology

8:50 *Battery Development for CADRE, NASA's Shoebox-Sized Lunar Rovers*
John-Paul Jones, Jet Propulsion Laboratory, California Institute of Technology



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9:10 *Design and Qualification of Family of Space COTS Batteries*

Rob Gitzendanner, EaglePicher Technologies

9:30 *Lithium Ion Cells Capable of Zero-Volt Storage and Recovery from Dead Bus Events*

Christopher Schauerma, Celtec Technologies, Inc.

9:50 Break

Energy Storage II – Cell Level Developments for Energy Storage:

10:00 *Development of High Specific Energy Li/CFx Primary Battery Cells for Deep Space Missions*

Erik Brandon, Jet Propulsion Laboratory, California Institute of Technology

10:20 *Qualification of the LSE12x -- New 12Ah Size Cell from GS Yuasa*

Thomas Pusateri, GS Yuasa Lithium Power

10:40 *Next Generation Lithium-Ion Cell Development and In-Orbit Performance*

Joe Troutman, EnerSys

11:00 *Update of Saft Gen 6 Cell and Batteries Status*

Chengsong Ma, Saft

11:20 *Energy Storage Workshop*

12:20 Lunch

Energy Storage III – Advanced Energy Storage Topics:

12:50 *Leveraging Machine Learning to Accurately Predict Si-Anode Performance*

Benjamin Park, Enevate Corporation

1:10 *Enabling Electric Aviation Applications with High Energy Density Silicon-Based Lithium-Ion Batteries*

Michael Sinkula, Zenlabs Energy, Inc.

1:30 *Advancing the Electrification of Space Travel & Exploration with Lithium-Silicon Battery Technologies*

Rick Costantino, Group14 Technologies

1:50 *High Energy Density Lithium-Ion Cells with Improved Rate Capability by Spatial Patterning*

Roberta Benedict, Celtec Technologies



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2:10 Conclusion of Day 3

Day 4, Friday, April 29:

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8:00 Introduction & Housekeeping Remarks

SPW Lightning Talks 1:

8:05 *Ultralight Low-Cost GaAs and InP Cells*

Phillip Jahelka, California Institute of Technology

8:13 *GaN in Space*

Sean Morrison, EPC Space

8:21 *How Silicon Technology May Modify the Current Solar Array Game?*

Romain Cariou, CEA-LITEN

8:29 *Establishing Procedures for Measuring Thermal Annealing Recovery in Irradiated III-V Multijunction Solar Cells*

Jann Grovogui, The Aerospace Corporation

8:37 *Update on ROSA (Roll-Out Solar Array) Achievements*

Matt LaPointe, Redwire Space Systems

8:45 *Towards Lower Cost Space Solar Cells*

Kristof Dessen, Umicore

8:53 *Development of the ISS Lithium Ion Battery*

Erich Soendker, Aerojet Rocketdyne

9:01 *Development of Graphene Batteries for Use in Space Applications*

Elena Bekyarova - Carbon Solutions, Inc.

9:09 Break



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SPW Lightning Talks 2:

9:50 *Transporting Batteries: Considerations for SOC, Cell Types, and Test Methods*

Tapesh Joshi, Underwriters Laboratories, Inc.

9:58 *Lithium Ion Battery for DeOrbiting*

E. Joseph Nemanick, The Aerospace Corporation

10:06 *Comparison of “Natural” Li Diffusion Behavior into Different Materials: TiO₂/Si(111), TiO₂, SrTiO₂*

Jozef Ociepa, OCI Vacuum Microengineering, Inc.

10:14 *Radiation-hard Low Turn-on Voltage Diode Tailorable for Ease of Integration in Space Power Applications*

R.D. Vispute, Blue Wave Semiconductors

10:22 *Power Conditioning Unit for GEO Satellites*

Wei Lu, Tianjin Institute of Power Sources

10:30 *Conclusion of Day 4*