

PROGRAM

44th ANNUAL AAS GUIDANCE, NAVIGATION & CONTROL CONFERENCE

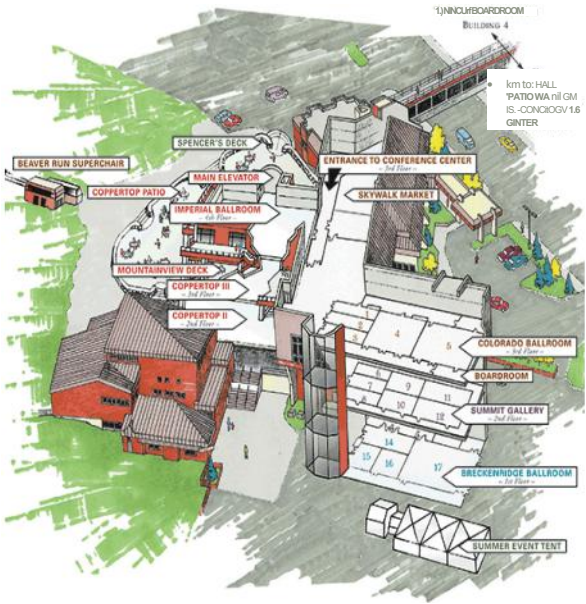
February 4th to
February 9th, 2022



Conference Location

BEAVER RUN CONFERENCE CENTER Breckenridge, Colorado

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

Registration Questions

Michelle Barath 303-887-7724

Amy Delay 303-731-9876

44th Annual AAS Guidance, Navigation & Control Conference Chairperson

Matt Sandnas

SEAKR Engineering, LLC

602-284-7341

matt.sandnas@seakr.com

Wi-Fi Access

Select “[Beaver Run Meeting](#)” wireless network.

Open a browser window

Enter voucher code: [AAS2022](#)

Conference Website

<https://aas-rocky-mountain-section.org/>

**Online Program and Pre-print Paper
Access read-only**

[2022 AAS - Rocky Mountain GN&C
Conference xcdsystem.com](https://2022.aas-rocky-mountain-section.org/)



QR Code for Online Program

Conference Schedule Overview

Friday February 4th

Conference Registration	5 – 8 pm
Welcome Reception	6 – 9 pm

Saturday February 5th

Breakfast	6:15 – 7 am
Morning Session	7 – 10 am
Tutorial	10 am - 11:30 am
NASA Astronaut for Children	4 – 5 pm
Technical Exhibits	5 – 8 pm

Sunday February 6th

Breakfast	6:15 – 7:00 am
Morning Session	7 – 10:30 am
Poster Session Break	8:30 – 9 am
Afternoon Session	4 – 7 pm
Casino Night	7:30 pm

Monday February 7th

Breakfast	6:15 – 7:00 am
Morning Session	7 – 10:30 am
Poster Session Break	8:30 – 9 am
Tutorial (w/ break for lunch)	10:30 am – 3 pm
Afternoon Session	4 – 7 pm
Diversity, Equity, and Inclusion (DEI) Event	7:30 - 8:30 pm

Tuesday February 8th

Breakfast	6:15 – 7:00 am
Morning Session	7 – 10:30 am
Poster Session Break	8:30 – 9 am
Tutorial (w/ break for lunch)	10:30 am - 3 pm
Afternoon Session	4 – 7 pm

Wednesday February 9th

Breakfast	6:15 – 7 am
Morning Session	7 – 10:30 am

**SATURDAY, FEBRUARY 5TH
7AM CONFERENCE OPENING**

STUDENT INNOVATIONS IN GN&C

Session 01 Saturday 07:00 - 10:00 AM

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. The session will be limited to 8 papers with the top 3 papers receiving monetary awards.

National Chairpersons

David Geller, Utah State University

david.geller@usu.edu

Luke Sauter, USAF/DFAS

luke.sauter@usafa.edu

Local Chairpersons

David Chart, Sierra Nevada Corp

david.chart@sncorp.com

Ian Gravseth, Ball Aerospace

Ian.Gravseth@ballaerospace.com



Tutorial

Real-Time Testing & Hardware-in-the-Loop with MATLAB/Simulink

10:00am-11:30am

This session will demonstrate the use of real-time simulation for test and evaluation of GN&C systems. Hardware-in-the-loop is one of the most realistic testing techniques prior to deployment, which can be done at the system or subcomponent level. We will present an approach for performing real-time tests directly from models in Simulink with Simulink Real-Time, and connect these tests to hardware for realistic functional testing of GN&C.

Special Event for Children of Conference Attendees at 4 PM

Imperial Ballroom

NASA Astronaut, Steven Lindsey

This presentation will inspire our next generation of engineers by offering kids the opportunity to interact with an astronaut who flew three STS missions!

TECHNICAL EXHIBITS

Saturday 5:00 PM – 7:00 PM

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, and include 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

Graeme Ramsey, Lockheed Martin Space

graeme.d.ramsey@lmco.com

Andrew Riskus, Ball Aerospace

andrew.riskus@ballaerospace.com

Exhibitors

Advanced Space	NewSpace Systems
Ball Aerospace	Redwire
General Atomics	SEAKR
Jena-Optronik GmbH	Sierra Space
Lockheed Martin	Sodern
MathWorks	Space Research at
Mclaurin Aerospace	LASR Lab, Texas
Moog Broad Reach	A&M
MSAC – Un. of Illinois	Space Dynamics
NanoAvionics	Laboratory: Utah St

**SUNDAY, FEBRUARY 6TH
TRIPLE MORNING SESSIONS**

**EXPLORING FRONTIERS –
THE MOON AND MARS**

Session 02

Sunday 07:00 - 10:30 AM

In recent years, the exploration and habitation of both the Lunar surface and Mars has become popularized in the commercial and private aerospace communities. With the Moon as the closest celestial body, and Mars as the closest and most hospitable planet near Earth, they are the most obvious next steps in human space exploration. Exploring both bodies poses a unique set of challenges in navigation, entry into a highly variable atmosphere, radiation resistance, and autonomous exploration. This session will explore the difficulties present in exploring the Moon and Mars and the innovative GN&C technologies and spacecraft operations that will aid in the manned and unmanned exploration of these bodies.

National Chairpersons

Robyn Woollands, University of Illinois at Urbana-Champaign

rmw@illinois.edu

Local Chairpersons

Cody Griffin, Sierra Nevada Corp

cody.griffin@sncorp.com

Hank Steadman, Lockheed Martin Space

harrison.steadman@lmco.com



ADVANCES IN GN&C HARDWARE

Session 03

Sunday 07:00 - 10:30 AM

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 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.

National Chairpersons

Scott Cryan, NASA Johnson Space Center

scott.p.cryan@nasa.gov

Steeve Kowaltschek, European Space Agency

steeve.kowaltschek@esa.int

Local Chairpersons

Vasili Kamtsioras, Ball Aerospace

Vasili.Kamtsioras@ballaerospace.com

Jim Russell, Lockheed Martin Space

james.f.russell@lmco.com



USING AI/ML IN GN&C

Session 04 Sunday 07:00 AM - 10:30 AM

As Guidance, Navigation and Control algorithms become increasingly autonomous, there is a natural progression towards incorporating cutting edge Artificial Intelligence, AI Machine Learning, ML technologies into the capabilities of today's autonomous systems. When combined with established systems and control theory, AI and ML algorithms can harness the wealth of information available from data obtained by sensors and cyberphysical systems over time. This session will highlight research and demonstrations focused on the theory and methods of learning, control, and computational intelligence for GN&C systems. Some example topics for this session include novel applications of AI systems in traditional GN&C systems, performance comparisons between classical GN&C methods and ones that leverage AI or ML, and demonstrations of design and/or test of GN&C systems that utilize ML.

National Chairpersons

Christoffer Heckman, University of Colorado at Boulder

Christoffer.Heckman@colorado.edu

Local Chairpersons

Kip Gwin, Ball Aerospace

Kip.Gwin@ballaerospace.com

Morgan Yost, Lockheed Martin

morgan.yost@lmco.com



POSTER SESSION BREAKS

**Sunday, Monday, & Tuesday
8:30-9:00 AM**

Jim Russell, Lockheed Martin Space
james.f.russell@lmco.com

Graeme Ramsey, Lockheed Martin Space
graeme.d.ramsey@lmco.com

Focused poster session breaks will take place with unique posters displayed in the main foyer and attended Sunday, Monday and Tuesday, allowing the poster presenters to interact with the attendees one-on-one or in small groups. Each poster will be in a focused session one of these days. The posters not in the focus session each day will be on display in the hallway but not attended.

FUTURE DIRECTIONS FOR GN&C TECHNOLOGY

Session 05

Sunday 04:00 - 07:00 PM

In the 1990's the space community mantra was "Faster, Better, Cheaper, FBC", but the common perception was one had to pick two out of the three attributes. Some FBC-based mission failures left the space community with a negative overall impression. With advances in computing, algorithms, technologies, and miniaturization, etc. is it a reasonable proposition to reconsider all three FBC mission attributes simultaneously? Space agencies including NASA, DoD, ESA and commercial space entities create roadmaps for their advanced GN&C technologies to systematically and strategically plan their investments. These agencies also perform parallel studies and analyses of technological readiness and programmatic feasibility as part of their formulation process for ambitious future mission concepts. This session presents the opportunity to step back and get a 30,000 ft view of GN&C's future and to highlight the impact of advances in technology on new mission applications. Papers may include GN&C technology roadmaps, future roles and mission concepts, mission performance and operational drivers, new alternative business practices, and their inter-relationships.

National Chairpersons

Neil Dennehy, NASA Engineering & Safety Ctr

cornelius.j.dennehy@nasa.gov

Tooraj Kia, NASA Jet Propulsion Laboratory

tooraj.kia@jpl.nasa.gov

Local Chairpersons

Lee Barker, Lockheed Martin Corporation

lee.a.barker@lmco.com



Social Event

Casino Night

Sunday 7:30pm – 9:30pm
Breckenridge Ballroom

Brought to you by Casino Party USA

- 2x Roulette
- 2x Craps
- 3x Blackjack
- 3x Texas Hold'em
- 4x Slot Machines

Family Members of conference attendees are welcome! (However only conference attendees are eligible for prizes; family members cannot compile chips with attendee)

PRIZES! Chips will be exchanged for raffle tickets at the end of the event (9:30) with prize winners determined in the following 15 minutes. Prizes include a Breckenridge Ski Day Pass, AAS Pint Glasses, and more.

A light dinner buffet will be provided.

**MONDAY, FEBRUARY 7th
TRIPLE MORNING SESSIONS**

**HUMAN SPACEFLIGHT/DEEP SPACE
GATEWAY**

Session 06

Monday 07:00 - 10:30 AM

NASA and its commercial and international partners strive to bring astronauts to new Lunar, asteroid and Martian destinations, increasingly new and innovative GN&C technologies will be required to transport and deliver crews and return them safely to the Earth. There is an increased urgency with the United States expressed goal to land the first woman and next man on the surface of the Moon by 2024. Orion and Space Launch System, SLS programs approach their final stages of development, new systems such as the Deep Space Gateway and Lunar Landers are being developed as the next steps to reach Mars in the coming decades. This session explores key advancements in automation, guidance, navigation and Fault Detection/Isolation, FDI technologies which will ultimately enable human exploration onto lunar bases and beyond.

National Chairpersons

David Dannemiller, NASA Johnson Space Center

david.p.dannemiller@nasa.gov

Local Chairpersons

Harvey Mamich, Lockheed Martin

harvey.r.mamich@lmco.com

Zach Yearout, Left Hand Design Corporation

zyearout@lefthand.com



ADVANCES IN NAVIGATION

Session 07

Monday 07:00 - 10:30 AM

Recent advances in navigation seek to push the boundaries of spacecraft navigation technology and address the shortcomings of current navigation systems. With the prospect of deploying large-scale constellations in the Earth orbit and the need for maintaining a safe orbital environment for all operators, new navigation techniques and robust architectures are required to complement the existing ground-based and GNSS systems. Other future lunar, interplanetary, and interstellar mission concepts require novel ways for collecting and processing observations from non-traditional sources. In this session, we will explore novel and advanced ground-based, space-based, and autonomous spacecraft navigation approaches. Of particular interest are methods for inter-satellite navigation and lost-in-space scenarios as well as new filtering techniques for processing optical observations, pulsar observations, and other deep space signals of opportunity. As the world continues to work towards expanded lunar exploration and long-term habitation, new techniques, algorithms, and technology are needed to enable in-situ autonomous exploration in cislunar space.

National Chairpersons

Evan Anzalone, NASA Marshall Space Flt Center

evan.j.anzalone@nasa.gov

Joel Parker, NASA Goddard Space Flight Center

joel.j.k.parker@nasa.gov

Local Chairpersons

Drew Engelmann, LASP

drew.engelmann@lasp.colorado.edu

Erin Griggs, Trusted Space, Inc.

erin.griggs@trustedspace.com



ADVANCES IN GN&C SOFTWARE

Session 08

Monday 07:00 - 10:30 AM

Successful GN&C system performance is often dependent on innovative software. This session is open to all development processes and systems ranging from vehicle code used to operate the spacecraft system, ground software used for operations/analysis, or simulations/frameworks used to test, validate or develop GN&C systems. The intent is to include current best practices as well as challenges in future software development such as the inclusion of complex systems like artificial intelligence, machine learning, vision processing, and iterative numerical solvers.

National Chairpersons

Paul Graven, Cateni

paul@graven.com

Local Chairpersons

Brian Bauer, Ball

Brian.Bauer@ballaerospace.com

Scott Piggott, Laboratory for Atmospheric and Space Physics

scott.Piggott@lasp.colorado.edu



Tutorial

Convex Optimization-Based Trajectory Generation

Part I 10:30am-12pm

Lunch Break 12-1pm

(lunch is not provided)

Part II 1-3pm

Reliable and efficient trajectory generation methods are a fundamental need for the envisioned autonomous aerospace vehicle systems of the future. The objective of this 3-hour tutorial is to provide an overview for practicing GN&C engineers of two major convex optimization-based trajectory generation methods. The first will be a lossless convexification algorithm (LCvx) for global optimality. The second will be sequential convex programming algorithm (SCvx) in which the solution to a sequence of convex problems converges to a feasible solution for coupled non-convex state/control constraints for local optimality.

**MONDAY, FEBRUARY 7th
TRIPLE EVENING SESSIONS**

ADVANCES IN PROPULSION

Session 09

Monday 4:00 - 7:00 PM

The development of advanced propulsion technologies is critical for enabling spacecraft platforms ranging from CubeSats to ambitious human and robotic space exploration missions. Innovative developments in chemical, electric, nuclear, and propellantless propulsion will provide higher performance and greater operability, enabling new approaches ranging from launch to interstellar travel. This session will highlight advanced propulsion technologies and enabling subsystems matured by NASA, DOD, industry, and academia.

National Chairpersons

Jeffrey Sheehy, NASA

jeffrey.sheehy@nasa.gov

Marcus Young, Air Force Research Laboratory

marcus.young.4@us.af.mil

Local Chairpersons

John Abrams, Analytical Mechanics Associates,
AMA

j.abrams@ama-inc.com

Jeff Parker, Advanced Space, LLC

parker@advancedspace.com



ENTRY, DESCENT & LANDING GN&C

Session 10

Monday 4:00 - 7:00 PM

Entry, descent, and landing technologies enable surface exploration of celestial bodies and the safe return of payloads to Earth. Recent advances in powered flight guidance and in atmospheric entry systems have improved landed mass capability to Mars, and has made the reuse of launch vehicle first stages commonplace on Earth. Continued advancements through the collaboration of government, industry and academia will enable even more ambitious capabilities and missions in the future. This session provides a venue for discussing advanced hypersonic entry vehicles, coupled with guidance, navigation and control technologies for powered and unpowered descent and landing systems. Topics include precision navigation and targeting, novel guidance and control methodologies, hazard avoidance, and controlled landings.

National Chairpersons

Henry Cordova, NASA Johnson Space Center

henry.s.cordova@nasa.gov

Sam W. Thurman, California Institute of
Technology

sam.w.thurman@jpl.nasa.gov

Local Chairpersons

Jim Chapel, Lockheed Martin Space

jim.d.chapel@lmco.com

Ernie Lagimoniere, Sierra Space

ernie.lagimoniere@sncorp.com



IMAGE PROCESSING FOR NAVIGATION

Session 11

Monday 4:00 - 07:00 PM

Image Processing, IP is a critical step in many GN&C and ADCS algorithms, including attitude determination from star cameras and optical navigation from imaging sensors. Applications occur in various mission phases including interplanetary cruise, planetary orbit, proximity operations, descent and landing, and surface operations. An image from a visible, IR, LIDAR, or similar sensor can offer a wealth of information about a space vehicle's navigation state, but this information must be distilled into measurements that can be ingested by a navigation algorithm. Therefore, the success of algorithms which rely on image data depends on how effectively these algorithms perform IP---defined here as the process of extracting the salient pieces of information from an image in the presence of noise, clutter, and other real-world issues. This session is dedicated to papers that explore the relationship between IP algorithms and the broader problem of GN&C. Topics include IP algorithms; feedback/feedforward between IP and GN&C; hosting platforms/architectures between CPUs, FPGAs, GPUs and other processing units; challenges with on-board real-time IP; on-board rendering; testing, verification and validation of IP algorithms; and lessons learned from past experiences.

National Chairpersons

Nikolas Trawny, NASA/JPL
nikolas.trawny@jpl.nasa.gov



Local Chairpersons

Ellis King, Lockheed Martin Space
ellis.king@lmco.com

Michael Osborne, Lockheed Martin Space
michael.l.osborne@lmco.com

Social Event

**Diversity, Equity, and Inclusion (DEI)
Cocktail Hour**

Monday 7:30pm – 8:30pm

Come join your GN&C colleagues for a networking and panel session. This event will focus on the future of the GN&C workforce and what is needed to develop a strong workforce, today and in the future. Audience questions are encouraged.

Heavy appetizers will be served.

TUESDAY, FEBRUARY 8th
TRIPLE MORNING SESSIONS

SMALL SAT GN&C

Session 12

Tuesday 7:00 - 10:30 AM

In recent years, small satellites including NanoSats and CubeSats have seen greater use for a range of applications in government, commercial, and educational sectors. At the high end of this mass range, ESPA-class spacecraft are now trusted platforms for scientific and defense missions. These missions require advanced technology insertion, GN&C, on-board processing while advancing manufacturing practices to achieve higher production rates. Some key challenges related to increasing production volume include: supply-chain management, automated production and testing, and design for manufacturing approaches. This session is open to papers covering advanced technology insertion on small sats, e.g. propulsion, optical communications, proximity operations, drag sails, etc., advanced manufacturing practices, e.g. best practices for satellite production, automation and design for manufacturing. Papers on practical mission experience in these areas are welcomed.

National Chairpersons

Jason Everett, NASA Marshall Space Flight Center

jason.m.everett@nasa.gov

Scott Palo, University of Colorado at Boulder

palo@colorado.edu

Local Chairpersons

Bruce Rabalais, Blue Canyon Technology

brabalais@bluecanyontech.com

DeAnn Redlin Sanders, Blue Origin

deann.sanders@gmail.com



SMALL BODY EXPLORATION

Session 13

Tuesday 7:00 - 10:30 AM

Recent years have seen an amazing array of planetary exploration missions to asteroids, comets, and other small solar system objects, with several new missions in various phases of development. This has led to the practical application of innovations in optical navigation, sensors, modeling, and autonomy that are essential to accomplish demanding mission objectives, such as characterizing the small body after arrival, operating in a micro-gravity environment, and in some cases navigating to the surface. This session solicits GN&C experiences, successes, lessons learned, and future challenges associated with the exploration of asteroids, comets, and other small bodies, and how these GN&C capabilities may be applied to other exploration applications.

National Chairpersons

Coralie Adam, KinetX, Inc.

coralie.adam@kinetx.com

Jay McMahon, CCAR, Colorado Center for
Astrodynamics Research

jay.mcmahon@colorado.edu

Local Chairpersons

Dan Kubitschek, Univ of Colorado-LASP

daniel.kubitschek@lasp.colorado.edu

Alexander May, Lockheed Martin

alexander.j.may@lmco.com



AUTONOMOUS CONTROL OF MULTIPLE SPACECRAFT

Session 14

Tuesday 7:00 - 10:30 AM

Satellite constellations are nothing new, but the sizes, scales and configurations of modern Distributed Satellite Systems, DSS are reaching unprecedented levels of scope and complexity. These configurations include constellations, swarms and various fractionated architectures. Recent demonstrations of these DSS systems show that handling the planning, coordination and operations associated with large-scale constellations is a critical logistical problem that must be addressed for continued effective application of these systems. In addition to the logistical challenges, large and small multi-spacecraft systems must also work through operational complexities such as autonomy, formation flying, fractionation, docking, structural assembly, tethering, station keeping for sparse aperture configurations and on-orbit servicing and reconfiguration. Some key system and subsystem challenges for DSS include: formation control, rendezvous management, expanded autonomous control, on-orbit calibration, station keeping, space traffic management, and human-interfacing with the DSS. Any and all papers related to these topics are welcome.

National Chairpersons

Hanspeter Schaub, CCAR, Colorado Center for
Astrodynamics Research

hanspeter.schaub@colorado.edu

Jekan Thangavelautham, University of Arizona

jekan@arizona.edu

Local Chairpersons

Kevin Goettsche, Ball Aerospace

kevin.goettsche@ballaerospace.com

Tom Knight, Sierra Nevada Corp

tom.knight@sncorp.com

Chris Pumford, Ball Aerospace

chris.pumford@ballaerospace.com



Tutorial

Mathworks – Hands on Machine Learning as Applied to GN&C

Part I 10:30am-12pm

Lunch Break 12-1pm

(lunch is not provided)

Part II 1-3pm

The adoption of machine learning and deep learning for AI based workflows in aerospace applications is increasing. In this session, through hands-on and code-along exercises, you will be introduced to a deep learning workflow in MATLAB that can be used for relative navigation, or other object detection or classification problems. The session will cover the full workflow from image pre-processing to deploying the deep learning algorithms on hardware.

Participants should bring their own laptops (chargers are also recommended) in order to participate in the hands-on exercises. Licenses to MATLAB Online for the session will be provided by MathWorks. We recommend installing the Chrome browser to ensure the best compatibility.

**TUESDAY, FEBRUARY 8TH
TRIPLE EVENING SESSIONS**

**HIGH-PERFORMANCE POINTING
MISSIONS**

Session 15 Tuesday 4:00 PM - 7:00 PM

NASA and other space agencies have ambitious plans for new space-based observatories which will investigate long-standing astronomical mysteries, such as the force behind the universe's expansion, dark energy, and the search for distant planets beyond our solar system. Scientists and engineers will closely collaborate on building these powerful observatories to accomplish "civilization-class science" goals. Providing high performance pointing control systems will be a fundamental challenge for GN&C engineers. This is especially true for those observatories hosting extremely sensitive optical sensor payloads with stringent requirements on allowable line-of-sight pointing / pointing stability /jitter errors and/or wavefront error. In this session examples of mission requiring high performance pointing missions with demanding GN&C engineering challenges will be introduced and described. Papers describing the process of precision pointing system analysis, modeling, simulation, ground testing, and in-flight testing are sought for presentation. Observatory architectural approaches for minimizing the impact of on-board disturbances, e.g., reaction wheels, instrument cryocoolers, appendage drive mechanisms, etc. on pointing/pointing stability/jitter are of prime interest. Modeling uncertainty and the ways in which ground testing can reduce that uncertainty are topics of interest as well, as are active or passive disturbance isolation systems.

National Chairpersons

Oscar Alvarez-Salazar, NASA Jet Propulsion Lab
oscar.s.alvarez-salazar@jpl.nasa.gov

Neil Dennehy, NASA Engineering and Safety Ctr
cornelius.j.dennehy@nasa.gov

Local Chairpersons

Lee Barker, Lockheed Martin Corporation
lee.a.barker@lmco.com

Drew Engelmann, LASP
drew.engelmann@lasp.colorado.edu



RESULTS AND EXPERIENCES FROM OSIRIS-REX

Session 16

Tuesday 4:00 - 07:00 PM

NASA's Origins, Spectral Interpretation, Resource Identification, and Security-Regolith Explorer, OSIRIS-REx mission successfully collected a sample of regolith from near-Earth asteroid Bennu in October 2020. In the year leading up to the dramatic sample collection, the spacecraft completed detailed reconnaissance passes of the final four candidate TAG sites, conducting flybys within 200 meters of the surface, and conducted a series of rehearsals for the sample collection event. Following successful stow of the sample canister in the sample return capsule, the spacecraft conducted a final flyby of Bennu to survey the sample collection site in April 2021, and performed a maneuver to depart Bennu and start the return to Earth in May. This session will include flight performance results leading up to and following the successful sample collection, and other analysis in preparation for returning the sample safely to Earth.

National Chairpersons

Dolan Highsmith, The Aerospace Corporation

Dolan.E.Highsmith@aero.org

Michael Moreau, NASA Goddard Space Flight Center

michael.c.moreau@nasa.gov

Local Chairpersons

Dan Kubitschek, Univ of Colorado-LASP

daniel.kubitschek@lasp.colorado.edu

Alexander May, Lockheed Martin

alexander.j.may@lmco.com



AUTONOMOUS RPOD, SERVICING, COLLISION AVOIDANCE

Session 17

Tuesday 4:00 - 07:00 PM

With each passing year, the utilization of space and complexity of systems continues to grow at an ever-increasing rate. Autonomous rendezvous, proximity operations, and docking are key enablers to supporting our key objectives such as maintaining the International Space Station or placing boots on the lunar surface again. Additionally, there is continued interest in the commercial servicing of existing spacecraft and removing orbital debris. This session explores all aspects of enabling technologies for Navigation, Guidance and Control, Computer Vision, Robotics, and Safety of Flight to support this class of missions.

National Chairpersons

Jack Brazzel, NASA Johnson Space Center

jack.brazzel@nasa.gov

Islam Hussein, Trusted Space, Inc.

Islam.Hussein@trustedspace.com

Local Chairpersons

Ellis King, Lockheed Martin Space

ellis.king@lmco.com

Melissa Sampson, Ball Aerospace

melissa.sampson@ballaerospace.com



RECENT EXPERIENCES

Session 18 Wednesday 7:00 - 10:00 AM

This session focuses on recent experiences in spaceflight GN&C, providing a forum to share insights gained through successes and failures. Discussions typically 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

Kurt Cavalieri, Sandia National Laboratories
kauresc@sandia.gov

David Dannemiller, NASA Johnson Space Ctr
david.p.dannemiller@nasa.gov

William E. Frazier, Jet Propulsion Laboratory
william.e.frazier@jpl.nasa.gov

Local Chairpersons

Heidi Hallowell, Ball Aerospace
Heidi.Hallowell@ballaerospace.com

Jastesh Sud, Lockheed Martin
jastesh.sud@lmco.com



NOTES:

2022 Planning Committee:

Amy Delay	Lockheed Martin Space
Alex May	Lockheed Martin Space
Alex May	Lockheed Martin Space
Andrew Riskus	Ball Aerospace
Brian Bauer	Ball Aerospace
Bruce Rabalais	Blue Canyon Technology
Cheryl Walker	Parsons
Christine Pumford	Ball Aerospace
Cody Griffin	Sierra Nevada Corp
Dan Kubitschek	Univ of Colorado-LASP
David Chart	Sierra Nevada Corp
Davin Swanson	Raytheon
DeAnn Redlin Sanders	Draper
Drew Engelmann	Univ of Colorado-LASP
Ellis King	Lockheed Martin Space
Erin Griggs	Trusted Space
Ernie Lagimoniere	Sierra Nevada Corp
Graeme Ramsey	Lockheed Martin Space
Hank Steadman	Lockheed Martin Space
Harvey Mamich	Lockheed Martin Space
Heidi Hallowell	Ball Aerospace
Ian Gravseth	Ball Aerospace
Jastesh Sud	Lockheed Martin Space
Jeffrey Parker	Advanced Space
Jim Chapel	Lockheed Martin Space
Jim Russell	Lockheed Martin Space
John Abrams	Analytical Mechanics Assoc. Inc.
Kevin Goettsche	Ball Aerospace
Kip Gwin	Ball Aerospace
Kyle Miller	Ball Aerospace
Lee Barker	Lockheed Martin Space
Matt Sandnas	SEAKR Engineering
Melissa Sampson	Ball Aerospace
Meredith Stephens	Ball Aerospace
Michael Drews	Lockheed Martin Space
Michael Osborne	Lockheed Martin Space
Michelle Barath	Lockheed Martin Space
Morgan Yost	Lockheed Martin Space
Scott Piggott	Univ of Colorado-LASP
Shawn McQuerry	Lockheed Martin Space
Tom Knight	Sierra Nevada Corp
Vasili Kamtsioras	Ball Aerospace
Zach Yearout	Left Hand Design Corporation

Please join us next year for the 2023
AAS GN&C Conference

