PROGRAM

36ᵗʰ ANNUAL AAS GUIDANCE & CONTROL CONFERENCE

February 1 to February 6, 2013

Breckenridge, Colorado

Beaver Run Conference Center

FRIDAY, FEBRUARY 1ˢᵀ

Room check-in at the Beaver Run Resort front desk 4:00 PM daily.

Conference registration

Friday 5:00 to 8:00 PM
Daily 6:30 to 10:00 AM and 4:00 to 6:00 PM

Session 0………………7:00-10:00 AM daily

POSTER SESSION
AVAILABLE EVERY DAY

The Poster Session will be available for viewing every day and authors will be on hand to discuss their projects and answer questions.

13-001   **Electromagnetic Formation Flight (EMFF) Model Development**
Andrew Hilton (US Air Force Academy)

13-002   Application of Bezier Curves to Kepler's Equation, Donghoon Kim and Daniele Mortari, (Texas A&M University)

13-003   ADEPT - Adaptable Deployable Entry Placement Technology, Paul Wercinski, (NASA Ames Research Center)

13-004   Model-Based Design for Large Safety-Critical Systems: A Discussion on Logic-Intensive Algorithms, Mike Anthony, Will Campbell,

Becky Petteys, (MathWorks)

13-005   GRAVMOD2: A New Tool for Precise Gravitational Modelling of Planetary Moons and Small Bodies, Zuccarelli, V. (Astos Solutions, Germany), Cadenas, R.(GMV, Spain), Huertas, I. (ESTEC, European Space Agency), Weikert, S. (Astos Solutions, Germany), Astos Solutions, GMV, (ESTEC ESA)

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

SATURDAY, FEBRUARY 2ᴺᴰ

**7am Conference Opening
by Lisa Hardaway**

Session I……………………..7:10-10:30 AM

STUDENT PAPER SESSION

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 and 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, applicability and fieldability to near-term systems, clarity of written and verbal delivery, number of completed years of schooling and adherence to delivery schedule. The session will be limited to 7 papers with the top 3 papers receiving awards

National Chairpersons
Tim Crain, NASA Johnson Space Center, tim.crain-1@nasa.gov, 281-244-5077
R. Scott Erwin, Air Force Research Lab – Kirtland AFB, richard.erwin@kirtland.af.mil, 505-846-9816

Local Chairpersons
Dave Chart, Lockheed Martin Space Systems, david.a.chart@lmco.com , 303-977-6875
Ian Gravseth, Ball Aerospace & Technologies Corp., igravseth@ball.com, 303-939-5421

13-011   **Laboratory Experiments Supporting Autonomous Space Debris Mitigation**
Kurt Cavalieri, Brent Macomber, Clark Moody, Austin Probe, John L. Junkins (Texas A&M)

13-012   **Electromagnetic Formation Flight Control Using Dynamic Programming**
Gregory Eslinger (USAF/MIT)

13-013   **Attitude Determination and Control of a Tumbling Resident Space Object by the Means of Distributed Sensors and Actuators**
Timothy Zuercher, Bogdan Udrea (Embry-Riddle Aeronautical University)

13-014   **Using Signals of Opportunity for Deep Space Navigation**
Ryan Handzo, Kenn Gold, George Born, Michael Davies (University of Colorado at Boulder)

13-015   **Daystar: Modeling and Testing a Daytime Star Tracker for High Altitude Balloon Observatories**
Nicholas Truesdale, Kevin Dinkel, Jedediah Diller, Zachary Dischnew (University of Colorado at Boulder)

13-016   Angular Rate Estimation from Geomagnetic Field Measurements and Observability Singularity Avoidance During Detumbling and Sun Acquisition
Christopher M. Pong, Kuo-Chia Liu, David W. Miller (MIT/SSL, NASA/GSFC)

13-017   High Order Optimal Tracking Feedback Gain Sensitivity Calculations using Computational Differentiation
Ahmad Bani Younes, James Turner, John Junkins (Texas A&M)

SPECIAL PLENARY SPEAKER
4:00-5:00

Gentry Lee of Jet Propulsion Laboratory speaking to, "From Viking to Curiosity: Reflections on the Exploration of Mars"

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
Kristen Francis, Lockheed Martin Space Systems, kristen.francis@lmco.com, 303-971-7450
Meredith Larson, Ball Aerospace & Technologies Corp., mlarson@ball.com, 303-939-6759

SUNDAY, FEBRUARY 3RD

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 aims to highlight GN&C software from all aspects. *Note: Advance in hardware applications are covered in Session IV, Advances in GN&C Hardware.*

National Chairperson
Frank Chavez, Air Force Research Lab, frank.chavez@kirtland.af.mil
Jacob Griesbach, Applied Defense Solutions, jgriesbach@applieddefense.com

Local Chairpersons
Cheryl Walker, TASC, Cheryl.walker@tasc.com, 719-393-8487
Lee Barker, Lockheed Martin Space Systems, lee.a.barker@lmco.com, 408-742-4679

13-031   Understanding Model and Code Behavior for Stateflow Constructs
Will Campbell (Mathworks)

13-032   Impacts of micro debris on MICROSCOPE
Florence Genin (CNES)

13-033   Spacecraft Design Tool For Plug-N-Play Satellite Simulation And Test Bypass Control
Jacob Griesbach (Applied Defense Solutions)

13-034   Parallelization of Sigma-Point and Particle Filter Implementations of a GPS/INS Integration Problem
Haijun Shen (Analytical Mechanics Associates)

13-035   A Survey of Spacecraft Jet Selection Logic Algorithms
David Shoemaker (Lockheed Martin Space Systems)

13-036   Closed-Loop Testing of the ORION Rendezvous GNC Algorithms in the Space Operations Simulation Center
John Christian (NASA)

13-037   The Wide-Field Infrared Survey Explorer
Martha Kendall (Ball)

Session IV……………..…..7:00-10:00 AM

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. *Note: Advance in software applications are covered in Session III,*

Advances in GN&C Software.

National Chairperson

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

Jim Masciarelli, Ball Aerospace & Technologies Corp, jmasciar@ball.com, 303-939-5146
Daniel Motooka, Lockheed Martin Space Systems, daniel.k.motooka@lmco.com, 408-756-8294

13-041 **Turnkey CMG-based Momentum Control for Agile Spacecraft**
Brian Hamilton (Honeywell International)

13-042 **Design and Ground Test Results for the Lander Vision System**
Andrew Johnson, Chuck Bergh, Yang Cheng, Dan Clouse, Kim Gostelow, Keizo Ishikawa, Anup Katake, Ken Klaasen, Milan Mandic, MIshrahim Morales, Sung Park, Al Sirota, Gary Spiers, Nik Trawny, John Waters, Aron Wolf, Jason Zheng and Will Zheng (Jet Propulsion Laboratory, California Institute of Technology)

13-043 **SINPLEX: a Small Integrated Navigation System for Planetary Landers**
Stephen Steffes, Stephan Theil (DLR German Aerospace Center, Institute of Space Systems), Erik Laan, Murat Durkut, Tom Duivenvoorde (Dutch Organization for Applied Scientific Research (TNO)), Jan Schulte, Daniel Skaborn, Stefan Söderholm (Ångström Aerospace Corporation), Joris Berkhout, Marco Esposito, Simon Conticello (Cosine Research B.V.), Richard Visee, Bert Monna (SystematIC Design B.V.)

13-044 **European Control Moment Gyroscope: In-orbit Heritage**
Philippe Faucheux, Xavier Calmet

13-045 **18-68 Nms Range Reaction Wheels Performance at Moog Bradford**
E.J. van der Heide, R. Ferreira, P. van Put (Moog Bradford), P. Le (TU Eindhoven)

13-046 **HYDRA On-board SPOT-6**
Benoit Gelin, Antoine Lacroix, Damien Piot (Sodern), Pierre-Emmanuel Martinez (CNES), Stephen Airey (ESA-ESTEC)

Educational Workshop…10:30AM-1:00 PM
Presented by
The Math Works, Inc.

Model-Based Design of Satellite Dynamics: Discussion of the iterative process of analysis, design and optimization involved in the development and implementation of a satellite spin-stabilization control method. This seminar will investigate how to accelerate the modeling process, show how to design controllers with gain scheduling and fault management, explore how to handle design verification challenges, and will demonstrate hardware-in-the-loop (HIL) testing of the embedded controller by running the plant model in real-time.

Local Chairperson

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

Session V……………………2:00-4:00 PM

HUMAN SPACEFLIGHT GN&C

The recent rise in interest for and development of commercial crew vehicles creates a new paradigm in which governmental and commercial entities must cooperate and sometimes compromise on operational and safety practices for human spaceflight. GN&C plays an essential role in both these factors. This session aims to draw upon the extensive experience of the Shuttle program and the International Space Station (ISS), as well as explore new and innovative GN&C concepts applied to human spaceflight. Topics focus on level of automation for human spaceflight GN&C vs human-in-the-loop, recent experiences with commercial vehicles (crewed/non-crewed) requiring to dock with the ISS, commercial crew vehicle GN&C design and other related topics.

National Chairpersons

Douglas Zimpfer, Draper Laboratory, zimpfer@draper.com, 281-212-1102
Jack Brazzel, NASA Johnson Space Center, jack.p.brazzel@nasa.gov, 281-483-8232

Local Chairpersons

Laura Brower, Ball Aerospace & Technologies Corp, lbrower@ball.com, 303-939-5838
Jeff Parker, University of Colorado, parkerjs@colorado.edu, 303-492-7061

13-051 **Control Requirements to Support Manual Piloting Capability**
Nujoud Merancy, (Booz Allen Hamilton), Kay Chevray, Rodolfo Gonzalez, Jennifer Madsen (NASA/JSC)

13-052 **Atlas V Evolution for Human Spaceflight**
John G. Reed, Rick Mingee (ULA)

13-053 **Supporting Crewed Lunar Exploration with LiAISON Navigation**

Jason M. Leonard, Jeffrey S. Parker (University of Colorado/Boulder), Rodney L. Anderson (NASA/JPL), Ryan M. McGranaghan, Kohei Fujimoto, George H. Born (University of Colorado/Boulder)

13-054   Optimal Recursive Digital Filters for Active Bending Stabilization
Jeb S. Orr (Draper Lab)

13-055   Capabilities and Development of Dream Chaser Space Vehicle GN&C
Ernest E. Lagimoniere Jr., Russell Howard (Sierra Nevada), Gregg H. Barton (Draper Lab)

13-056   The Rendezvous Monitoring Display Capabilities of the Rendezvous and Proximity Operations Program
Christopher W. Foster, Jack P. Brazzel, Peter T. Spehar, Fred Clark, Erin Eldridge (NASA/JSC)

Session VI………………….2:00-4:00 PM

POSITIONING, NAVIGATION AND TIMING

Positioning, Navigation, and Timing (PNT) Assurance has become an important issue. Dependencies on PNT systems, such as the Global Positioning System (GPS) and other Global Navigation Satellite Systems (GNSS), are prolific throughout government, commercial business, and society today. GPS revolutionized military and commercial business, affecting everything from aviation flight safety and spacecraft, to cell phone technology and automobile navigation, to ship navigation and container tracking, to banking industry and cyber transactions. Assuring access to PNT has become a focus as threats to the signal environment increase. These threats range from unintentional threats of overuse of the spectrum where spread spectrum GNSS signals reside, to intentional threats from hostile jammers. Recent broadband initiatives by the US Government and LightSquared to look at licensing adjacent spectrum brought about considerable controversy regarding the assurance of PNT spectrum. This unclassified session is intended to discuss, from all perspectives, the lessons learned, applied design improvements and considerations towards assuring the viability of PNT in the present future. Open for discussion are 1) assurance mitigation strategies by the GPS/DoD for PNT delivery including new capabilities and signals, 2) possible new standards for future receiver development, and 3) user end receiver, filter, and antenna advances in GNSS technology to mitigate issues arising from a less quiet spectrum in the future.

National Chairpersons
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Mike Moreau, NASA Goddard Space Flight Center, michael.c.moreau@nasa.gov, 301-286-8382

Local Chairpersons
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Shawn McQuerry, Lockheed Martin Space Systems, shawn.c.mcquerry@lmco.com, 303-971-5264

13-061   First Use of Global Positioning System Metric Tracking for Launch Vehicle Tracking, John Reed (ULA)

13-062   SVN49 and its Space Service Volume, Willard Marquis (LMSSC)

13-063   GOES-R Use of GPS at GEO (Viceroy 4), Stephen Winkler, Chuck Voboril (LM), Roger Hart, Mike King (GD)

13-064   GOES-R Worst-Case GPS Constellation For Testing Navigation At Geosynchronous Orbit, Kristin Larson, Dave Gaylor (Emergent Space Technologies)

MONDAY, FEBRUARY 4TH

Session VII……………..…..…..7:00-10:00 AM

ENTRY, DESCENT AND LANDING FLIGHT DYNAMICS

The process of getting a spacecraft safely from the top of a planetary body's atmosphere to the surface is often one of the most challenging aspects of a given mission. Many factors must be accounted for including extreme heating environments, high deceleration loads, stability throughout many aerodynamic regimes, and landing site targeting. Demands for higher entry masses and velocities have continually pushed the envelope of our EDL capabilities, making this a very dynamic and interesting field. This session will explore the challenges of entry, descent, and landing by examining recent EDL experiences as well as current and future advancements in EDL strategies and technology.

National Chairpersons
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Prasun Desai, NASA Headquarters, prasun.n.desai@nasa.gov, 202-358-3755

Local Chairpersons
Scott Francis, Lockheed Martin Space Systems, scott.francis@lmco.com, 303-977-8253
Paul Graven, Cateni, paul@cateni.com, 310-245-4301

13-071 Evolution of Guidance, Navigation, and Control in Mars Entry, Descent, and Landing
Alejandro Miguel San Martin (Jet Propulsion Laboratory)

13-072 Blunt Body Dynamic Stability During Parachute Reefing Stages
Michael P. Hughes (Lockheed Martin Space Systems Company), Joe D. Gamble (MEI Technology, Inc.)

13-073 Apollo Final Phase Algorithm
Scott C. Jenkins (Draper Laboratory)

13-074 Descent and Landing Triggers for the Orion Multi-Purpose Crew Vehicle Exploration Flight Test-1
Brian D. Bihari (UTC Aerospace Systems), Charity J. Duke (Lockheed Martin Space Systems Company), Jeffrey D. Semrau (Honeywell Technology Systems, Inc.)

13-075 Dragon Entry, Descent, and Landing
Justin Richeson (Space Exploration Technologies)

13-076 ADAPT – A Closed-Loop Testbed for Next-Generation EDL GN&C Systems
MiMi Aung (Jet Propulsion Laboratory), Behcet Acikmese (University of Texas), Andrew E. Johnson, Martin W. Regehr , Jordi Casoliva, Swati Mohan, Aron A. Wolf (Jet Propulsion Laboratory), David Masten , Joel Scotkin (Masten Space System, Inc.)

13-077 ACS Performance of IRVE-3
Robert Dillman (NASA Langley Research Center), Valerie Gsell (NASA Langley Research Center), et al.

13-078 Mars Science Laboratory (MSL) Entry, Descent, and Landing Instrumentation (MEDLI): Hardware Performance and Data Reconstruction
Alan Little, Michelle M. Munk, Mark Schoenenberger, Chris Kuhl, Chuck Antill (NASA Langley Research Center), Ron Verhappen (SSAI), Chris Karlgaard, Prasad Kutty (Analytical Mechanics Associates, Inc.),

Deepak Bose (NASA Ames Research Center), Todd White (ERC, Inc.)

Session VIII……………………3:30-6:00 PM

GN&C BEYOND 2022

Order of magnitude improvements in the 2022 and beyond timeframe for guidance, navigation and control. Papers are solicited to discuss novel technologies and approaches that offer significant improvements over current systems in future decades. These can include new sensor technologies for star trackers, gyros, and accelerometers; new actuator technologies for momentum exchange devices, fast steering mirrors, and electric propulsion systems; new approaches to data fusion in order to estimate platform position, velocity and orientation; new applications for these improvements as well as challenging future environments such as GPS-denied conditions. Paper should concentrate on developments that are feasible in the 2022 and beyond timeframe.

National Chairpersons
Bryan Dorland, U.S. Naval Observatory, bdorland@usno.navy.mil, 202-762-0134
Tae Lim, U.S. Naval Academy, lim@usna.edu, 410-293-6527

Local Chairpersons
Kyle Miller, Ball Aerospace & Technologies Corp, kbmiller@ball.com, 303-533-4348
Michael Epstein, Lockheed Martin Space Systems, michael.d.epstein@lmco.com, 215-497-1382

13-081 Switched (TDS) Inertial Sensors as an Enabler for Next Generation Missions
D. Garber, W.Wimmer, K Easler, R. Dao, D. Jacobs, S. Abassi, M. Fralick, R.L. Waters

(Lumedyne Technologies)

13-082 The Role of X-rays in Future Space Navigation and Communication
Luke Winternitz, Munther Hassouneh, Jason Mitchell, Fotis Gavril, Zaven Arzoumanian, Keith Gendreau (NASA/GSFC)

13-083 Future Uses for Aerodynamic Force and Torque Vector Knowledge in Attitude Control and Orbital Stationkeeping
Charles Reynerson (GeoEye)

13-084 Draper Perspective on Future GN&C
Marvin Biren, Bradley Moran (Draper)

13-085 Fast Steering Mirrors for Spacecraft Slew, Settle, And Tracking Performance Enhancement
Tae Lim (US Naval Academy)

13-086 Navigation and Mission Design Technologies for Future Planetary Science Missions
Lincoln Wood, Laureano Cangahuala (NASA/JPL)

13-087 Looking Back at Predicted Advances in GNC from 1999
Frank Bauer, Neil Dennehy (NASA/GSFC)

BANQUET ACTIVITIES
SOCIAL HOUR……………..6-7 PM
DINNER………….…………7-9 PM
DINNER SPEAKER…………..8-9 PM

Thomas J. "Dr. Colorado" Noel, Ph.D.

Professor of History and Director of Public History, Preservation & Colorado Studies at University of Colorado Denver

Speaking on:

TUESDAY, FEBRUARY 5TH

Session IX………..………..…..7:00-10:00 AM

GN&C OPERATIONS AROUND ASTEROIDS AND COMMETS

Over the last two decades, multiple countries have engaged on missions to develop and fly spacecraft that explore small solar system bodies, including asteroids and comets. These efforts have revealed successful approaches and operational challenges for GNC around small bodies. Robust GNC includes mission design and autonomy to accommodate long round-trip light times, chaotic trajectories around distended shapes, precision navigation accuracies to meet science data needs, and spacecraft control when contacting a surface. Through participation of NASA, JAXA, and ESA representatives, this session will provide a setting for international collaboration to explore the progress in trying to meet these challenges, paving the way for future success in humankind's exploration of asteroids and comets.

National Chairpersons
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Local Chairpersons
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Alex May, Lockheed Martin Space Systems, alexander.j.may@lmco.com; 303-977-6620

13-091 **ESA's Rosetta comet mission: Close proximity operations at comet 67P/Churyumov-Gerasimenko and landing Philae**
J. Biele, S. Ulamec (DLR), E. Jurado, E. Canalias, A. Blazquez (CNES), M. Küppers, B. Grieger (ESA)

13-092 **Advanced GNC technologies for approach and proximity operations in missions to small bodies**
J. Gil-Fernandez, T. Prieto, M. di Domenico (GMV), D. Agnolon, I. Huertas (ESA-ESTEC)

13-093 **GN&C for MARCO POLO-R and Moons of Mars Sample Return Missions: System Design, Critical Technologies and Synergy**
D. Gherardi, D. Agnolon, D. Rebuffat (ESA-ESTEC), M. Chapuy, L. Peacocke (Astrium), F. Cometto, G. Bruno Amata (Thales Alenia Space), F. Cacciatore (Elecnor Deimos)

13-094 **GN&C of Hayabusa 2 in Proximity of an Asteroid**
F. Terui, N. Ogawa, Y. Mimasu (JAXA), M. Uo (NEC)

13-095 **OSIRIS-REx Touch-And-Go (TAG) Mission Design and Analysis**
K. Berry, M. Beckman, B. Barbee (NASA GSFC), B. Sutter, A. May (LM), K. Williams, B. Williams (KinetX)

13-096 **Spacecraft Flight Dispersion Envelopes for Passively-Controlled Touch-and-Go Comet Sample Return Missions**
J. Aldrich, B. Acikmese, M. Mandic, D. Bayard (NASA JPL)

13-097 **Payload Use and Close Proximity Operations at Near Earth Asteroids**
J. Bellerose, A. Colaprete, D. Andrews (NASA Ames), P. Miotto, L. Singh (Draper), S. Warwick (NG)

Session X……………..………4:00-7:00 PM

RENDEZVOUS, PROXIMITY OPERATIONS AND DOCKING

Increasingly autonomous capability in rendezvous, proximity operations, and docking (RPOD) of space assets will be required for future robotic and human exploration missions. Applications range broadly, including in-space assembly and disassembly, satellite servicing, robotic inspection, proximity operations about Primitive Bodies and Near Earth Objects, and planetary sample return. RPOD is a system capability enhanced by innovative system-level as well as component-level technology advancements. This session explores current and future applications, state of the art and advancement of related technologies for RPOD.

National Chairpersons
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Local Chairpersons
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Joel Nelson, Ball Aerospace & Technologies
Corp, jnelson@ball.com, 303-533-4092

13-101   **Gyro-Aided Vision-Based Relative POSE Estimation for Autonomous Rendeviys and Docking**
Vaibhav Ghadiok (University of California Riverside), Jeremy Goldin (Hanscom Air Force Base), and David Geller (Utah State University)

13-102   **Advanced 3D Sensing, Algorithms and Computer Architectures to**

Enable Simultaneous Mapping, Close Proximity GNC and Robotic Space Operations
Manoranjan Majji (University at Buffalo) and Dan Junkins (Texas A&M)

13-103   **Hardware In the Loop Validation of GNC for RvD/RvC Scenarios**
Pablo Colmenarejo and Valentín Barrena (GMV Aerospace & Defense)

13-104   **Pose Determination Using Only 3D Range Images from the STORRM Mission**
Reuben R. Rohrschneider and William Tandy (Ball Aerospace & Technologies Corp.)

13-105   **Rendezvous, Proximity Operations & Docking/Mating Technologies for On-Orbit Servicing**
Andrew Allen, John Lymer, Cameron Ower, and Dan King (MDA Canada)

13-106   **Catching a Dragon by the Tail: SpaceX Dragon Proximity Operations with the International Space Station**
Paul Wooster, Andrew Howard, Mark Peretich (Space-X)

Session XI…………..………4:00-7:00 PM

NESTED CONTROL LOOPS LEVERAGING PAYLOAD CAPABILITIES

Traditional spacecraft attitude control systems may at times be supplemented by high-precision capabilities inherent in their payloads. The use of scan mirrors, steering mirrors, narrow-field focal planes, or other features built-in to the payload instruments may be used to provide much higher pointing precision and/or agility than can be done cost-effectively at the vehicle level. This session explores the issues encountered and capabilities afforded by these types of nested control systems in past, present, and future missions.

National Chairpersons
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Doug Freesland, ACS Engineering, Douglas.C.Freesland@nasa.gov, 301-286-4951

Gianfranco Sechi, ESA TEC-ECC, Gianfranco.Sechi@esa.int, +31 (0) 71 565 5718

Local Chairpersons
Jim Chapel, Lockheed Martin Space Systems, jim.d.chapel@lmco.com, 303-977-9462
Bill Frazier, Ball Aerospace & Technologies Corp., wfrazier@ball.com, 303-939-4985

13-111   **Two-Stage Control Analysis and Design for High-Precision Pointing on ExoplanetSat**
Christopher Pong (MIT), Kuo-Chia Liu (NASA/GSFC), David Miller and Sara Seager (MIT)

13-112   **Orbit and Attitude Control for Gravimetry Drag-Free Satellites**
Enrico Canuto & Andrès Molano Jimenez (Politecnico di Torino), Marcello Buonocore (Thales Alenia)

13-113   **GOES-R Advanced Baseline Imager Precise Pointing Control and Image Collection**
David Igli (ITT Exelis Geospatial Systems)

13-114   **High Frequency Measurement of Spacecraft Pointing Using the HiRISE Camera**
Alan Delamere (Delamere Space Sciences), Alfred McEwen, Sarah Matson, Audrie Fennama (University of Arizona), Randolph Kirk (USGS), Jim Chapel (Lockheed Martin)

13-115   **Trading Active Payload Pointing with Spacecraft Bus Agility**
Tim Hindle, Brett McMickell, Brian Hamilton (Honeywell)

13-116   **The OpTIIX Pointing Control System**
Paul Brugarolas, Jim Alexander, David Bayard, Dhemetrios Boussalis, Ed Litty, Glenn Macala, Swati Mohan, Scott Ploen, Zahidul Rahman, Matt Wette (NASA/Jet Propulsion Lab)

13-117   **Stratospheric Balloon-borne Telescope Modeling and Precision-Pointing Control**
Jack Aldrich, Paul Brugarolas, James Lanzi, David Stuchlik, Wes Traub, Steve Unwin (NASA/Jet Propulsion Lab)

13-118   **Flight Demonstration of a Balloon Borne Arc-Second Pointing System**
R. James Lanzi, Brett T. Vincent, and David W. Stuchlik (NASA/Wallops Flight Facility)

WEDNESDAY, FEBRUARY 6TH

Session XII……………..……7:00-10:00 AM

RECENT EXPERIENCES

Lessons learned through experience prove most valuable when shared with others in the GN&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.

National Chairpersons

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Local Chairpersons

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Steve Jolly, Lockheed Martin Space Systems, steven.d.jolly@lmco.com, 303-971-6759

13-121 **Formation Flight Attitude Control Approach and Operations Results of the NASA GRAIL Spacecraft** Christine Edwards-Stewart, Dave Eckart, Ryan Olds, Thomas Kennedy (Lockheed Martin Space Systems)

13-122 **Attitude Control Activities During Commissioning of the Twin RBSP Spacecraft**
G.D. Rogers, J. H. Wirzburger, M. N. Kirk, A. M. Fosbury, R. M. Vaughan, (The Johns Hopkins University Applied Physics Laboratory)

13-123 **MSL EDL Development Challenges and Preliminary Flight Performance** Adam Steltzner (JPL)

13-124 **Recovering Cloudsat to Active Operations** Ian Gravseth (Ball)

13-125 **Odyssey Preparation for and Role in Curiosity Entry, Descent and Landing with focus on Attitude Selection**
Noel Hughes (Lockheed Martin Space Systems)

13-126 **In-Orbit Results of Telecomm Satellite Propulsion Monitoring**
J. Maureau, C. Fallet (CentreNational d'Etudes Spatiales)

13-127 **JUNO Deep Space Maneuvers**
Jay St. Pierre, Kristin Francis (Lockheed Martin Space Systems)