

# 34<sup>th</sup> ANNUAL AAS GUIDANCE & CONTROL CONFERENCE

Breckenridge, Colorado  
February 4-9, 2011

Sponsored by the AAS  
Rocky Mountain Section



***Please see our website: <http://aas-rocky-mountain-section.org/> for additional information on the Conference, Beaver Run Resort, recreational activities, and the town of Breckenridge, CO.***

## CONFERENCE AGENDA

### Registration

Room check-in at the Beaver Run Resort front desk 4:00 PM daily.  
Conference registration 6:00 to 10:00 AM and 4:00 to 6:00 PM daily.

### Friday, February 4, 2011

**Evening: 6:00 – 9:00 PM “Wine and Cheese”**

Early Conference registration 6:00 to 8:00 PM

**Poster Session, Feb 5 – 9, 2011**

**Held in Break Room during Breakfast**

**Organizer: Mary Klaus, Lockheed Martin Space Systems, [mary.a.klaus@lmco.com](mailto:mary.a.klaus@lmco.com), 303-971-2724**

**Saturday, February 5, 2011**

**Morning: 7:00-10:00 AM Session I - "Global Navigation Satellite Systems"**

**THEME:** Since becoming operational, Global Positioning System (GPS) has ushered in a wave of new technologies, capabilities, and products taking advantage of precise timing and navigation signals. The GPS receiver industry was born, and GPS revolutionized military and commercial business, affecting everything from aviation and spacecraft, to cell phone technology and automobile navigation, to ship navigation and container tracking. Recent advances in GPS products, along with developments in other Global Navigation Satellite Systems (GNSS), further continue to push state of the art advances in a host of applications while striving to meet new requirements. Examples include Accuracy Improvements Initiatives (AII) by GPS, new military and civil signals in the latest generation of GPS IIR-M, and GPS IIF satellites, and new receivers. Development of the next generation of spacecraft and control systems is already underway for GPS, the European Galileo system, and others. This session is intended to discuss advances in GPS products including new capabilities and signals, advances in other GNSS systems (Galileo, GLONASS, COMPASS, etc), advances in GNSS receiver technology, and space applications of GNSS.

**Organizer**

Lee Barker, Lockheed Martin Space Systems, [lee.a.barker@lmco.com](mailto:lee.a.barker@lmco.com), 408-742-4679

Shawn McQuerry, Lockheed Martin Space Systems, [shawn.c.mcquerry@lmco.com](mailto:shawn.c.mcquerry@lmco.com), 303-971-5264

**National Chairperson**

Chris Hegarty, MITRE, [chegarty@mitre.org](mailto:chegarty@mitre.org), 781-271-2127

Col Stephen Steiner, SMC GPS Wing Commander, [Stephen.steiner@dtsa.mil](mailto:Stephen.steiner@dtsa.mil), 781-271-2127

**Afternoon: 5:00-8:00 PM Session II-"Technical Exhibits"**

**THEME:** 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 and excellent complimentary buffet and interact with the technical representatives and authors. This session takes place in a social setting and family members are welcome!

**Organizers**

Scott Francis, Lockheed Martin Space Systems, [scott.francis@lmco.com](mailto:scott.francis@lmco.com), 303-977-8253

Kristen Terry, Lockheed Martin Space Systems, [kristen.terry@lmco.com](mailto:kristen.terry@lmco.com), 303-971-7450

Vanessa Baez, Lockheed Martin Space Systems, [vanessa.baez@lmco.com](mailto:vanessa.baez@lmco.com), 303-971-6481

## Sunday, February 6, 2011

### Morning: 7:00-10:00 AM Session III-“Advances in GN&C”

**THEME:** Many programs depend on heritage, but the future is advanced by those willing to design and implement new and novel architectures, technologies, and algorithms to solve the GN&C problems. This session is open to papers with topics 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.

#### Organizers

Zach Wilson, Lockheed Martin Space Systems, [zachary.s.wilson@lmco.com](mailto:zachary.s.wilson@lmco.com), 303-971-4799  
Alex May, Lockheed Martin Space Systems, [alexander.j.may@lmco.com](mailto:alexander.j.may@lmco.com); 303-977-6620

#### National Chairpersons

Brad Moran, Charles Stark Draper Labs, [bamoran@draper.com](mailto:bamoran@draper.com), 617-258-1263  
Gabe Rogers, Johns Hopkins University/Applied Physics Lab, [Gabe.Rogers@jhuapl.edu](mailto:Gabe.Rogers@jhuapl.edu), 443-778-7298

### Afternoon: 2:00-4:00 Session IV-“Commercial and Civil Overhead Imagery Systems”

**THEME:** The commercial and municipal overhead imagery market has historically been met with airborne sensors while government intelligence demands have been met with large, space-based assets. Commercially-owned high-resolution space-systems now globally augment commercial, civil, and military imagery requirements leading to cross-market growth and a strong demand for high-performance imaging satellites. In this session, leading remote sensing contractors provide summaries of related GN&C requirements, solutions, and challenges.

#### Organizers

Bill Frazier, Ball Aerospace & Technology Corp., [wfrazier@ball.com](mailto:wfrazier@ball.com), 303-939-4986  
Jay Speed, Ball Aerospace & Technology Corp., [jspeed@ball.com](mailto:jspeed@ball.com), 303-939-5322

#### National Chairperson

Dan Schuresko, NGA, [Daniel.d.Schuresko@nga.mil](mailto:Daniel.d.Schuresko@nga.mil), 703-264-7161

## Monday, February 7, 2011

### Morning: 7:00-10:00 AM Session V-“Small Body Proximity Operations”

**THEME:** Spacecraft proximity operations in the vicinity of small bodies such as asteroids and comets represent a challenge to traditional operations, mission design and navigation scenarios. Short orbital periods about small bodies coupled with the required small response times and long round-trip light times drive autonomy and robust mission designs. The mission design problem is greatly complicated by distended shapes that ultimately drive chaotic trajectories with sensitivities to initial condition errors, perturbations and gravity field errors. Navigation strategies must rely upon traditional radiometric data types coupled with optical imaging and landmark tracking. This session explores the current progress in trying to meet these challenges as mission enablers for future efforts.

#### Organizers

Dave Chart, Lockheed Martin Space Systems, [david.a.chart@lmco.com](mailto:david.a.chart@lmco.com), 303-977-6875  
Ian Gravseth, Ball Aerospace & Technologies Corp., [igravseth@ball.com](mailto:igravseth@ball.com), 303-939-5421

#### National Chairperson

Chris D’Souza (NASA/Johnson), [chris.dsouza@nasa.gov](mailto:chris.dsouza@nasa.gov), 281-483-8246  
Dan Scheeres (University of Colorado), [scheeres@colorado.edu](mailto:scheeres@colorado.edu), 303-492-7420

### Afternoon: 4:00-6:00 PM Session VI –“Microvibration”

**THEME:** Microvibration, with its effects on payloads and GNC systems, is becoming an ever more important consideration. As the sensitivity of missions has increased, requirements have tightened and the need for mitigation of microvibration has also increased. This in turn has led to challenges in design, characterization and testing. This 'semi-tutorial' style session is intended to use real-world examples as an introduction to the sources and negative effects of micro-vibration on spacecraft. Additionally, this session will outline various techniques for mitigating and reducing the effects while also explaining the difficulties in measuring and testing for micro-vibration.

#### Organizers

Lisa Hardaway, Ball Aerospace, [lhardawa@ball.com](mailto:lhardawa@ball.com), 303-939-4335  
Brian Clapp, Lockheed Martin Space Systems, [brian.clapp@lmco.com](mailto:brian.clapp@lmco.com), 303-971-4994

#### National Chairperson

Stephen “Phil” Airey, ESA TEC-ECC, [Stephen.Airey@esa.it](mailto:Stephen.Airey@esa.it), +31 (0)71 565 5295  
Frank Cepollina, Goddard Space Flight Center, [Frank.j.cepollina1@gsc.nasa.gov](mailto:Frank.j.cepollina1@gsc.nasa.gov), 301-286-1266

## BANQUET ACTIVITIES

**SOCIAL HOUR.....6-7 PM**

**DINNER.....7-9 PM**

**DINNER SPEAKER.....8-9 PM**

**Lance Lord, General USAF (Retired)**

## Tuesday, February 8, 2011

### **Morning: 7:00-10:00 AM Session VII-“ Servicing and Assured Disposal”**

**THEME:** Extending the life of healthy on-orbit assets, repairing vehicles that have experienced failures, and safely disposing of vehicles that have suffered anomalies, all provide a compelling need to establish high-TRL space servicing capabilities. This session will explore the challenges and fundamental technologies of space servicing missions such as on-orbit refueling, replenishment or repair of payloads, installation of advanced instrumentation, in-situ assembly of large structures, and the capture of errant spacecraft for safe disposal.

#### **Organizer**

Michael Osborne, Lockheed Martin Space Systems, [michael.l.osborne@lmco.com](mailto:michael.l.osborne@lmco.com), 303-977-5867  
Mike Drews, Lockheed Martin Space Systems, [michael.e.drews@lmco.com](mailto:michael.e.drews@lmco.com), 303-971-3622

#### **National Chairperson**

Bo Naasz, NASA/Goddard, [bo.j.naasz@nasa.gov](mailto:bo.j.naasz@nasa.gov), 301-286-3819

### **Afternoon: 4:00-7:00 PM Session VIII - “Recent Experiences”**

**THEME:** Lessons learned through experience prove most valuable when shared with others in the G&C community. This session, which is a traditional part of the conference, provides a forum for candid sharing of insights gained through successes and failures. Past conferences have shown this session to be most interesting and informative.

#### **Organizer**

Chris Randall, Ball Aerospace & Technologies Corp., [crandall@ball.com](mailto:crandall@ball.com), 303-939-6732  
Cheryl Walker, TASC, [Cheryl.walker@tasc.com](mailto:Cheryl.walker@tasc.com), 719-393-8487

#### **National Chairperson**

Bob Friend, Boeing Space Systems, [r.friend@boeing.com](mailto:r.friend@boeing.com), 562-797-2605  
David Geller, SDL and Utah State University, [david.geller@usu.edu](mailto:david.geller@usu.edu), 435-797-2952

## Wednesday, February 9, 2011

### **Morning: 7:00-10:00 AM Session IX- “Design Approaches for Precision Pointing Applications” (ITAR Restricted Session)**

**THEME:** Various spacecraft mission requirements continue the push for improved vehicle pointing performance. Significant advancements have recently been made in sensors, actuators, isolation systems, and spacecraft design for precision pointing applications. This session examines design approaches for jitter suppression and control, thermal effects mitigation, in-flight calibrations, extended state estimation for instrument pointing, and flexible-body excitation and control.

#### **Organizers**

Jim Chapel, Lockheed Martin Space Systems, [jim.d.chapel@lmco.com](mailto:jim.d.chapel@lmco.com), 303-977-9462  
Larry Germann, Left Hand Design, [lgermann@lefthand.com](mailto:lgermann@lefthand.com), 303-652-2786

#### **National Chairperson**

Al Bosse, Draper, [albert.bosse.ctr@uda.mil](mailto:albert.bosse.ctr@uda.mil), 256-890-7392  
Ronald Ninneman, Air Force Research Lab, [ronald.ninneman@kirtland.af.mil](mailto:ronald.ninneman@kirtland.af.mil), 505-846-4699

Special note: Because we are emphasizing a 'paperless' method for collecting and distributing papers, it will be valuable if you can bring a laptop computer to the meeting. We will provide wireless in the conference area for distribution of papers, but we will not be providing Internet service. If you cannot bring a laptop, we will provide you with an electronic version of the papers on premises either by CD or copies placed on your personal 'thumb drive'.