

**MONDAY, AUGUST 8**

# Session 1

## **MISSION PAYLOADS AND THEIR APPLICATIONS**

Advanced, cutting edge mission sensors (not bus sensors) designed specifically with small satellite missions in mind.

Chair: Bruce Yost, NASA/ARC Small Spacecraft Division

**3:00 P.M.**

The BRITE Constellation Space Telescope—Design and Test of a Wide Field, High Resolution, Low Noise Optical Telescope for a Nanosatellite Constellation  
Jake Cheng, Jakob Lifshits, Cordell Grant, Mihail Barbu, Robert Zee—Space Flight Laboratory/University of Toronto

**3:15 P.M.**

The COVE Payload—A Reconfigurable FPGA-Based Processor for CubeSats  
Dmitriy Bekker, Paula Pingree, Thomas Werne, Thor Wilson, Brian Franklin—Jet Propulsion Laboratory

**3:30 P.M.**

Microscope: A Microsatellite for Equivalence Principle Measurement in Space  
Valerio Cipolla, Jean-Bernard Dubois, Benjamin Poulloux, Pascal Prieur—CNES

**3:45 P.M.**

Compact Hyperspectrals

Luca Maresi, Semen Grabarnik, Matteo Taccola—European Space Agency (ESA); Vincent Moreau, Coralie De Clercq—AMOS; Bavo Delauré, Stephanie Delalieux, Els Knaeps, Wouter Dierckx—VITO; Cees Coolen, Mathieu Breukers—VDL ETG; Lieve De Vos—OIP NV

**4:00 P.M.**

Enabling Low-cost, High Accuracy Magnetic Field Measurements on Small Sats for Space Weather Missions

Odile Clavier, Theodore Beach, Brynmar Davis, Ariane Chepko—Creare Inc.; James Cutler—University of Michigan

**4:15 P.M.**

Compact Half-Unit Imaging Electron Spectrometer for CubeSat Operations (CHICO)

Joshua Méndez—Boston University; David Voss—Air Force Research Laboratory; Francisco Suárez, Theodore Fritz—Boston University; Doug Carssow—Naval Research Laboratory; Avi Gunda—Boston University

**\* ALTERNATES \***

Small SAR Satellite using Small Standard Bus

Kiyonobu Ono, Takashi Fujimura, Toshiaki Ogawa, Tsunekazu Kimura—NEC Corporation

Remote Sensing using GPS Signals—The SGR-RESI Instrument

M. Unwin, R. de Vos Van Steenwijk, Alex Da Silva Curiel, M. Cutter, Brent Abbott—Surrey Satellite Technology Ltd.; C. Gommenginger—National Oceanographic Centre; C. Mitchell—University of Bath; S. Gao—Surrey Space Centre

**MONDAY, AUGUST 8**

# Session II

**FROM 0 TO 7.5 KM/S**

Launch systems or launch opportunities that are specifically designed to provide access to space for small satellites.

Chair: Gerry Webb, Commercial Space Technologies Limited

**4:45 P.M.**

Multi-Payload Integration Lessons Learned from Space Test Program Mission S26  
Dana Rand, Capt Rachel Derbis, Capt Austin Eickman, Capt Robert Wilcox—SMC Space Development & Test Wing, DoD Space Test Program; Joseph Bartsch, Maria Elena Foster—Jackson & Tull; Sabrina Herrin—The Aerospace Corporation

**5:00 P.M.**

ELaNa—Educational Launch of Nanosatellite: Enhance Education through Space Flight  
Garrett Skrobot—NASA

**5:15 P.M.**

An Advanced Standard for Cubesats  
Ryan Hevner, Walter Holemans—Planetary Systems Corporation; Jordi Puig-Suari—California Polytechnic State University; Robert Twiggs—Morehead State University

**5:30 P.M.**

SpaceX—Continuing to Drive Launch Costs Down and Launch Opportunities Up for the Small Sat Community  
Lauren Dreyer, Brian Bjelde, Dustin Doud, Kimberly Lord—SpaceX

**5:45 P.M.**

ALSET—Air Launch System Enabling Technology R&D Program  
Takashi Arime, Masanori Sugimine, Seiji Matsuda, Jun Yokote—IHI Aerospace Co., Ltd.; Takayoshi Fuji, Kenji Sasaki—Institute for Unmanned Space Experiment Free Flyer; Dominic DePasquale—SpaceWorks Commercial; Hideki Kanayama, Mitsuteru Kaneoka—CSP Japan Inc.

**6:00 P.M.**

Recent CubeSat Launch Experiences on U.S. Launch Vehicles  
Jordi Puig-Suari, Roland Coelho—California Polytechnic State University; Scott Williams, Victor Aguero, Kyle Leveque, Bryan Klofas—SRI International

## **\* ALTERNATES \***

CubeStack Wafer Adapter for CubeSats on Small Launch Vehicles

Gregory Sanford, Kenneth Brunetto—LoadPath LLC; Joseph Maly, James Goodding—Moog CSA Engineering; Hans-Peter Dumm—Air Force Research Laboratory/RVSV

Ticket to Space—How to Get your Small Satellite from the Cleanroom to Orbit

Jason Andrews—Spaceflight Services; Abe Bonnema—ISL—Innovative Space Logistics BV

**TUESDAY, AUGUST 9**

# Session



## REFLECTIONS ON THE PAST

Reports on the successes or failures of small satellite missions that have been flown over the last 18 months with an emphasis on lessons learned.

Chair: Debra Facktor Lepore, DFL Space LLC

**8:00 A.M.**

25 Years of Small Satellites  
Siegfried Janson—The Aerospace Corporation

**8:30 A.M.**

One Year of In-Flight Results from the Prisma Formation Flying Demonstration Mission  
Nils Pokrupa, Niklas Ahlgren, Thomas Karlsson, Per Bodin, Robin Larsson—OHB Sweden

**8:45 A.M.**

Initial On-Orbit Engineering Results from the O/OREOS Nanosatellite  
Christopher Kitts, Mike Rasay, Laura Bica, Ignacio Mas, Michael Neumann, Anthony Young—Santa Clara University; Giovanni Minelli, Antonio Ricco, Eric Stackpole, Elwood Agasid, Christopher Beasley, Charlie Fredericks—NASA Ames Research Center

**9:00 A.M.**

The FASTRAC Mission: Operations Summary and Preliminary Experiment Results  
Sebastián Muñoz, Jamin Greenbaum, Glenn Lightsey—The University of Texas at Austin; Thomas Campbell, Shaun Stewart, Greg Holt—NASA Johnson Space Center Amateur Radio Club

**9:15 A.M.**

The First US Army Satellite in Fifty Years: SMDC-ONE First Flight Results  
John London, Mark Ray, David Weeks, Brent Marley—United States Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT)

**\* ALTERNATES \***

AISSat-1 Early Results  
Bjorn Narheim, Oystein Hellenen, Oystein Olsen, Richard Olsen—Norwegian Defence Research Establishment; Harald Rosshaug—Kongsberg Saetex AS; Alexander Beattie, Daniel Kekez, Robert Zee—Space Flight Laboratory/University of Toronto

STP-SIV: Lessons Learned through the First Two Standard Interface Vehicles  
Michael Pierce, David Kaufman—Ball Aerospace & Technologies Corp.; Kenneth Reese—SMC Space Development & Test Wing, DoD Space Test Program

Mayflower: Next Generation CubeSat Flight Testbed  
Talbot Jaeger—Northrop Grumman NovaWorks; Michael Clifone, Eric Anden—Northrop Grumman Advanced Concepts RRS

**TUESDAY, AUGUST 9**

# Session

# IV

## ON THE HORIZON

A preview of missions that are scheduled to fly within the next 5 years with an emphasis on the mission and its scientific, technological or military purpose.

Chair: Reyhan Baktur, Utah State University

**11:15 A.M.**

Distant Horizons: Smallsat Evolution in the Mid-to-Far Term

Matt Bille, Paul Kolodziejewski, Tom Hunsaker—Booz Allen Hamilton

**11:30 A.M.**

The ISS as a Launch Platform for Phenomena of Interest

Phillip Anderson, Bryan Bingham—Space Dynamics Laboratory; Charles Swenson—Utah State University; Chad Fish—Space Dynamics Laboratory; Joshua Martineau—Utah State University

**11:45 A.M.**

AsteroidFinder: A Small Satellite to Characterize the IEO Population

Jakob Fromm Pedersen, Olaf Eßmann, Ross Findlay, Hartmut Müller —DLR Institute of Space Systems; Harald Hoffmann, Gabriele Messina, Stefano Mottola—DLR Institute of Planetary Research

**12:00 P.M.**

Advanced EO System for the Japanese Small Satellite ASNARO

Shuhei Hikosaka, Tetsuo Fukunaga—PASCO Corporation; Toshiaki Ogawa—NEC Corporation; Shoichiro Mihara—Institute for Unmanned Space Experiment Free Flyer (USEF)

**12:15 P.M.**

NanoSat/MicroSat Constellations and the Next Generation Unmanned Systems Strategy

Frederick Kuhnert, Arthur Garrison—Northrop Grumman Systems Corporation

**12:30 P.M.**

Iridium NEXT SensorPODs: Global Access for Your Scientific Payloads

Om Gupta—Iridium Communications Inc.

**12:45 P.M.**

CubeSat Investigating Atmospheric Density Response to Extreme Driving (CADRE)

James Cutler, Aaron Ridley—University of Michigan; Andrew Nicholas—Naval Research Laboratory

**\* ALTERNATE \***

The Antarctic Broadband Demonstration Nanosatellite: Fast Internet for the Bottom of the Earth

Grant Bonin, Robert Zee—Space Flight Laboratory/University of Toronto; Michael Brett, Jan King—Aerospace Concepts Pty Ltd

**TUESDAY AUGUST 9**  
**SESSION V: PANEL DISCUSSION**

Moderator: Bob Meurer, Conference Technical Chair



**2:45 P.M.**

The Conference will conduct a panel/roundtable on the technology needs (pull) of the small satellite sector in the coming decade. Specific emphasis will be placed on both bus and payload related technologies that are enabling of missions across a broad spectrum of uses, i.e., game-changing. Panelists will be asked to emphasize technologies that provide a quantum improvement in the performance to cost trade-off and especially those that are achievable in the near term (<5 years). The panel will be interactive with the audience so as to permit joint discussion of the best means by which to pursue R&D, technology insertion, operational experimentation, and other opportunities to develop these game-changing technologies.

This year's panel will be interactive, with real-time audience participation.

**PANEL MEMBERS**

- ★ Mr. John Hines—Center Chief Technologist, NASA Ames Research Center
- ★ Sir Martin Sweeting—Founder & Executive Chairman, Surrey Satellite Technology Ltd.
- ★ Dr. Peter Wegner—Director, Operationally Responsive Space Office

**TUESDAY, AUGUST 9**

# Session VI

## **SMALL BUT MIGHTY**

A session dedicated to CubeSat/NanoSat innovations and concepts that enable future missions.

Chair: Sam Myers Sims, The Aerospace Corporation/Space Test Program

**4:30 P.M.**

**NanoSail-D: The Small Satellite That Could!**

Dean Alhorn, Joe Casas—NASA Marshall Space Flight Center; Elwood Agasid—NASA Ames Research Center; Charles Adams—Gray Research, Inc.; Greg Laue—NeXolve Corporation; Christopher Kitts—Santa Clara University; Sue O'Brien—University of Alabama Huntsville

**4:45 P.M.**

**Pre-launch Optical Characterization of the Oculus-ASR Nanosatellite for Attitude and Shape Recognition Experiments**

Lyon King, Philip Hohnstadt—Michigan Technological University; Kelly Feirstine—Schafer Corporation

**5:00 P.M.**

**Attack of the CubeSats: A Statistical Look**

Michael Swartwout—Saint Louis University

**5:15 P.M.**

**Distributed EPS in a CubeSat Application**

Robert Burt—Space Dynamics Laboratory

**5:30 P.M.**

**Initial Flight Assessment of the Radio Aurora Explorer**

James Cutler, John Springmann, Sara Spangelo—University of Michigan; Hasan Bahcivan—SRI International

**5:45 P.M.**

**Ho'oponopono: A Radar Calibration CubeSat**

Larry Martin, Nicholas Fisher, Windell Jones, John Furumo, James Ah Heong, Monica Umeda, Wayne Shiroma—University of Hawaii

**6:00 P.M.**

**Enabling Collaborative Behaviors among CubeSats**

Daniel Browne, Michael West—Georgia Tech Research Institute

### **\* ALTERNATES \***

**Emergency Locator Signal Detection and Geolocation Small Satellite Constellation Feasibility Study**

Adam Gunderson, Celena Byers, David Klumpar—Montana State University

**Evaluation of Solar Array Peak Power Tracking Technologies for CubeSats**

Daniel Erb, Samir Rawashdeh, James Lump—University of Kentucky

**An Off-the-shelf Electric Propulsion System for CubeSats**

Craig Clark—Clyde Space Ltd; Francesco Guarducci, Michele Coletti—Mars Space Ltd; Stephen Gabriel—University of Southampton

**WEDNESDAY, AUGUST 10**

# Session

**VIII**

## **SPACECRAFT SYSTEMS AND STANDARDS**

A session looking at the emerging spacecraft systems engineering of small satellites and their developing standards.

Chair: Jason Cavett, The SI Organization Inc.

**8:00 A.M.**

Can Small Do What Big Does—Only Better? (An Update)

Jan King—Southern Cross Space & Communications Pty Ltd

**8:15 A.M.**

An Evaluation of CubeSat Orbital Decay

Daniel Oltrogge—Analytical Graphics, Inc.; Kyle Leveque—SRI, Inc.

**8:30 A.M.**

HOW ORS—Modular Space Vehicle on the T2E Mission

Charles Finley—Operationally Responsive Space Office; Kimberly Richards, Jose Cabanillas, Denny Gudea, Phil Katz, Sarah Ray—Northrop Grumman Aerospace Systems; George Moretti—Millennium Engineering and Integration; Demosthenes Tsairides—NASA Ames Research Center

**8:45 A.M.**

Epicycle Parameter Filter for Long Term Orbital Parameter Estimation

P. Palmer, S. Gilani—University of Surrey

**9:00 A.M.**

Small Rocket/Spacecraft Technology (SMART) Platform

Jaime Esper, Thomas Flatley, James Bull—NASA Goddard Space Flight Center

**9:15 A.M.**

Rapid Build and Space Qualification of CubeSats

Joshua Debes, Nathan Howard, Ryan Harrington, Richard Cobb, Jonathan Black—Air Force Institute of Technology

**\* ALTERNATE \***

Optimization of Fuel Consumption with Respect to Orbital Requirements for High Resolution Remote Sensing Satellite Constellations

Drago Matko, Tomaž Rodic, Kristof Oštir, Aleš Marsetić, Marko Peljhan, Sašo Blažič, Gregor Klancar, Gašper Mušič—Space-SI

WEDNESDAY, AUGUST 10

VIII

# Session

## FRANK J. REDD STUDENT SCHOLARSHIP COMPETITION

Technical Chair: Stanley Kennedy, Comtech AeroAstro, Inc.  
Scholarship Co-Chairs: Gwynne Shotwell and Lauren Dreyer,  
Space Exploration Technologies

**10:15 A.M.**

Analysis of the Performance Characteristics of a Gossamer Sail for Nanosatellite Applications

Kevin Schillo, Christopher Valle—University of Central Florida

**10:30 A.M.**

Development of a Drift-Free Stellar Gyroscope

Samir Rawashdeh—University of Kentucky

**10:45 A.M.**

CubeSat Attitude Determination via Kalman Filtering of Magnetometer and Solar Cell Data

Erik Babcock—University of Illinois

**11:00 A.M.**

Attitude-Independent Magnetometer Calibration with Time-Varying Bias

John Springmann—University of Michigan

**11:15 A.M.**

Optically Transparent Multifunctional Patch Antennas Integrated with Solar Cells for Small Satellites

Tursunjan Yasin—Utah State University

**11:30 A.M.**

A Passive High Altitude Deorbiting Strategy

Charlotte Lücking—University of Strathclyde

### ★ COMPETITION JUDGES ★

**Academia:** Rudy Panholzer, Naval Postgraduate School

**At Large:** John Egan, Advanced Systems and Technology Directorate, National Reconnaissance Office

**Department of Defense:** Bryan Dorland, United States Naval Observatory

**Industry:** Brent Abbott, Surrey Satellite Technology

**International:** Robert Zee, Space Flight Laboratory/University of Toronto

**NASA:** Hannah Goldberg, NASA Jet Propulsion Laboratory



**AWARDS WILL BE  
PRESENTED**

**3:45 P.M.**

**TODAY**



**WEDNESDAY, AUGUST 10**

# Session IX

## **MISSION ENABLING TECHNOLOGIES I**

Innovative technologies (hardware or software) that offer disruptive or cross-cutting capabilities for the next generation of small spacecraft missions.

Chair: Christian Lenz, Broad Reach Engineering

**2:30 P.M.**

InSAR Microsatellite Constellations Enabled by Formation Flying and Onboard Processing Capabilities

Erica Peterson, Robert Zee—Space Flight Laboratory/University of Toronto; Georgia Fotopoulos—University of Texas at Dallas

**2:45 P.M.**

In-Space Demonstration of High Performance Green Propulsion and its Impact on Small Satellites

Kjell Anflo, Ben Crowe—ECAPS AB Sweden

**3:00 P.M.**

Development of a Comprehensive Mission Operations System Designed to Operate Multiple Small Satellites

Trevor Sorensen, Eric Pilger, Mark Wood, Miguel Nunes—Hawaii Space Flight Laboratory; Bruce Yost—NASA Ames Research Center

**3:15 P.M.**

Development of the Pico Star Tracker ST-200—Design Challenges and Road Ahead

Tom Segert—Berlin Space Technologies GmbH; Steven Engelen—Delft University of Technology; Matthias Buhl—Berlin Space Technologies GmbH; Bert Manna—SYSPA B.V.

**3:30 P.M.**

Rapid Development of Electronic Systems for Space Applications

Brett McMickell, Thom Kreider, Lindsay Harding, Ron Strong—Honeywell Engineering and Technology; Kosta Ilic, Brad Mouring—National Instruments

**\* ALTERNATE \***

Radiation Hardened by Design 8 bit RISC with Dual I2C Bus Support and SPI for External NVM Support

Sasan Ardalan, Donald Elkins, Will Burke—Micro-RDC; Richard Marquez—Air Force Research Laboratory

**THURSDAY AUGUST 11**  
**SESSION X: MISSION**  
**ENABLING TECHNOLOGIES II**

Innovative technologies (hardware or software) that offer disruptive or cross-cutting capabilities for the next generation of small spacecraft missions.

Chair: Paul Jaffe, Naval Research Laboratory

**8:00 A.M.**

COTS Detectors for Nanosatellite Star Trackers: A Case Study  
John Enright, Christy Fernando—Ryerson University; Doug Sinclair—Sinclair Interplanetary

**8:15 A.M.**

MEMS Micropropulsion Components for Small Spacecraft  
Pelle Rangsten, Håkan Johansson, Maria Bendixen, Kerstin Jonsson, Johan Bejhed, Tor-Arne Grönland—NanoSpace AB

**8:30 A.M.**

Nanosat Deorbit and Recovery System to Enable New Missions  
Jason Andrews, Krissa Watry, Kevin Brown—Andrews Space, Inc.

**8:45 A.M.**

Hydrazine Propulsion Module for CubeSats  
Derek Schmuland, Robert Masse, Charles Sota—Aerojet

**9:00 A.M.**

Isothermal Structural Panels for Spacecraft Thermal Management  
Scott Schick, Blake Rusch, Clair Batty—Thermal Management Technologies

**9:15 A.M.**

Arc-Minute Attitude Stability on a Nanosatellite: Enabling Stellar Photometry on the Smallest Scale  
Bryan Johnston-Lemke, Karan Sarda, C. Grant, Robert Zee—Space Flight Laboratory/University of Toronto

**9:30 A.M.**

Development of a NASA 6-U Satellite  
Linda Thompson—NASA

**\* ALTERNATE \***

NASA GSFC Development of the SpaceCube Mini  
Michael Lin, Tom Flatley, Alessandro Geist, Dave Petrick—NASA Goddard Space Flight Center

**THURSDAY, AUGUST 11**

# Session **XI**

## **COMMUNICATIONS**

Emerging technologies or techniques for the timeless challenge of communicating with small satellites where power comes at a premium and real estate for antennas is sparse.

Chair: Brian Lewis, NASA

**10:30 A.M.**

Multi-functional Miniaturised Slot Antenna System for Small-satellites

Jose Padilla—JAST SA; Gabriele Rosati, Anton Ivanov—Ecole Polytechnique Fédérale de Lausanne (EPFL); Frédéric Bongard, Stefano Vaccaro—JAST SA; Juan Mosig—Ecole Polytechnique Fédérale de Lausanne (EPFL)

**10:45 A.M.**

FPGA-based Coherent MSK Spread Spectrum Modem for Small Satellites  
TT&C Transponders

Ahmed Maghawry—National Authority for Remote Sensing & Space Sciences (NARSS); Magdi Fikri—Cairo University

**11:00 A.M.**

Characterization of Two Types of Conformal Antennas for CubeSats

Jesús Arellano, Mangalam Chandak, Maryam Jamali, Reyhan Baktur—Utah State University; Robert Burt—Space Dynamics Laboratory

**11:15 A.M.**

Reconfigurable, Radiation Tolerant S-Band Transponder for Small Satellite  
Applications

Christopher Sauer, Jennifer Alvarez, John Dickinson, Michael Epperly, Meredith Lecoche—Southwest Research Institute

**\* ALTERNATE \***

GNSS Receive Antennas on Satellites for Precision Orbit Determination

Jan Zackrisson, Mikael Ohgren—RUAG Space AB



**Win Prizes**  
while visiting exhibitors!

**THURSDAY, AUGUST 11**

# Session XII

## **THE NEXT GENERATION**

Recent and planned educational small satellite programs that train a new generation of engineers while benefiting the small satellite community.

Chair: David Richie, United States Air Force

**12:30 P.M.**

Real Science, Real Education: The University Nanosat Program

David Voss—Air Force Research Labs; Jared Clements—ATA Aerospace; Kelly Cole, Melody Ford, Chris Handy—Air Force Research Labs; Abbie Stovall—Air Force Institute of Technology

**12:45 P.M.**

RockOn and RockSat: A NASA and COSGC Collaboration to Train Tomorrow's Engineers

Chris Koehler, Shawn Carroll, Emily Logan—Colorado Space Grant Consortium

**1:00 P.M.**

Characterization and Analysis for Flying COTS Electronics On-Orbit

Jason Niederhauser, Jonathan Black, Carl Hartsfield—Air Force Institute of Technology

**1:15 P.M.**

The ExoplanetSat Mission to Detect Transiting Exoplanets with a CubeSat Space Telescope

Matthew Smith, Sara Seager, Christopher Pong, Matthew Knutson, David Miller—Massachusetts Institute of Technology; Timothy Henderson, Sungyung Lim, Tye Brady, Michael Matranga, Shawn Murphy—Draper Laboratory

**1:30 P.M.**

PEZ: Expanding CubeSat Capabilities through Innovative Mechanism Design

Tyler Murphy, Jon Kanaber, Christopher Koehler—University of Colorado at Boulder

**1:45 P.M.**

Dynamic Ionosphere Cubesat Experiment (DICE)

Geoff Crowley—Atmospheric & Space Technology Research Associates (ASTRA) LLC; Chad Fish, Charles Swenson, Robert Burt, Eric Stromberg, Tim Neilsen, Steve Burr—Space Dynamics Laboratory; Aroh Barjatya—Embry-Riddle Aeronautical University; Gary Bust—Atmospheric & Space Technology Research Associates (ASTRA) LLC; Miguel Larsen—Clemson University

### **\* ALTERNATES \***

Aeneas—Colony I Meets Three Axis Pointing

Michael Aherne, Tim Barrett, Lucy Hoag, Eric Teegarden, Rohan Ramadas—Space Engineering Research Center

CubeSat Components: A Collection of Ideas from AFRL Space & Phillips Scholars

Keith Avery, Sylvia Reiser, Eric Murray, Matthew Robertson, Deryk Harder—Air Force Research Laboratory

Lessons from 5 Years of Space Plug & Play Avionics (SPA) Device Development with High School Students

Paul Jaffe, Sean Lynch, Jolyon Zook—Naval Research Laboratory