

**Room Check-In at the Beaver Run  
Resort Front Desk 4 PM daily**

**Conference Registration  
Daily 6:30 to 10 AM and  
4 to 6 PM**

**WIRELESS ACCESS Conference Area  
via: GlobalMeetingWireless**

**Location: Peak 5  
Group/Company Name: AAS2014  
Passcode: beaver**

**AAS / Rocky Mountain  
Section Website:  
<http://aas-rocky-mountain-section.org/>**

**Registration Questions During  
the Conference contact:**

**Carolyn O'Brien 720-277-5851  
Lis Garratt 303-931-7622**

**ALL PAPERS LOCATED AT**

**<https://drive.google.com>**

**Login: [aasgnc2014@gmail.com](mailto:aasgnc2014@gmail.com)**

**Password: AAS2014Breck**

**Friday, January 31, 2014**

Classified Session 7 AM – 3 PM  
Conference Registration 4 – 6 PM  
Wine and Cheese Reception 6 – 9:30PM  
(*Mountain Overview Talk at 7:30 PM*)

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**Saturday, February 1 2014**

Sessions: 7–10:30 AM  
Astronaut Talk for Children: 4 – 5 PM  
Technical Exhibits: 5 – 8 PM

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**Sunday, February 2, 2014**

Sessions: 7–10 AM & 2 – 4 PM  
Analytical Graphics presents: Spacecraft  
Simulation in STK 10:30 AM–1:30 PM

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**Monday, February 3, 2014**

Sessions: 7–10 AM & 4 – 6 PM  
Networking Event: 6 – 7:30 PM  
*Presentation of Student Awards:*  
*Keynote Speakers: Neil Dennehy,*  
*Goddard Space Flight Center,*  
*and Stephen “Phil” Airey,*  
*European Space Agency*

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**Tuesday, February 4, 2014**

Sessions: 7–10 AM & 4 – 7 PM

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**Wednesday, February 5, 2014**

Session: 7–10 AM

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**POSTER SESSION  
AVAILABLE EVERY DAY**

*The Poster Session is set up in the break-fast room and will be available for viewing every day. Authors will be on hand to discuss their projects and answer questions.*

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**Poster Session 7:00-10:00 AM daily**  
**Held in Break Room during Breakfast**

The Poster Session provides a forum for authors and interested parties to discuss relevant topics.

**Local Chairperson**

Lisa Hardaway, Ball Aerospace & Technologies Corp. 303-939-4335

lhardawa@ball.com

- 14-001 **Testing Facility for Spacecraft GNC Systems at West Virginia University**  
Thomas Evans, John Christian (West Virginia University)
- 14-002 **Unified Simulation and Analysis Framework for Deep Space Navigation Design**  
Evan Anzalone (NASA)
- 14-003 **Spacecraft and GN&C Development in a Model-Based Systems Engineering Environment**  
Christine Edwards-Stewart (LM/SSC)
- 14-004 **Green Propellant Infusion Mission Program Overview**  
Amy Brown (Ball)
- 14-005 **Recent Work Within the Control Systems Design and Analysis Branch at NASA Marshall Space Flight Center**  
Eric Gilligan (MSFC)
- 14-006 **Experimental Design of a Rigid-flexible Satellite Control System**  
Luiz Carlos Gadelha de Souza (National Institute for Space Research–INPE-Brazil)
- 14-007 **Airborne Star Tracker Dynamic Simulator**  
John Mastrangelo (Ball)
- 14-008 **The Minimum Fuel Guidance and Control of an Active Debris Removal Small Satellite**  
Aaron Avery (USU)
- 14-009 **Iridium PRIME: The World's First Turnkey Hosted Payloads Solution**  
David Anhalt (Iridium Communications)

**SATURDAY, FEBRUARY 1<sup>st</sup>**  
**7am Conference Opening**  
**by Alexander May**

**Session I**

**7:30-10:30 AM**

**Student Innovations in GN&C**

This session embraces the wealth of research and innovative projects related to spacecraft GN&C being accomplished in the university setting. Papers in this session address hardware/software research as well as component, system or simulation advances. Papers submitted must have a student as the primary author and presenter. Papers will be adjudicated based on level of innovation, complexity of problem solved, perceived technical readiness level, applicability and fieldability to near-term systems, clarity of written and verbal delivery, number of completed years of schooling and adherence to delivery schedule. Prizes will be awarded to the top 3 papers sponsored by: **Space X, Sierra Nevada Corp** and **Intuitive Machines, LLC.**

**National Chairpersons**

Tim Crain, Intuitive Machines

tim@intuitivemachines.com 281-244-5077

**Local Chairpersons**

Dave Chart, Lockheed Martin Space Systems

Company 303-977-6875

david.a.chart@lmco.com

Ian Gravseth, Ball Aerospace & Technologies

Corp. 303-939-5421

igravseth@ball.com

14-011 **Hardware-in-the-Loop Testing of a  
CubeSat's Attitude Determination and  
Control System**

Meghan Prinkey (USAF/MIT)

14-012 **Developing Three Degree of Freedom  
Air Bearing Small Satellite Simulator as  
Testbed for Attitude Determination and  
Control Using Momentum Wheels and  
as a Hardware Implementation of  
Nonlinear Control Strategies**

Marina A. Samuels, Jan Sommer, Mariana  
Barbosa, Landon Terry, Rees Fullmer  
(Utah State University)

- 14-013 **General-Use SIMULINK Hardware and  
Environment Models and Applications  
in Control Simulation and Analysis**  
Nicholas Ravago (University of Colorado/  
Boulder)
- 14-014 **Density Model Corrections at Low Alti-  
tudes Derived from ANDE Orbit Data**  
Travis Lechtenberg (University of Kansas)
- 14-015 **Vision-Based Relative Navigation Filter  
for Asteroid Rendezvous**  
Dylan Conway, Brent Macomber, Kurt A.  
Cavalieri, John L. Junkins (Texas A&M  
University)
- 14-016 **Closed-Loop GN&C Linear Covariance  
Analysis for Mission Safety**  
Alex Perez (Utah State University)
- 14-017 **A New Solution for the General  
Lambert Problem**  
Robyn M. Woollands, John L. Junkins  
(Texas A&M University)
- 14-018 **Mission Considerations for Direct  
Transfers to a Distant Retrograde Orbit**  
Chelsea Welch (University of Colorado/  
Boulder)

Special Event for Children  
at 4 PM in Rm. Peak 11

***NASA Astronaut, Joe Tanner***

This presentation will inspire our next  
generation of engineers by offering kids  
the opportunity to interact with an  
astronaut who flew four STS missions  
including the mission for the Hubble  
Space Telescope

**Session II**

**5:00-8:00 PM**

### **Technical Exhibits**

The Technical Exhibits Session is a unique opportunity to observe displays and demonstrations of state-of-the-art hardware, design and analysis tools, and services applicable to advancement of guidance, navigation, and control technology. The latest commercial tools for GN&C simulations, analysis, and graphical displays are demonstrated in a hands-on, interactive environment, including lessons learned and undocumented features. Associated papers not presented in other sessions are also provided and can be discussed with the author. Come enjoy an excellent complimentary buffet and interact with the technical representatives and authors. This session takes place in a social setting and family members are welcome!

#### **Local Chairpersons**

Meredith Larson, Ball Aerospace & Technologies Corp. 303-939-6759  
mlarson@ball.com

Rick Jackson, Lockheed Martin (Retired)  
rjackson333@yahoo.com

<b>TECHNICAL EXHIBIT PARTICIPANTS</b>
<b>Airbus Defence and Space</b>
<b>Analytical Graphics, Inc.</b>
<b>Ball Aerospace &amp; Technologies, Corp.</b>
<b>Bei Precision Systems &amp; Space Company</b>
<b>Blue Canyon Technologies</b>
<b>Cayuga Astronautics</b>
<b>dSPACE Inc.</b>
<b>Jena-Optronik GmbH</b>
<b>Left Hand Design Corp.</b>
<b>Lockheed Martin Space Systems Company</b>
<b>Monarch High School</b>
<b>NASA Marshall Spaceflight Center</b>
<b>National Instruments</b>

<b>SELEX ES</b>
<b>Sierra Nevada Corporation</b>
<b>SODERN</b>
<b>Surrey Satellite Technology</b>
<b>Texas A&amp;M University</b>
<b>United Launch Alliance, LLC</b>
<b>Utah State University Space Dynamics Lab</b>
<b>University of Colorado / Boulder</b>

**SUNDAY, FEBRUARY 2<sup>nd</sup>**

**DUAL MORNING SESSIONS**

**Advances in GN&C Software ..... Peak 4**

**Advances in GN&C Hardware ..... Peak 5**

**Session III 7:00-10:00 AM**

**Advances in GN&C Software**

The GN&C hardware is often dependent on or successful due to GN&C software. This session is open to all GN&C software ranging from on orbit software used to drive or process data, ground software used for operations or simulation software used to test, validate or develop GN&C systems. This session highlights GN&C software from all aspects. *Note: Advances in hardware applications are covered in Session IV.*

**National Chairpersons**

Stephen "Phil" Airey, ESA TEC-ECC  
Stephen.Airey@esa.it +31 (0)71 565 5295

Tooraj Kia, NASA / JPL  
Tooraj.Kia@jpl.nasa.gov 818-354-5165

John Wirzburger, Johns Hopkins Applied Physics Laboratory  
John.Wirzburger@jhuapl.edu 240-228-0394

**Local Chairpersons**

Lee Barker, Lockheed Martin Space Systems Company  
lee.a.barker@lmco.com 408-742-4679

Jim Chapel, Lockheed Martin Space Systems Company  
jim.d.chapel@lmco.com 303-977-9462

Kyle Miller, Ball Aerospace & Technologies Corp.  
kbmiller@ball.com 303-533-4348

- 14-032 **Distributed GN&C Flight Software Simulation for Spacecraft Cluster Flight.**  
Shaun M. Stewart, Lucas Ward (Emergent Space Technologies, Inc.)
- 14-033 **Ionospheric Delay Modeling for Single Frequency GPS Space Users**  
Lee Barker (LM/SSC), Chuck Frey (LM/IS&GS)
- 14-034 **Elastic Model Transitions: A Hybrid Approach Using Quadratic Inequality Constrained Least Squares / (LSQI) and Direct Shape Mapping (DSM)**  
Robert J. Jurenko (Leidos), Jason Bush (TriVector Services, Inc.), John Ottander (Dynamic Concepts, Inc.)
- 14-035 **Prediction of Limit Cycles Using Describing Function Analysis and the LuGre Friction Model**  
Ashley Moore, Russel W. Benson, Alison S. Kremer, Richard M. Dolphus (The Aerospace Corp).
- 14-036 **Vehicle Dynamic Modeling Assisted State Estimation for Planetary Exploration Applications**  
Joseph Nsasi Bakambu, Adam Philip, Andrew C.M. Allen, Raja Mukherji (MDA Corp)
- 14-037 **Model-Based Guidance and Control for Atmospheric Guided Entry**  
Enrico Canuto (Politecnico di Torino), Marcello Buonocore (Thales Alenia)
- 14-038 **Space Launch System Ascent Flight Control Design**  
Jeb S. Orr (Draper), John H. Wall (Dynamic Concepts), Tannen S. VanZwieten, Charles E. Hall (NASA/Marshall)



### Advances in GN&C Hardware

Many programs depend on heritage, but the future is advanced by those willing to design and implement new and novel architectures and technologies to solve the GN&C problems. This session is open to papers with topics concerning GN&C hardware ranging from theoretical formulations to innovative systems and intelligent sensors that will advance the state of the art, reduce the cost of applications, and speed the convergence to hardware, numerical, or design trade solutions.

- 14-041 **ASTRIX™ 1000 Series: The Best of the FOG Technology for Satellites**  
Gilbert Cros (Astrium SAS), Jean-Jacques Bonnefois (IXSPACE), Steeve Kowaltschek (ESA), Guillaume Delavoipiere (CNES)
- 14-042 **Target Relative Navigation Results from Hardware-in-the-Loop Tests Using the SINPLEX Navigation System**  
Stephen Steffes, Stephan Theil, Michael Dumke, David Heise, Marco Sagliano, Malak A. Amaan (DLR), Erik Laan, Murat Durkut, Han Oosterling, Erik Boslooper (TNO), Jan Schulte, Stefan Söderholm, Daniel Skaborn (ÅAC Microtec AB), Yuriy Yanson, Joris Berkhout, Marco Esposito, Simon Continello (Cosine Research B.V.), Richard Visee, Bert Monna, Frank Stelwagen (SystematiC design B.V.)
- 14-043 **BRRISON Fine Steering System Design and Performance**  
Jed Diller, Kevin Dinkel, Zach Dischner, Nick Truesdale, Eliot Young (Southwest Research Institute)
- 14-044 **Calibration and Testing of a Space-Ready Flash LIDAR**  
Matthew Strube (NASA/GSFC), Reuben Rohrshneider (Ball)

- 14-045 **Technology Development of Backside Illuminated CMOS Image Sensors for Medium Accuracy Star Tracker Applications**  
R. Winzenread, R. Jerome,  
S. Hong, D. Price, (On Semiconductor),  
J.R. Zhu, P. Levine, J. Tower (SRI International), M. Sileo, E. Tchilian (Ball)
- 14-047 **Miniature Control Moment Gyroscope Development**  
Erik Mumm (Honeybee Robotics)

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**Educational Workshop**      **10:30AM-1:00PM**  
**Peak 4 & 5**

**Presented by:**

**Analytical Graphics, Inc.**

A spacecraft simulation environment in STK: Including full rotational dynamics; attitude determination and control; sensor and actuator models; and power and payload modeling. Learn how spacecraft design engineers can rapidly evaluate system trade-offs and ensure that spacecraft capabilities and constraints are being met. After an accelerated design and analysis cycle, the resulting flight software configuration can be targeted for actual flight avionics at the touch of a button. The modular flight software architecture provides rapid spacecraft development, assembly, test and integration, as well as autonomous on-board operations and enhances integration and test with its high-fidelity "test like you fly" capabilities.

**Local Chairperson**

Meredith Larson, Ball Aerospace & Technologies Corp.      303-939-6759  
mlarson@ball.com

**Session V**

**2:00-4:00 PM**

### **Adaptive & Optimal Control**

This session focuses on novel applications of adaptive or optimal control. When seeking to apply adaptive or optimal control approaches to a specific application, an algorithm must be selected, tailored, and/or re-designed such that it is suitable for the system under consideration and can meet or exceed industry standards with respect to performance and robustness. Session topics focus on the development and/or application of adaptive and optimal control concepts for real systems demonstrating appreciable improvements over the baseline design. Authors are encouraged to provide comprehensive analysis and discussion supported by test data in a laboratory or field environment.

#### **National Chairpersons**

Bradley Moran, Draper Laboratory  
bamoran@draper.com 617-258-1263

Tannen VanZwieten, NASA / MSFC  
tannen.s.vanzwieten@nasa.gov 256-961-1509

#### **Local Chairpersons**

Tim Bevacqua, Lockheed Martin Space Systems  
Company 303-971-2458  
timothy.bevacqua@lmco.com

Dan Motooka, Lockheed Martin Space Systems  
Company 408-756-8294  
daniel.k.motooka@lmco.com

Mike Ruth, Orbital Sciences Corp.  
ruth.michael@orbital.com 703-406-5785

14-051 **Space Launch System Implementation  
of Adaptive Augmenting Control**

John H. Wall (Dynamic Concepts, Inc.),  
Jeb S. Orr (Draper Laboratory), Tannen S.  
VanZwieten (NASA / MSFC)

14-052 **Adaptive Augmenting Control Flight  
Characterization Experiment on an F/A-18**

Tannen S. VanZwieten, Eric Gilligan  
(NASA / MSFC), John H. Wall (Dynamic  
Concepts, Inc.), Jeb S. Orr (Draper Labor-  
atory)

- 14-056 **Toward Practical Implementation of Optimal Orbital Pursuit Evasion Maneuvers**  
 Will Hafer, James D. Turner, Helen Reed  
 (Texas A&M University), Khanh Pham (Air Force Research Laboratory)
- 14-057 **A\* Pathfinding for Continuous-Thrust Trajectory Optimization**  
 Nathan Parrish, Jeffrey S. Parker  
 (University of Colorado, Boulder)

**MONDAY, FEBRUARY 3<sup>rd</sup>**

**Session VI**

**7:00-10:00 AM**

**CubeSats & SmallSats**

Cubesats and smallsats range in mass from less than 1kg up to 180kg, and are gaining in popularity and utility. At the high end of this mass range, 100 to 180kg ESPA-class spacecraft are now trusted platforms for missions and offer pointing accuracy, pointing stability, and position knowledge that is compatible with Earth science missions. At the cubesat end of the spectrum the GN&C capabilities are advancing quickly in an effort to support science and technology development missions. This session is open to papers covering both hardware and software aspects of smallsat and cubesat GN&C. Papers on technology development for GN&C and mission GN&C experience are also included.

**National Chairpersons**

David Geller, Utah State University/Space  
 Dynamics Laboratory 435-797-2952  
 david.geller@usu.edu

Bruce Yost, NASA  
 bruce.d.yost@nasa.gov 650-604-0681

**Local Chairpersons**

Michael Epstein, Lockheed Martin Space  
 Systems Company, 215-497-1382  
 michael.d.epstein@lmco.com

Reuben Rohrschneider, Ball Aerospace & Technologies Corp.  
 303-939-7197  
 rrohersch@ball.com

- 14-061 **Three-Degree-of-Freedom Testing of Attitude Estimation and Control Algorithms on ExoplanetSat**  
Christopher M. Pong, Sara Seager, David W. Miller (MIT)
- 14-062 **Formulation of Small Spacecraft Avionics Testbed**  
Matt Sorgenfrei (SGT), Matt Nehrenz (Jacobs Technology), Robert Edwards, Sanjay Joshi (University of California, Davis)
- 14-063 **Aerodynamic Attitude and Orbit Control Capabilities of the  $\Delta$ DSAT Cubesat**  
Josep Virgili, Peter C.E. Roberts, Zhou Hao (Space Research Center, Cranfield University)
- 14-064 **Pointing Stability Analysis for the Doppler Wind and Temperature Sounder Microsatellite Demonstration Mission**  
William Frazier, Reuben R. Rohrschneider, Shane Roark (Ball)
- 14-065 **Advantages of Small Satellite Carrier Concepts for LEO/GEO**  
David K. Geller, Derick Crocket (Utah State University), Randy Christensen, Adam Shelly (Space Dynamics Laboratory)
- 14-066 **Prox-1: Automated Image-Based Guidance and Control for On-Orbit Inspection**  
Sean Chait, David Spencer (Georgia Institute of Technology)
- 14-067 **Smallsat Spin-Assisted Angles-Only Navigation and Control**  
Randy Christensen (Space Dynamics Laboratory), David Geller (Utah State University)
- 14-068 **DICE: Challenges of Spinning CubeSats**  
Tim Neilsen (Space Dynamics Laboratory)

## DUAL AFTERNOON SESSIONS

**Hosted Payloads ..... Peak 4**

**Saving the Spacecraft: Rescues, Fault Protection & Life Extensions ..... Peak 5**

**Session VII 4:00-6:00 PM**

### Hosted Payloads

This session provides an overview of the emerging paradigm for delivering and operating payloads on rides of opportunity. Both the DoD and NASA have major initiatives focused on leveraging hosted payload opportunities to enhance access and affordability. The session covers the players, the benefits and challenges, the technical requirements, experiences, and the GN&C considerations.

#### National Chairpersons

David Anhalt, Iridium-Prime 703-287-7493  
dave.anhalt@iridium.com

Prasun Desai, NASA HQ 202-358-3755  
prasun.d.desai@nasa.gov

#### Local Chairpersons

Bill Frazier, Ball Aerospace & Technologies Corp.  
wfrazier@ball.com 303-939-4986

Paul Graven, Cateni 310-245-4301  
paul@graven.com

14-071 **Hosted Payload Movement Overview**  
Dave Anhalt (Hosted Payload Alliance)

14-072 **Earth Observations from the International Space Station: The Teledyne “Multiple User System for Sensing” (MUSES)**  
Mark Whorton (Teledyne Brown)

14-073 **The TEMPO Mission: It’s About Time!**  
Brian Baker, Laura Hale, Dennis Nicks, Kenton Lee (Ball), Kelly Chance, Ziong Liu, Raid Sulieman (Smithsonian Astrophysical Observatory), Jim Carr (Carr Astro), David Flittner, Jassim Al-Saadi, Wendy Pennington, Alan Little, David Rosenbaum (NASA/LRC)

14-074 **The Common Instrument Interface (CII)**  
Nikzad Toormarian (NASA/JPL)

14-075 **Hosting the Deep Space Atomic Clock (DASC) on the Orbital Test Bed (OTB-1) Satellite**  
Brent Abbott (Surrey), Todd Ely (NASA/JPL)

**Session VIII**

**4:00-6:00 PM**

**Saving the Spacecraft: Rescues, Fault Protection & Life Extensions**

Throughout the history of space missions, well-crafted automation and human ingenuity have saved and extended missions. One of the inspirations for this session is the Apollo 13 mission in which the team united to solve a critical problem that rescued the crew. The goal of this session is to gather both historic and modern stories about spacecraft rescues, fault protection design, and life extension efforts.

**National Chairpersons**

Frank Geisel, Draper Laboratory  
fgeisel@draper.com 617-258-2448

Sam W. Thurman, NASA JPL 818-393-7819  
sam.w.thurman@jpl.nasa.gov

**Local Chairpersons**

Christy Edwards-Stewart, Lockheed Martin Space Systems Company 303-977-5302  
christine.m.edwards@lmco.com

14-083 **Simple Safe Site Selection: Hazard Avoidance Algorithm Performance at Mars**  
Andrew E. Johnson (NASA/JPL), Amit

14-084 **Verification of Mars Odyssey Flight Software Ten Years after Launch**  
Dave Gingerich (LM/SSC)

14-085 **HAYABUSA - Asteroid Sample Return through Hardships during Its Seven Years Round-Trip Voyage**  
Junichiro Kawaguchi (JAXA)

14-086 **Fault Detection and Isolation for Autonomous Parafoils**  
Matthew Stoeckle, Amer Fejzic, Louis Breger, (Charles Stark Draper Laboratory), Jonathan How (MIT)

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**NETWORKING EVENT**                      **6:00-7:30 PM**  
**in the Imperial Ballroom**

A generous appetizer buffet and an opportunity for conference attendees and guests to network with each other. The event will also include the presentation of the student paper awards plus remarks by our keynote speakers. Continued networking after the formal event is encouraged!

**Student Paper Awards:**

Grand Prize	\$1,000
sponsored by <b>Space X</b>	
2nd Place	\$500
sponsored by <b>Sierra Nevada Corp.</b>	
3rd Place	\$250
sponsored by <b>Intuitive Machines, LLC</b>	

KEYNOTE SPEAKERS

***Neil Dennehy***  
**Goddard Space Flight Center**  
*and*

***Stephen “Phil” Airey***  
**European Space Agency**

***Discuss: “Issues Concerning the GN&C Community”***



**TUESDAY, FEBRUARY 4<sup>th</sup>**

**DUAL MORNING SESSIONS**

**ORION Multi-Purpose Crew Vehicle  
Guidance, Navigation & Control .....Peak 4**

**Mixed Actuator Attitude Control .....Peak 5**

**Session IX** **7:00-10:00 AM**

**ORION Multi-Purpose Crew Vehicle  
Guidance, Navigation & Control**

This session will highlight the recent Guidance, Navigation & Control developments for the Orion Multi-Purpose Crew Vehicle (MPCV) from the Exploration Flight Test 1 (EFT-1), scheduled to launch in September 2014, and demonstrate the system capability to perform a high-energy entry, to the Exploration Missions that will take the Orion MPCV and Crew beyond earth orbit. The papers in this session will overview the Orion system from the launch abort capabilities and navigation systems to future exploration mission concepts and design references.

**National Chairpersons**

Tim Straube, NASA Johnson Space Center  
timothy.m.straube@nasa.gov 281-483-7291

Chris D'Souza, NASA Johnson Space Center  
chris.dsouza-1@nasa.gov 281-483-8246

**Local Chairpersons**

Daniel G. Kubitschek, Lockheed Martin Space  
Systems 303-971-8150  
daniel.kubitschek@lmco.com

14-091 **Full-Envelope Launch Abort System  
Performance Analysis Methodology**  
Vanessa Aubuchon (NASA/LRC)

14-092 **Orion Exploration Flight Test 1  
Absolute Navigation Design**  
Jastesh Sud (LM/SSC), Renato Zanetti  
(Charles Stark Draper Laboratory), Greg  
Holt (NASA/JSC)

- 14-093 **Translation Between Dissimilar IMU Error Models to Enable Proper EKF Testing and Validation,**  
Robert W. Gillis (Emergent Space Technologies), Harvey Mamich (LM/SSC)
- 14-094 **Definition of the Design Trajectory and Entry Flight Corridor for the NASA Orion Exploration Mission 1 Entry Trajectory Using an Integrated Approach and Optimization**  
Luke W. McNamara (NASA/JSC), Robert D. Braun (Georgia Institute of Technology)
- 14-095 **Navigation Design and Analysis for the Orion Cislunar Exploration Missions**  
Chris D'Souza, Greg Holt, Robert Gay (NASA/JSC), Renato Zanetti (Charles Stark Draper Laboratory)
- 14-096 **Trajectory Design Analysis over the Lunar Nodal Cycle for the Multi-Purpose Crew Vehicle (MPCV) Exploration Mission 2**  
Jeff Gutkowski, Tim Dawn, Richard Jedrey (NASA/JSC)
- 14-097 **Orion Sample Capture and Return (OSCAR)**  
John Ringelberg, Reid Hamilton, Chris Norman (LM/SSC)

**Session X**

**7:00-10:00 AM**

**Mixed Actuator Attitude Control**

This session will explore the recent renewed community interest in the design and development of spacecraft attitude control systems employing mixed control torque actuators. Such 'hybrid' attitude control systems are of potential utility in cases where, for example, a spacecraft has lost the use of one or more of their reaction wheel set such that there are less than three functional operating reaction wheels remaining. Typically mixed actuator/hybrid attitude control modes are ones in which thrusters or, in some mission applications, magnetic torquers, are oper-

ated in tandem with the two remaining healthy reaction wheels to provide three-axis attitude control torques. Mixed actuator attitude control techniques have been successfully implemented in the past on such spacecraft as FUSE and TIMED. To extend their productive mission life several currently flying spacecraft are currently considering the use of mixed actuator modes for contingency attitude control in the face of reaction wheel failures suffered on-orbit. The papers in this session will review the community's historical experience (lessons learned) with contingency mixed actuator/hybrid spacecraft attitude control using only two reaction wheels. The results of more recent mixed actuator design and development work will also be addressed by the papers in this session.

**National Chairpersons**

Neil Dennehy, NASA/GSFC                    301-286-5696  
cornelius.j.dennehy@nasa.gov

Allan Lee, NASA/JPL                         818-354-4097  
allan.y.lee@jpl.nasa.gov

**Local Chairpersons**

Scott Francis, Lockheed Martin Space Systems  
Company                                         303-977-8253  
scott.francis@lmco.com

14-101 **Spacecraft Hybrid Control at NASA: A Historical Look Back, Current Initiatives, and Some Future Considerations**  
Neil Dennehy (NASA/GSFC)

14-102 **Hybrid Control Architecture for the Kepler Spacecraft**  
Dustin Putnam, Doug Wiemer (Ball)

14-103 **Pointing and Maneuvering a Spacecraft with a Rank-Deficient Reaction Wheel Complement**  
Eric Stoneking (NASA/GSFC), Ken Lebsack (Orbital Sciences Corporation)

14-104 **Precision Pointing for a Skewed 2-Reaction Wheel Control System**  
M. Ross, W. Kang, M. Karpenko, R. Proulx (Naval Postgraduate School)

- 14-105 **A Cold Gas Micro Propulsion System as Actuator of Fine Pointing and Attitude Control Missions on Science and Earth Observation Satellites**  
G. Matticari, G. Noci, L. Ceruti, L. Fallerini, F. Boldrini (Selex ES)
- 14-106 **High Efficiency Magnetic Torque Bars (MTBs)**  
Jim Krebs, Eric Stromswold (Cayuga Astronautics)
- 14-107 **Dawn Spacecraft Operations with Hybrid Actuator Control: Inflight Performance and Ceres Applications**  
Brett A. Smith (NASA/JPL)

**Session XI**

**4:00-7:00 PM**

### **HWIL Testbeds and Demonstration Laboratories**

As the complexity of aerospace flight systems continues to rise, increasingly more-elaborate means of system- and subsystem-level testing have become necessary to reduce programmatic risk, thus motivating development of advanced 'test-like-you-fly' HWIL testbeds. Many of these facilities accommodate modular testing of newly developed flight control algorithms, flight software, and flight hardware. In some cases, HWIL testbed laboratories enable a virtual fly-off to be held between competing designs. This session explores capabilities of existing sophisticated, high-fidelity, GN&C laboratories throughout the industry.

#### **National Chairpersons**

Lars Dyrud, Draper Laboratory  
ldyrud@draper.com 617-258-2309

James Turner, Texas A&M University  
jturner@tamu.edu 979-229-0091

### **Local Chairpersons**

Jeff Bladt, Ball Aerospace & Technologies Corp.  
jbladt@ball.com 303-939-5971

Michael L. Osborne, Lockheed Martin Space  
Systems Company 303-977-5867  
michael.l.osborne@lmco.com

- 14-112 **Honeywell's Momentum Control System Testbed**  
Brian Hamilton (Honeywell)
- 14-113 **System Level Hardware-in-the-Loop Testing for CubeSats**  
Bryan Bingham, Cameron Weston (Utah State University / Space Dynamics Laboratory)
- 14-114 **A 5DoF Experimental Platform for Research in Spacecraft Proximity Operations**  
Panagiotis Tsiotras (Georgia Institute of Technology)
- 14-115 **LASR: A University-Based National Testbed for Space Proximity Operations in an Operationally Relevant Environment**  
James Turner, John Junkins, John Hurtado (Texas A&M University)
- 14-116 **The Space Operations Simulation Center: A 6DOF Laboratory for Testing Relative Navigation Systems**  
Sherri Ahlbrandt, Frank Moore, David Huish, Cory Burr, Reid Hamilton (LM/SSC)
- 14-117 **Spacecraft Hardware-in-the-Loop Testing at the Servicing Technology Center**  
Matthew Strube, Brian Roberts (NASA/GSFC)

**WEDNESDAY, FEBRUARY 5<sup>th</sup>**

**Session XII**

**7:00-10:00 AM**

**Recent Experiences**

This session focuses on recent experiences in spaceflight GN&C, providing a forum to share insights gained through successes and failures. Discussions include GN&C experiences ranging from Earth orbiters to interplanetary spacecraft. This session is a traditional part of the conference and has shown to be most interesting and informative.

**National Chairpersons**

Mimi Aung, NASA Jet Propulsion Laboratory  
mimi.aung@jpl.nasa.gov 818-354-6987

Chiold Epp, NASA Johnson Space Center  
chiold.d.epp@nasa.gov 281-244-7733

**Local Chairpersons**

Kristen Francis, Lockheed Martin Space Systems Company  
kristen.francis@lmco.com 303-971-7450

Jeff Parker, University of Colorado/Boulder  
parkerjs@colorado.edu 303-931-5334

14-121 **Reconstructed Flight Performance of the Mars Science Laboratory Guidance, Navigation, and Control System for Entry, Descent, and Landing**

A. Miguel San Martin, Paul B. Brugarolas, Frederick Serricchio, Gurkirpal Singh (NASA/JPL) Gavin F. Mendeck (NASA/JSC)

14-122 **Effects of Radioisotope Thermoelectric Generator on Dynamics of the New Horizons Spacecraft**

Gabe D. Rogers, Sarah H. Flanigan (APL)

14-123 **The Prisma Irides Rendezvous Experiment**

Thomas Karlsson, Björn Jakobsson, Per Bodin, Bengt Larsson (OHB Sweden)

- 14-124 **Bearing Noise Detection, Modeling and Mitigation Measures on ESA's X-ray Observatory XMM-Newton**  
Marcus G. F. Kirsch, Jim Martin (ESA ESOC), Stephen Airey, Anders Elfving (ESA ESTEC), Patrick Chapman, Denis Di Filippantonio (Astrium Ltd), Rob Harris (Rhea Systems S.A.), Rainer Kresken, Alastair McDonald (CGI), Mauro Pantaleoni, Jeroen Vandersteen (RHEA System BV), Frederic Schmidt, Detlef Webert, Uwe Weissmann (Telespazio Vega), Tommy Strandberg (Astrium GmbH)
- 14-125 **Suomi NPP Commissioning**  
Steve Stem, Meredith Larson, Scott Asbury (Ball)
- 14-126 **United Launch Alliance Recent Experiences 2013**  
John Reed, Brian Lathrop (ULA)
- 14-127 **The Last Days of GRAIL**  
Mark S. Wallace, Ralph B. Roncoli, Brian T. Young, Sara J. Hatch (NASA/JPL)

**The 2015 Annual AAS  
Rocky Mountain Section  
Guidance and Control Conference**

will be held at Beaver Run in Breckenridge, CO  
Jan 30 - February 4, 2015

**Chairperson:** Ian J. Gravseth, Ph.D.  
Ball Aerospace & Technologies Corp.  
(303) 939-5421  
igravseth@ball.com



### Conference Committee 2014

Brent Abbott	Surrey Space
Lee Barker	LMSSC
Jeff Bladt	Ball
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Deb Wright	LMSSC (Retired)