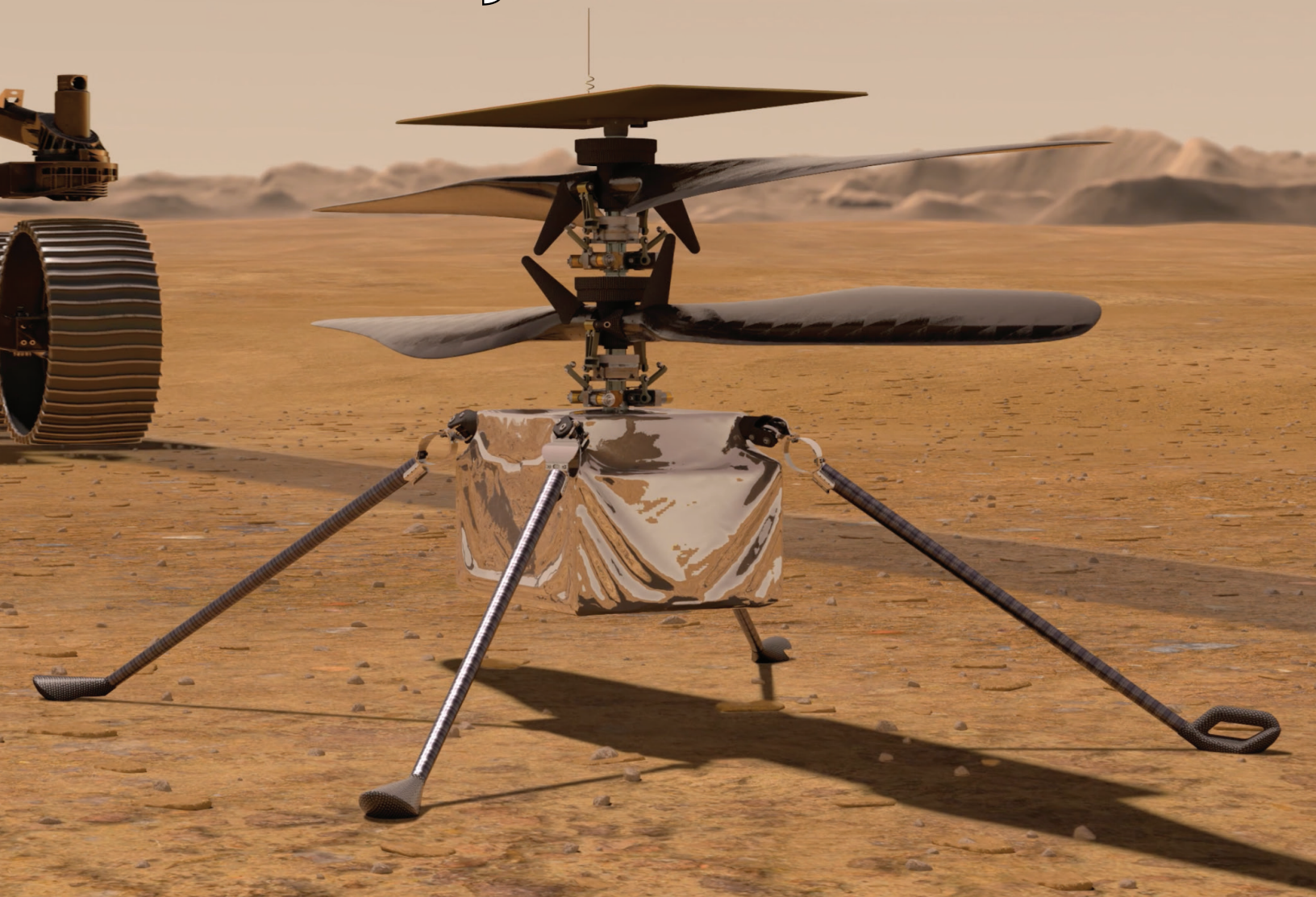
2022 IEEE Aerospace Conference

Technical Cosponsors

AIAA phmsociety

CALL for PAPERS



Yellowstone Conference Center, Big Sky, Montana, March 5- 12, 2022

The Conference

The international IEEE Aerospace Conference, with AIAA and PHM Society as technical cosponsors, is organized to promote interdisciplinary understanding of aerospace systems, their underlying science and technology, and their application to government and commercial endeavors. The annual, week-long conference, set in a stimulating and thought-provoking environment, is designed for aerospace experts, academics, military personnel, and industry leaders. The 2022 conference is the 43rd in the conference series.

Who Should Attend

This is a conference for **Participants.** Consider attending if you have a professional interest in aerospace engineering or science and wish to:

- Present results and insights from your own work
- Interact with colleagues who present papers in your field
- Engage with people and ideas across a broad spectrum of aerospace technologies
- Understand how your organization might participate in next year's conference

What Sets This Conference Apart

High-Quality Papers and Presentations. Each year, a large number of presentations are given by professionals distinguished in their fields and by high-ranking members of the government.

Science and Aerospace Frontiers. The plenary sessions feature internationally prominent researchers working on frontiers of science and engineering that may significantly impact the world. Registrants are briefed on cutting-edge technologies emerging from and intersecting with their disciplines.

Multidisciplinary Focus. This is the single general IEEE conference designed to facilitate cross-fertilization of aerospace disciplines and dialogue among members of government, industry, and the academic community.

Exceptional Networking Opportunities. The conference provides extraordinary opportunities for discussions and collaborative dialogue with aerospace pacesetters. Professional exchanges benefit the participants, their organizational sponsors, industry, and the engineering and scientific professions.

Author Development. The conference provides thorough and supportive paper reviews, relying on expert guidance from senior engineers and scientists and an opportunity for instructive interaction between author and reviewers.

Conference Proceedings. Electronic download of Conference Proceedings (comprised of 400+ papers) is included in the registration package.

International Participation. Representatives of 23 countries participated in the 2021 conference.

Sequestered Venue. The Yellowstone Conference Center and lodging are nestled closely together in the small village of Big Sky, fostering communications and ensuring easy access to all events.

What Attendees Say: Simply the Best!

- Highly acclaimed IEEE Conference Proceedings with peer review.
- A fantastic conference that fosters collaboration at the same time it encourages participants to strengthen their personal and family relations. Amazing achievement!
- I've made invaluable connections every year.
- I really enjoyed the collaborative and supportive atmosphere. The exchange of ideas that resulted was something that I have not seen in any other conference that I have attended.
- It is the most technical aerospace conference and incredibly useful for networking. The plenary talks were wonderful, and the diversity of subjects was fantastic.
- No conference packs so much into one week.
- Never have I encountered such a concentrated and collaborative environment at a conference.
- The technical stature of this conference makes it one of the best places to present your ideas and receive competent comments.
- Allows me to interact with people in ways that are simply not possible otherwise. The benefit to my work has been tremendous.
- For my company, the networking and high profile of the conference are second to none!
- Beautiful facility, amazing staff, conference well organized. Junior conference amazingly well done.

Technical Program

This Call invites papers reporting original work or state-of-the-art reviews that will enhance knowledge of:

- Aerospace systems, science and technology
- Applications of aerospace systems and technology to military, civilian or commercial endeavors
- Systems engineering and management science in the aerospace industry
- Government policy that directs or drives aerospace programs, systems and technologies

Specific topics planned for the 2022 Conference are listed in the **Tracks, Sessions and Organizers** section, pages 6–30.

Networking Program

The Networking Program provides opportunities for engaging with other conference professionals beyond the technical sessions. Networking events include:

- Saturday arrival icebreaker reception
- Buffet dinners at four evening meetings
- Pre-dinner receptions
- Midweek mountainside lunch
- Networking "Java Jams" prior to afternoon sessions
- Post-session fireside ice cream socials
- Friday evening farewell dinner

The costs for these are covered in the registration and guest registration fees.

Front Cover – *This artist concept shows the Mars Helicopter, a small, autonomous rotorcraft, which has travellled with NASA's Mars 2020 rover mission, launched in July 2020, to demonstrate the viability and potential of heavier-than-air vehicles on the Red Planet.* ***Photo Credit: NASA/JPL-Caltech.***

Abstract Submission

An abstract of 500 words or less is due by **July 1, 2021** at the conference website www.aeroconf.org.

Abstracts will be accepted ONLY through the conference website. Accept/reject notices will be emailed promptly. Author instructions are on the website.

Note: The IEEE Aerospace Conference is designed as a venue for engineers and scientists to present and discuss their work. **Please submit only if you expect to attend the conference yourself to personally present your paper. (See IEEE Policies on Presentation and Reuse below.)**

Paper Submission

Properly formatted papers of 6-20 pages must be submitted for review no later than **Friday, October 15, 2021**, a **firm** deadline! Each paper must be in final publishable format and submitted via the conference website as a PDF file. Use our format template to type your paper and see useful links: http://www.aeroconf.org/paper-submission. **Revised** papers responsive to reviewer comments must be submitted to the website by **Friday, January 14, 2022**. This is a **firm** deadline!

Questions regarding the review process may be directed to:

James Hoffman, Paper Review Chair
PaperReviewChair@aeroconf.org

IEEE Copyright forms (see link on your "My Submissions" page) must be signed and submitted by **Friday, January 14, 2022.**

Submitted papers are considered for track and conference **Best Paper Awards**, which are selected prior to the conference on the basis of technical innovation and quality of the written paper.

(See www.aeroconf.org for criteria.)

IEEE Policies on Presentation and Reuse

Publication of Conference Papers in the *IEEE Xplore* Digital Library

IEEE policy on publication of papers accepted for IEEE conferences states that "IEEE reserves the right to exclude a paper from distribution after the conference (e.g., removal from *IEEE Xplore*), if the paper is not presented at the conference."

IEEE Xplore is the association's digital library of over 4.5 million full-text documents. IEEE journals and conference proceedings are among the world's most highly cited technical publications.

Reuse of Conference Papers in Journal Publications

IEEE policy recognizes and encourages the evolutionary publication process from conference presentation to scholarly publication. Guidelines for author reuse of their presented papers and other intellectual property rights can be found at:

https://www.ieee.org/publications/rights/author-originality.html

A list of IEEE journals can be found at:

https://www.ieee.org/membership-catalog/subscriptions.html

Registration

The conference registration fee includes:

- Access to all technical sessions
- Electronic copy of Conference Proceedings
- Electronic copy of Conference Digest and Schedule
- Networking/Social Program
- Recreation activities discount

REGISTRATION FEES (US$) Including Activities & Meals	Received by Nov 30, 2021	Received after Nov 30, 2021	Received after Jan 24, 2022
IEEE & AIAA Members	880	1,060	1,290
Non-Members	1,120	1,380	1,590
Guests* and Jr. Engineers (Activities & Meals only)	260	285	315

*Spouse/partner/child of primary registrant

Travel and Lodging

Special rates for travel from major cities and lodging near the Yellowstone Conference Center are available through the conference travel agent. Check www.aeroconf.org after October 1, 2021. Book early for best choice.

For More Information

Visit Our Web Site: www.aeroconf.org for additional information on abstract and paper submission, and any further notices on the 2022 Conference.

CONFERENCE-RELATED QUESTIONS

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Melissa Soriano — Vice-Chair@aeroconf.org

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SCHEDULE OVERVIEW

6 Days of Presentations, Over 175 Hours of Technical Sessions, and 20 Hours of Conference-Sponsored Technical Networking Events

Registration and Icebreaker Wine & Cheese Reception
Saturday March 5, 6:30–9:00 PM

Sunday March 6	Monday March 7	Tuesday March 8	Wednesday March 9	Thursday March 10	Friday March 11
Continued Registration 8:45–11:30 AM	Technical Sessions 8:30 AM–Noon	Technical Sessions 8:30 AM–Noon	Technical Sessions 8:30 AM–Noon	Technical Sessions 8:30 AM–Noon	Technical Sessions 8:30 AM–Noon
Continued Registration 3:30–6:45 PM	Lunch Break Noon–1:00 PM	Catered Lunch Noon–1:30 PM	Lunch Break Noon–1:00 PM	Lunch Break Noon–1:00 PM	Lunch Break Noon–1:00 PM
	Panels 1:00–4:00 PM	Jr Engineering & Science Conference 2:00–4:30 PM	Panels 1:00–4:00 PM	Panels 1:00–4:00 PM	Ad Hoc Individual Track Planning Meetings
Java Jam 4:00–4:30 PM	Java Jam 4:00–4:30 PM	Ad Hoc Session Workshops (see announcement board for time and location)	Java Jam 4:00–4:30 PM	Java Jam 4:00–4:30 PM	Track/Session Organizers Planning Session for 2021 Conference 4:00–5:30 PM
Technical Sessions 4:30–5:45 PM	Technical Sessions 4:30–5:45 PM		Technical Sessions 4:30–5:45 PM	Technical Sessions 4:30–5:45 PM	
Plenary Session 5:50–6:35 PM	Plenary Session 5:50–6:35 PM		Plenary Session 5:50–6:35 PM	Plenary Session 5:50–6:35 PM	
Hosted Reception 6:35–7:05 PM	Hosted Reception 6:35–7:05 PM	Free Evening in Big Sky Village	Hosted Reception 6:35–7:05 PM	Hosted Reception 6:35–7:05 PM	Farewell Networking Catered Reception & Dinner 6:30–11:00 PM (Buffet open 6:30 –8:30 PM)
Catered Dinner 7:05–8:05 PM	Catered Dinner 7:05–8:05 PM		Catered Dinner 7:05–8:05 PM	Catered Dinner 7:05–8:05 PM	
Plenary Session 8:05–8.50 PM	Plenary Session 8:05–8.50 PM		Plenary Session 8:05–8.50 PM	Plenary Session 8:05–8.50 PM	
Technical Sessions 9:00–10:15 PM	Technical Sessions 9:00–10:15 PM		Technical Sessions 9:00–10:15 PM	Technical Sessions 9.00–10:15 PM	
Après Session Fireside Cheer and Chat 10:15–11:00 PM	Après Session Fireside Cheer and Chat 10:15–11:00 PM		Après Session Fireside Cheer and Chat 10:15–11:00 PM	Après Session Fireside Cheer and Chat 10:15–11:00 PM	

All dinners and networking activities are intended to promote, enhance, and facilitate technical discussions and long-term professional and personal relationships.

Tracks, Sessions & Organizers

Track 1 Science and Aerospace Frontiers (Plenary Sessions)

David Woerner **david.f.woerner@jpl.nasa.gov**

Project Manager, Jet Propulsion Laboratory. Over 35 years of experience at the Jet Propulsion Laboratory. Currently, Systems Formulation Manager for the Radioisotope Power System Program at NASA and Chief Engineer for the Nuclear Space Power Office at JPL. Previously, Principal Engineer for the RPS Program, Manager of Launch Services and Multi-Mission Radioisotope Thermoelectric Generator for the Mars Science Laboratory, and Chief Engineer of the avionics for the Mars Pathfinder. Also worked on many deep space missions, including Galileo, Cassini, and Magellan missions. Chair of the Board of Directors for the IEEE Aerospace Conferences. Numerous NASA awards, including Exceptional Service and Exceptional Achievement Medals.

Track 2 Space Missions, Systems and Architectures

Peter Kahn
peter.b.kahn@jpl.nasa.gov

Manager of the Project Systems Engineering and Formulation Section at the Jet Propulsion Laboratory. Over 30 years systems engineering experience in space flight projects.

Steven Arnold
steven.arnold@jhuapl.edu

Deputy Executive, Civil Space, APL. Oversees all Civil Space programs at APL, including NASA missions. Responsible for strategic activities such as core technology development, internal research and development, external partnering programs, program formulation, and program execution. BSEE, Virginia Tech; MSEE, Purdue University.

Session 2.01 Deep Space, Earth and Discovery Missions

Addresses status and results of missions in formulation, implementation, and operation. Session objective is to provide a full mission prospective and discuss the system level trade offs, challenges and lessons learned. From operational missions, results are discussed along with the in-flight challenges. Session addresses all types of missions from Earth orbiting to planetary to heliophysics to astrophysics missions.

James Graf **james.e.graf@jpl.nasa.gov**

Director, Earth Science and Technology Directorate, Jet Propulsion Laboratory

Nick Chrissotimos **nicholas.g.chrissotimos@nasa.gov**

Associate Director of Flight Projects Code 460, NASA - Goddard Space Flight Center

Keyur Patel **keyur@jpl.nasa.gov**

Deputy Director for Solar System Exploration, Jet Propulsion Laboratory

Session 2.02 Future Space and Earth Science Missions

Concepts for future space or Earth science programs or missions, from early formulation through Phase B.

Patricia Beauchamp **patricia.m.beauchamp@jpl.nasa.gov**

Chief Technologist, Jet Propulsion Laboratory

Arthur Chmielewski **abc@jpl.nasa.gov**

Project Manager, Jet Propulsion Laboratory

Session 2.03 System and Technologies for Landing on Planets, the Moon, Earth and Small Bodies

This session includes landing spacecraft, including precision and safe landing, atmospheric entry, descent, and landing/rendezvousing with small bodies.

Ian Clark **ian.g.clark@jpl.nasa.gov**

Systems Engineer, Jet Propulsion Laboratory

Clara O'Farrell **ofarrell@jpl.nasa.gov**

Guidance and Control Engineer, Jet Propulsion Laboratory

Session 2.04 Access to Space and Emerging Mission Capabilities

The high cost of launch continues to be a roadblock to space missions large and small. The development of adapters (ESPA, PPOD, e.g.), the development of new launch vehicles, the acceptance of risk for accommodating secondary or auxiliary payloads, and the explosion of cubesat and smallsat capability have led to some creative approaches to space missions. This session is meant to showcase how our space colleagues are leveraging these emerging capabilities.

Eleni Sims sam.sims@aero.org

Project Engineer, Aerospace Corporation

Kara O'Donnell kara.a.odonnell@aero.org

Principal Director, Aerospace Corporation

Session 2.05 Robotic Mobility and Sample Acquisition Systems

Use of robotic systems for in situ space exploration involving robotic mobility, manipulation, and sampling. All aspects of these robotic systems, including design, development, implementation, and operation are valued topics of presentation. Research prototypes as well as fielded or flown systems are of interest.

Richard Volpe volpe@jpl.nasa.gov

Section Manager, Jet Propulsion Laboratory

Paul Backes backes@jpl.nasa.gov

Group Supervisor, Jet Propulsion Laboratory

Session 2.06 Future Missions & Enabling Technologies for In Situ Exploration, Sample Returns

Future mission concepts, planetary protection technologies, sample handling techniques, novel technologies for in situ exploration, technologies not covered under robotic mobility and sample acquisition, human precursor mission concepts, and technologies that enable precursor missions.

Patricia Beauchamp patricia.m.beauchamp@jpl.nasa.gov

Chief Technologist, Jet Propulsion Laboratory

Michael Johnson michael.a.johnson@nasa.gov

Chief Technologist, Engineering and Technology Directorate, NASA Goddard Space Flight Center

Session 2.07 In Situ Instruments for Landed Surface Exploration, Orbiters, and Flybys

This session solicits papers that describe advanced instrument concepts and/or innovative analytical protocols that enable the characterization of surface and subsurface chemistry and geology (elemental, isotopic, molecular, mineralogical composition), astrobiological potential, geophysical processes (tectonics, internal structure, heat flow, geochronology), atmospheric chemistry and dynamics, dust and particles, charged particles/plasmas, and magnetic fields.

Stephanie Getty stephanie.a.getty@nasa.gov

Deputy Director, NASA - Goddard Space Flight Center

Ricardo Arevalo rarevalo@umd.edu

Associate Professor, University of Maryland

Xiang Li xiang.li@nasa.gov

Associate Research Scientist, University of Maryland, Baltimore County

Session 2.08 Space Exploration with Small, Low-Cost Missions

This session will explore the use of small spacecraft (smallsats, cubesats, etc.) to enable new, exciting low-cost missions for space exploration. This session will focus on: (1) small, low-cost missions in study, formulation, implementation, operations, and completed and (2) results and lessons-learned from small, low-cost missions that have flown.

Young Lee young.h.lee@jpl.nasa.gov

Technical Group Supervisor and Project Support Lead, Jet Propulsion Laboratory

Andrew Petro andrew.j.petro@nasa.gov

Program Executive, NASA - Headquarters

Session 2.09 Mission Design for Spacecraft Formations

This session covers all the aspects related to missions that utilize two or more spacecraft flying in formation about the Earth, other celestial bodies or in deep-space. Topics in this session include mission designs and architectures of distributed space systems; federated and/or disaggregated satellite systems; system engineering aspects applied to spacecraft formations (requirements definition and assessment, specific subsystems, system configurations and trade-offs); guidance and navigation issues and solutions addressing autonomy and coordination of distributed space systems; coordinate attitude and/or orbit dynamics and control for spacecraft formation flying; operational issues, experience and findings.

Giovanni Palmerini giovanni.palmerini@uniroma1.it

Professor, Guidance and Navigation, Sapienza Universita' di Roma

Leonard Felicetti leonard.felicetti@cranfield.ac.uk

Lecturer in Space Engineering, Cranfield University

Session 2.10 Space Radiation and its Interaction with Shielding, Electronics and Humans

The mitigation of adverse effects from radiation on humans and electronics in space is a critical step in mission success. This session focuses on research in understanding the nature of the radiation field in space and how that field is changed as it passes through shielding materials, electronics, and the human body. Topics include radiation measurements made in space, projectile and target fragmentation measurements and materials studies conducted at accelerator facilities on ground, radiation transport modeling, improvements of nuclear reaction models and radiation transport codes, shielding of electronics and humans, and benchmarking of measurements performed both in space and on ground for the verification and validation of the transport codes.

Lembit Sihver lembit.sihver@tuwien.ac.at

Professor Dr., Chalmers University of Technology

Maria De Soria Santacruz Pich maria.de.soria-santacruz.pich@jpl.nasa.gov

Systems Engineer, Jet Propulsion Laboratory

Session 2.11 Space Debris and Dust: The Environment, Risks, and Mitigation Concepts and Practices

Operational satellites are at risk from collisions with the more than 20,000 trackable debris objects that remain in orbit today, as well as hundreds of thousands of objects, including micrometeoroids, that are too small to be cataloged. Beyond the realm of Earth-oriented orbits, unique and immensely valuable science-gathering spacecraft can also be exposed to similar hypervelocity collisional risks, but from cometary and asteroidal micro-milliscale particles (dust). Papers are invited that address the space debris population and growth projections; debris and dust characteristics; impact modeling and materials testing; modeling and simulation and/or test results that can lead to quantification of the risks to spacecraft in various orbits and exploration missions; and mitigation strategies including debris removal or repositioning, spacecraft shielding, orbit selection, and spacecraft operations. Papers documenting past mission anomalies traced to space debris, and mitigation strategies employed today, are also of interest.

Kaushik Iyer iyerka1@jhuapl.edu

Materials Physicist/Manager, Johns Hopkins University/Applied Physics Laboratory

Douglas Mehoke doug.mehoke@jhuapl.edu

SEM Group Supervisor of the Mechanical Systems Group, Johns Hopkins University Applied Physics Laboratory (JHU/APL)

Session 2.12 Asteroid Detection, Characterization, Sample-Return, and Deflection

This Session invites papers on flight and ground system concepts, mission concepts, and technologies that address the need to detect, characterize and deflect asteroids that could pose an impact hazard to Earth. Papers on instrument technologies and technologies for proximity operations near, and landing on, asteroids are also sought.

Jeffery Webster jeff.webster@aeroconf.org

Senior Systems Engineer, NASA / Jet Propulsion Laboratory

Paul Chodas paul.chodas@jpl.nasa.gov

Senior scientist, Jet Propulsion Laboratory

Session 2.13 Orbital Robotics: On-Orbit Servicing and Active Debris Removal

On-going and future missions involving in-space robotic systems and operations, to include On-Orbit Servicing, Active Debris Removal, Assembly, and Astronaut Assistance. All designs and methods to accomplish robotic tasks in orbit, such as mobility, manipulation, assembly or maintenance, are of interest. Specific aspects may be addressed, such as hardware design, open-loop or closed-loop control, rendezvous trajectory generation, computer vision, autonomy, tele-operation, experimental facilities on the ground, or others of relevance. Mission concept papers are to include technical development toward ground testing or flight operation.

David Sternberg david.c.sternberg@jpl.nasa.gov

Guidance and Control Engineer, NASA Jet Propulsion Laboratory

Markus Wilde mwilde@fit.edu

Associate Professor, Florida Institute of Technology

Track 3 Antennas, RF/Microwave Systems, and Propagation

James Hoffman
james.p.hoffman@jpl.nasa.gov

Senior Engineer in JPL's Radar Science and Engineering Section. Over 10 years experience in microwave instrument design for remote sensing applications. Currently the RF System Lead for the NI-SAR radar mission (NASA-ISRO) and the InSight Landing Radar.

Glenn Hopkins
glenn.hopkins@gtri.gatech.edu

GTRI Fellow and Chief Engineer of the Antenna Systems Division of the GTRI Sensors and Electromagnetic Applications Laboratory, specializing in array antenna technologies. Interests include phased arrays, wide bandwidth antennas, digital beam forming and RF subsystems.

Session 3.01 Phased Array Antenna Systems and Beamforming Technologies

Included are active power combining, thermal management, phasing networks, integration, power, test and evaluation and beamsteering, algorithm development and associated hardware implementations, and modeling and simulation for all levels of phased array development and beamsteering.

Janice Booth **janice.c.booth2.civ@mail.mil**

Electronics Engineer, AMRDEC Weapons Development and Integration Directorate

Glenn Hopkins **glenn.hopkins@gtri.gatech.edu**

Principal Research Engineer, Georgia Tech Research Institute

Session 3.02 Ground and Space Antenna Technologies and Systems

Papers on all aspects of antenna systems for ground, ground to/from space and space communications, including reflector antennas and feeds, arrays, and transmit/receive subsytems.

Farzin Manshadi **farzin.manshadi@jpl.nasa.gov**

JPL Spectrum Manager, Jet Propulsion Laboratory

Chris Rose **chris.rose@viasat.com**

Chief Technology Office - Antenna Systems, Viasat

Session 3.03 RF/Microwave Systems

Papers about RF and microwave systems or components, passive and active, including radar systems.

James Hoffman **james.p.hoffman@jpl.nasa.gov**

Senior Research Engineer, Jet Propulsion Laboratory

Session 3.04 Radio Astronomy and Radio Science

Papers on the techniques, hardware, systems, and results in the fields of Radio Astronomy and Radio Science.

Mark Bentum **m.j.bentum@tue.nl**

Professor, Eindhoven University of Technology

Melissa Soriano **webguru@aeroconf.org**

Payload Systems Engineer, Jet Propulsion Laboratory

Session 3.05 Miniaturized RF/Microwave Technologies Enabling Small Satellite and UAV Systems

Papers in all fields that advance the state-of-art in the miniaturization of RF and microwave technologies. These include device technologies such as RF ASICs, MMICs, and system-on-chip; packaging technologies such as flexible electronics, 3D microwave integration, and hybrid techniques; instruments and systems for small satellites, and UAVs.

Dimitris Anagnostou **danagn@ieee.org**

Associate Professor, Heriot Watt University

Track 4 Communication & Navigation Systems & Technologies

Shirley Tseng
shirleytseng@earthlink.net

Consults on design and implementation of large-scale, high-performance satellite and terrestrial high performance networks. Previously: satellite design, development, test; satellite operations & ground station design, GE.

Kar Ming Cheung
kar-ming.cheung@jpl.nasa.gov

Principal Engineer and Technical Group Supervisor, JPL's Communication Architectures and Research section. 30+ years in advanced channel coding, source coding, synchronization, image restoration, and communication analysis. NASA Exceptional Service Medal. BSEE, University of Michigan; MS and PhD, California Institute of Technology.

John Enright **jenright@ryerson.ca**

John Enright is an Associate Professor in the Department of Aerospace Engineering at Ryerson University. His primary research interests concern the development of attitude sensors for spacecraft, optical navigation, and mobile robotics.

Session 4.01 Evolving Space Communication Architectures

A forum in which to trace, examine and predict trends in the architectures of space communications and navigation, including ground infrastructure and support and interactions between terrestrial and space networks. Innovative concepts and game changing approaches with a system view are especially sought.

Shervin Shambayati **shervin.shambayati@aero.org**

Senior Systems Engineering, Aerospace Corporation

Session 4.02 Communication Protocols and Services for Space Networks

The focus is communication protocols and services supporting space systems, including ground- and space-based methods to increase efficiency, enable new exploration/applications, provide more secure systems, and improve Quality of Service. Techniques include relay communications, routing, delay/disruption tolerant networking, retransmission approaches, adaptive link/network/transport methods, demand access, and advanced scheduling. Novel space network architectures are of key interest, including microspacecraft swarms, sensor webs, and surface networks. Implementation and evolution of communications networking into space systems, as well as application to specific missions, are sought.

Shervin Shambayati **shervin.shambayati@aero.org**

Senior Systems Engineering, Aerospace Corporation

Session 4.03 Next Generation Space Systems: AESS GLUE

This session solicits papers on advanced, interdisciplinary, topics in Space System Engineering, based on the concept of interdependency of systems. This includes new broadband communications systems and techniques, their use platforms, such as small satellites, Internet-of-Remote Things and Internet-of-Space-Things, software control and implementation of sky communications and networks (SDR and SDN), end-to-end system considerations, augmented 3D reality for manned space missions, integration of navigation, communications and sensing functionalities, and advanced signal processing techniques for emerging space communications and data applications.

Claudio Sacchi **claudio.sacchi@unitn.it**

Assistant professor, University of Trento

Session 4.04 Navigation and Communication Systems for Exploration

Systems, technology, and operations for navigation and/or communication among elements involved in civil, commercial, or national security missions in any orbital domain (Earth and interplanetary). The session focuses on enabling technologies, strategies, new operational concepts and performance improvements for advancing mission capability.

Patrick Stadter **patrick.stadter@jhuapl.edu**

Principal Professional Staff, Johns Hopkins University/Applied Physics Laboratory

David Copeland **david.copeland@jhuapl.edu**

Principal Professional Staff, Johns Hopkins University/Applied Physics Laboratory

Session 4.05 Relay Communications for Space Exploration

For a wide range of space exploration scenarios, multi-hop relay communications can provide significant benefits in terms of increased data return and reduced user burden (mass, power, cost) over conventional space-to-ground links. In this session we examine relay communications for both Earth-orbiting missions and missions throughout the solar system. Topics of interest include relay system architecture, relay spacecraft design (for both dedicated relay orbiters and for hybrid science/telecom spacecraft), relay telecommunications payload design, relay communication protocols, mission applications and operational experiences/lessons-learned.

David Israel **dave.israel@nasa.gov**

Exploration and Space Communications Projects Division Architect , NASA - Goddard Space Flight Center

Charles Edwards **chad.edwards@jpl.nasa.gov**

Mgr, Advanced Studies, Mars Exploration Program, Jet Propulsion Laboratory

Session 4.06 Space Communication Systems Roundtable : Networking the Solar System

The roundtable will provide a forward-looking view of the development of a Solar System Internetwork - a layered architecture aimed at offering ubiquitous, high-bandwidth communication throughout the solar system in support of robotic and, ultimately, human exploration at the Moon and in deep space. Panelists will assess trends in physical layer capabilities, including migration to higher RF frequencies (Ka-band) and/or to optical wavelengths, as well as higher layers in the protocol stack, including networking protocols such as DTN. Based on assessment of forecasted commercial satcom trends, and building on the multi-hop relay capabilities operating today at Earth and at Mars, the roundtable will describe the evolution towards a true Solar System Internetwork in the coming decades.

David Israel **dave.israel@nasa.gov**

Exploration and Space Communications Projects Division Architect , NASA - Goddard Space Flight Center

Session 4.07 Innovative Space Communications and Tracking Techniques

This session solicits innovative contributions to improve flight and ground communication and tracking systems such as antenna arrays, software-defined radios, advance receivers, deployable antennas, relay satellites, Ka and Optical communications, novel signal formats, new coding methods, and CubeSat communications and tracking techniques.

Kar Ming Cheung **kar-ming.cheung@jpl.nasa.gov**

Technical Group Supervisor, Jet Propulsion Laboratory

Alessandra Babuscia **alessandra.babuscia@jpl.nasa.gov**

Telecommunication Engineer, NASA Jet Propulsion Laboratory

Session 4.08 Communication System Analysis & Simulation

This session solicits innovative contributions on modeling, analysis, and/or simulation of satellite, aerospace, or terrestrial communication systems. Topics include modeling and design of network services and systems, communication waveforms and modulation, integration of terrestrial and satellite networks, deep space communication systems, terrestrial and deep space relay communication networks, communication protocols for satellite communication, traffic modeling, traffic engineering and analysis, network measurements, network optimization and resource provisioning, next generation internet, overlay and virtual networks, autonomic communication systems, cross-layer & cross-system protocol design, and communication network monitoring.

Yogi Krikorian **yykrikorian@yahoo.com**

Senior Engineering Specialist, Aerospace Corporation

Session 4.09 Communications and/or Related Systems: Theory, Simulation, and Signal Processing

This session solicits innovative contributions on theory, modeling and simulation, and signal processing foundations of satellite, aerospace and terrestrial wireless communications.

David Taggart **dtaggart1912@gmail.com**

Engineer, Self

Session 4.10 Wideband Communications Systems

This session solicits innovative contributions about wideband communication systems in terrestrial, satellite, and hybrid Space-terrestrial communications systems transmitting information at high data rates. Papers dealing with modelling and simulations of communications systems, evaluating performance, or describing hardware/software implementation of communication system components are welcome. Detailed topics include, but are not limited to: Broadband satellite and aerospace transmission; Broadband terrestrial wireless transmission; Millimeter wave communications; Spread-spectrum and CDMA communications; TV and HDTV broadcasting over satellite; Modulation and channel coding techniques; MIMO techniques; Antenna design; Multi-carrier communications; Multi-user transmission; Channel equalization; Carrier and timing synchronization; Radio resource management and scheduling; Emerging technologies for safety-critical and emergency communications; Emerging standards for terrestrial and satellite communications (LTE, LTE-A, WiMax, DVB-S2, IEEE 802.11x); Energy-efficient terrestrial and satellite communications; and networking.

David Taggart **dtaggart1912@gmail.com**

Engineer, Self

Claudio Sacchi **claudio.sacchi@unitn.it**

Assistant professor, University of Trento

Session 4.11 Q/V band connectivity and Alphasat experience

Future High Throughput Satellite (HTS) systems, able to support terabit/s connectivity, will require a very large bandwidth availability; this pushes towards the exploitation of the so-called "beyond Ka-band" systems.

This session focuses Q/V band and beyond satellite missions and future perspectives, relevant theoretical and experimental scientific results and enabled applications. New concepts for high throughput system architecture and enabling technologies for space and ground segments are also addressed, such as smart gateway architectures, propagation impairment mitigation methods and adaptive techniques, high power generation systems, small satellite applications etc.

Giuseppe Codispoti giuseppe.codispoti@asi.it

QV Band Telecommunications Program Manager, ASI, Italian Space Agency

Giorgia Parca giorgia.parca@asi.it

Telecommunications Engineer, Italian Space Agency

Session 4.12 Software Defined Radio and Cognitive Radio Systems and Technology

This section presents papers on software and cognitive radio in general, and their application to space communications in particular. Both original and space-centric tutorial papers are welcome.

Eugene Grayver eugene.grayver@aero.org

Principal Engineer, Aerospace Corporation

Genshe Chen gchen@intfusiontech.com

CTO, Intelligent Fusion Technology, Inc

Session 4.13 Global Navigation Satellite Systems

This session focuses on recent advances in satellite navigation. Current and future envisioned applications of GPS, GLONASS, Galileo, and Compass global navigation satellite systems (GNSSs) are addressed, as well as global, regional and local augmentation systems. The topics covered include next generation GNSSs, receiver technologies, interoperability, orbit computation, multi-sensor fusion, and navigation model, methods and algorithms.

Gabriele Giorgi gabriele.giorgi@dlr.de

Senior researcher, German Aerospace Center - DLR

Lin Yi lin.yi.dr@ieee.org

Technologist, NASA Jet Propulsion Laboratory

Session 4.14 Space Navigation Techniques

Papers in this session are collected on topics of architecture, hardware and algorithms relating to space navigation techniques including, but not limited to: Ground-based deep space navigation using NASA Deep Space Network, ESA Deep Space Antenna, as well as similar deep space navigation facilities from China, India, Japan, etc.; Navigation at lunar surface and deep space gateway; Navigation in deep space CubeSats missions; Spacecraft formation flying navigation; Navigation in rendezvous missions; Novel navigation methods (e.g. using pulsars); Relative navigation between spacecraft; Spacecraft navigation with GNSS (Papers accepted under this topic can overlap with the GNSS session topics, and please expect coordination in the final program arrangement); Spacecraft navigation with in-situ sensors including but not limited to magnetometers, inertial sensors, etc.; Navigation robustness; Autonomous navigation; Integrated navigation.

Lin Yi lin.yi.dr@ieee.org

Technologist, NASA Jet Propulsion Laboratory

John Enright jenright@ryerson.ca

Associate Professor, Ryerson University

Session 4.15 CNS Systems and Airborne Networks for Manned and Unmanned Aircraft

This session focuses on communications, navigation and surveillance systems, including on-board and ground-based systems for all vehicles operating in the National Airspace System (NAS): manned and unmanned vehicles, fixed wing and rotor-craft, general aviation, civil transport and military that may carry passengers, cargo or are performing surveillance-type missions. Topics range from concept development, simulation and modeling, technology development and verification, through flight testing and certification. Emerging fields include surface wireless networks, ADS-B, Datacomm, airborne network security, UAS integration, satellite-based CNS, and international activities.

Jamal Haque jamal_haq@yahoo.com

Sr.Principal Engineer, Raytheon

Dylan Hasson dylan.hasson@dot.gov

General Engineer, Volpe National Transportation Systems Center

Session 4.16 Aerospace Cyber Security and Cyber-Physical Systems

Wireless communications, data networks, information systems, and cyber security are significant emerging topics in aerospace. Systems that integrate with the cyberspace and enable safe, efficient and/or profitable operation and performance, with minimal or no human intervention, are of growing interest to the community. This session focuses on related timely topics including, but not limited to, security, privacy, and safety issues/developments in the following areas: aerospace software, data and multimedia distribution; next-generation air traffic control systems; IVHM; aeronautical and space networks; airport and airline information systems; aircraft, UAS/UAM, spacecraft, and commercial space vehicles; cloud computing, cyber-physical systems, and IoT.

Krishna Sampigethaya sampiger@erau.edu

Department Chair and Associate Professor, Embry-Riddle Aeronautical University

Jamal Haque jamal_haq@yahoo.com

Sr.Principal Engineer, Raytheon

Session 4.17 Civil and National Security Space Panel: Joint NASA/DoD Technology Initiatives

This panel will focus on the intersection of technology between NASA and the DoD. We are seeing an increased emphasis on sharing technology between governmental agencies, including communications, navigation, launch services, hosted payloads, small sats, etc. Come join us to hear the latest technology areas where this collaboration is currently being demonstrated.

Steven Arnold steven.arnold@jhuapl.edu

Deputy Executive, Civil Space, Johns Hopkins University/Applied Physics Laboratory

Patrick Stadter patrick.stadter@jhuapl.edu

Principal Professional Staff, Johns Hopkins University/Applied Physics Laboratory

Track 5 Observation Systems and Technologies

Gene Serabyn
gene.serabyn@jpl.nasa.gov

Senior Research Scientist at JPL developing high-contrast coronagraphy and interferometry techniques for direct exoplanet imaging, and microscopy techniques for remote life detection.

William Danchi
william.c.danchi@nasa.gov

Senior Astrophysicist, NASA Goddard Space Flight Center in Greenbelt, Maryland. Current projects include tthe Cosmic Evolution Through UV Spectroscopy (CETUS) Probe Study, research on exoplanets forming in transitional protoplanetary disks and on the effect of space weather on exoplanet habitability and potential for life.

Session 5.01 Space Based Optical Systems and Instruments

This session covers all aspects of design, assembly, alignment and testing of optical systems and instruments for applications including astronomy, energy, defense and remote observation. Topics range through design and engineering to integration, alignment, test and control of space-based large optical systems.

Ryan McClelland rmccle@gmail.com

Research Engineer, NASA Goddard Space Flight Center

Bogdan Oaida bogdan@jpl.nasa.gov

Systems Engineer, Jet Propulsion Laboratory, California Institute of Technology

Session 5.02 Balloon-based observatories

This session covers all aspects of balloon-based observatories. Papers discussing existing and proposed balloon-based observatories, instruments and systems, and important techniques and subsystems such as pointing control systems are welcome, together with results and future plans.

Stefan Martin stefan.r.martin@jpl.nasa.gov

Optical Engineer, Jet Propulsion Laboratory

J. Kent Wallace james.k.wallace@jpl.nasa.gov

Member, Technical Staff, Jet Propulsion Laboratory

Session 5.03 Exoplanet Instruments, Missions and Observations

Current and future missions such as TESS, JWST and WFIRST, as well as potential missions such as HabEx, OST and LUVOIR promise to revolutionize exoplanet science, and astrophysics in general. All such missions involve new technological approaches that provide access to new regions of observational parameter space. This session focuses on the new technologies, and the missions and observations thereby enabled.

William Danchi **william.c.danchi@nasa.gov**

Senior Astrophysicist, NASA Goddard Space Flight Center

Stefan Martin **stefan.r.martin@jpl.nasa.gov**

Optical Engineer, Jet Propulsion Laboratory

Session 5.04 Atmospheric Turbulence: Propagation, Phenomenology, Measurement, Mitigation

This session deals with all aspects of wave propagation through atmospheric turbulence. Topics of interest to this session are adaptive optics systems, deformable/fast-steering mirror modeling and control algorithms, wave front sensing, laser beacon systems and modeling, scintillation, anisoplanatism, atmospheric turbulence characterization and modeling, deconvolution/imaging algorithms, partially-coherent light, and scattering.

Jack McCrae **jack.mccrae@afit.edu**

Research Assistant Professor, Air Force Institute of Technology

Noah Van Zandt **n.r.vanzandt@gmail.com**

Electro-Optical Engineer, Air Force Research Laboratory

Session 5.05 Image Processing

A forum on the theory and practice of image restoration and analysis. Potential topics include image registration, feature detection and estimation, image denoising, multimodal image fusion, and hardware/software architectures for image storage and processing.

William Danchi **william.c.danchi@nasa.gov**

Senior Astrophysicist, NASA Goddard Space Flight Center

Session 5.06 Optical Detection and Analysis for Space Domain Awareness (SDA)

This session focuses on systems, data products, and processes related to the optical detection, characterization, and tracking of near-Earth man-made resident space objects (RSOs). Possible topical areas include: small automated optical systems for the tracking of man-made objects and space debris, methods for characterizing and analyzing unresolved objects, multi-site and multi-operator cooperative data fusion and analysis, and operational image processing capabilities that contribute to SDA. The aim of this session is to provide a forum for discussion and collaboration between satellite owners/operators and providers of SDA data.

Michael Werth **mikewerth1@gmail.com**

Physicist/System Engineer, Boeing Company

Session 5.07 Photonics and Lasers

Papers on active (including LEDs, lasers, and photodetectors) and passive (such as optical waveguides, filters, and fiber) optical components, integration of photonic components with Si electronics and optoelectronic subsystems that have applications in aerospace are solicited.

Joshua Shank **jshank@sandia.gov**

Joshua Shank, Sandia National Laboratories

Session 5.08 Techniques and instruments for extant life detection

Various instruments can be used to search for evidence of both extant and past life in a variety of environments, such as Mars and the Ocean Worlds. This session addresses the various techniques that can potentially play a role in life detection, ranging from microscopy to mass spectrometry, as well as sample collection and handling approaches, and associated data processing. These techniques can include terrestrial and biomedical methods that can be extended to life detection on planetary missions.

Chris Lindensmith **lindensm@mail.jpl.nasa.gov**

Systems Engineer, Jet Propulsion Laboratory, California Institute of Technology

J. Kent Wallace **james.k.wallace@jpl.nasa.gov**

Member, Technical Staff, Jet Propulsion Laboratory

Morgan Cable **morgan.l.cable@jpl.nasa.gov**

Postdoctoral scholar, NASA Jet Propulsion Laboratory

Track 6 Remote Sensing

Jordan Evans
jordan.p.evans@jpl.nasa.gov

Deputy Project Manager, Europa Clipper. Previously the Deputy Director for Engineering and Science at JPL and Division Manager of JPL's Mechanical Systems Division. Development experience with space projects at both NASA Goddard and JPL, including FUSE, WFC3, GLAST, LISA, and MSL along with numerous architecture studies.

Darin Dunham
darin@vectraxx.com

LM Fellow and Spiral 8.2-7 Chief Engineer, C2BMC Missile Defense National Team, Lockheed Martin, Huntsville. Working on target tracking and discrimination algorithms within the Ballistic Missile Defense System. Served almost 10 years in the Marine Corps. MSEE, Naval Postgraduate School; BSEE, Carnegie Mellon.

Session 6.01 Systems Engineering Challenges and Approaches for Remote Sensing Systems

The need to make a particular measurement from a particular vantage point drives us to build sophisticated remote sensing instruments and launch them on similarly sophisticated spacecraft, aircraft, submersibles, balloons, etc. This session explores the highly coupled nature of the instrument, platform architecture, flight path design, ground system and mission operations, and the systems engineering challenges and solutions employed.

Topics include instrument influences on platform architectures and flight path design, platform-to-instrument integration, trade studies, trends and novel solutions.

Todd Bayer **todd.j.bayer@jpl.nasa.gov**

Principal Systems Engineer, NASA Jet Propulsion Lab

Session 6.02 Instrument and Sensor Architecture, Design, Test, and Accommodation

This session covers topics related to the physical or functional architecture and design of instruments/sensors. Topics include hardware/software trade studies, fault protection approaches, unique or innovative system interfaces, accommodation of payloads within a system, system-level instrument/sensor testing, instrument/sensor integration, test, and calibration, and approaches to the processes involved in engineering an instrument or sensor.

Matthew Horner **mhorner@jpl.nasa.gov**

Engineer, Jet Propulsion Laboratory

Keith Rosette **keith.a.rosette@jpl.nasa.gov**

Deputy Project Manager, Jet Propulsion Laboratory

Session 6.03 Imaging Spectrometer Systems, Science, and Science Applications

This session covers the design, component technology, integration, calibration, and operation of imaging spectrometer instruments as well as the processing and interpretation of data acquired with them. Proposed instruments, science and applications, and lessons learned from all phases are included.

Peter Sullivan **peter.sullivan@jpl.nasa.gov**

Electrical Engineer, NASA Jet Propulsion Lab

Session 6.04 Radar Systems and Signal Processing

This session focuses on radar systems and signal processing. Topics include the design of surveillance and imagining radars, as well as other novel applications of radar. Synthetic Aperture Radar (SAR), Space-time Adaptive Processing (STAP), multi-static radar, compressive sensing, target, clutter, and interference models, and any other radar related topics are of interest. We are inclusive of the theoretical aspects of radars, as well as the engineering problems of practical importance.

Donnie Smith **donnie.smith@gatech.edu**

Radar Engineer, Waymo

Thomas Backes **tdbackes@gmail.com**

Engineer, Thomas D. Backes

Session 6.05 Information Fusion

This session focuses on exploitation of all sources of information, including physical sensor data, context information, and human inputs. Methodologies for effective multi-sensor multi-target tracking of highly disparate sources are of interest, as are algorithms and advances in downstream analysis of track data for situational awareness.

Stefano Coraluppi **stefano.coraluppi@ieee.org**

Chief Scientist, Systems & Technology Research

Craig Agate **cagate@toyon.com**

Senior Staff Analyst, Toyon Research Corporation

Session 6.06 Multisensor Fusion

Papers that address all aspects of information fusion for the integration of multiple sensors are sought. Of particular interest are the theoretical aspects of some popular questions like, When is sensor fusion better than a single sensor? or, How does one ensure that sensor fusion produces better results? Algorithms that address one of the many challenges in multisensor/multitarget tracking or multisensor resource management are also sought.

William Blair **dale.blair@gtri.gatech.edu**

Principal Research Engineer, Georgia Tech Research Institute

Laura Bateman **laura.bateman@jhuapl.edu**

System Engineer, Johns Hopkins University/Applied Physics Laboratory

Session 6.07 Applications of Target Tracking

Tracking of targets, both cooperative and uncooperative, moving under water, on water, on land, in air or in space, with sonar, radar or electro-optical sensors. Fusion of data from multiple sensors. Algorithms for handling target maneuvers and data association. Estimation of sensor properties (biases, noise variances).

John Glass **jglass20@gmail.com**

Systems Engineer, Raytheon Technologies

John Grimes **john.p.grimes@baesystems.com**

Scientist, BAE Systems, Inc

Session 6.08 Guidance, Navigation and Control

The target of this section is collecting the most recent works of research and development regarding guidance, navigation and control (GNC) in order to provide an exhaustive (as much as possible) picture of the state of art and a likely key to the reading of today's new challenges. With this section we intended to give emphasis both to the more interesting theoretical aspects of the matter and to engineering problems of great practical importance, so a wide spectrum of arguments is welcomed.

Terry Ogle **terry.ogle@gtri.gatech.edu**

Sr. Research Engineer, Georgia Tech Research Institute

Christopher Elliott **christopher.m.elliott@lmco.com**

LM Fellow, Lockheed Martin Aeronautics Company, Texas Christian University, The University of Texas at Arlington

Session 6.09 Fusion Integration of Sensor Harvesting

Methods for situation awareness/assessment, threat/impact analysis, sensor/processing refinement, user/man-machine interfaces, and mission awareness/responsiveness. Techniques for system design leveraging information fusion for Command, Control, Communications, Computers, and Cyber Intelligence, Surveillance and Reconnaissance (C5ISR) over multi-domain sensor data and intelligence collections. Applications focusing on space, air, and architecture developments for efficient and effective distributed net-centric operations, edge computing, and complex networks. Approaches for software/hardware dynamic data-driven applications systems (DDDAS) improvements, context-enhanced results, and avionics protocols for big data scenarios. Use of information fusion to optimize and coordinate machine analytics with users for human-machine teaming.

Erik Blasch **erik.blasch@gmail.com**

IEEE Aerospace & Electronic Systems Society,

Peter Zulch **peter.zulch@us.af.mil**

Engineer, Air Force Research Laboratory

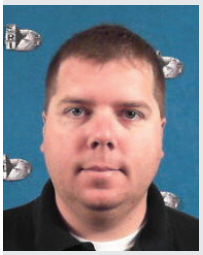
Track 7 Avionics and Electronics for Space Applications

John Samson
jrsamson1970@gmail.com

Research Affiliate/Aerospace Consultant, Morehead State University. 50+ years experience in onboard processing for space and airborne applications. Over 50 publications in onboard processing systems and architectures. Senior Member IEEE, Associate Fellow AIAA. Graduate of IIT, MIT, and University of South Florida.

John Dickinson
jrdicki@sandia.gov

Experience in spacecraft & payload systems engineering and avionics design & test on Kepler, WISE, JUNO, IBEX, RBSP, MMS, SPP, Solar Orbiter, CYGNSS, and multiple government programs. BSEE, Johns Hopkins University; MSEE, Georgia Institute of Technology.



Patrick Phelan **pphelan@swri.org**

Manager - R&D, Southwest Research Institute. Systems engineer and project manager for the ESA Solar Orbiter SPICE Electronics Box program. 14 years' experience, including project management of DoD technology demonstration programs, and avionics systems engineer for the NASA PUNCH mission. BSCE, MSEE, Georgia Institute of Technology.

Session 7.01 High Performance Computing and On-Board Data Processing for Space Applications

Explore innovations and new developments in spacecraft on-board and embedded computing architectures. Example hardware topics: processors, data handling and companion processing ASICs and FPGAs, multicore processing architectures, application of soft-core embedded FPGA processors, emerging GPU technologies for space-based applications, on-orbit reconfiguration, and new or applied standards for embedded space electronics applications. Example software topics: machine learning techniques, embedded cluster computing, on-board big data analytics, power-aware optimal reconfiguration algorithms, reconfigurable software-implemented hardware fault tolerance algorithms and designs, evolutionary platforms, and autonomous computing designs. Papers should address, as applicable: processing performance, size-weight-power (SWaP) comparisons of different components and architectures, standardized form factors, protocols and interfaces, radiation hardness by design, process, or technology, mitigation of other spacecraft environmental factors, software support, and integration and test of elements. Descriptions and performance of actual development, test, flight, or mission usage are highly sought.

Jamal Haque **jamal_haq@yahoo.com**

Sr.Principal Engineer, Raytheon

Dmitriy Bekker **dmitriy.bekker@jhuapl.edu**

Chief Technologist, Space Systems Implementation Branch, Johns Hopkins Applied Physics Laboratory

Robert Merl **merl@lanl.gov**

Electrical Engineer, Los Alamos National Laboratory

Session 7.02 Peripheral Electronics, Data Handling, and Interconnects for Space Applications

This session explores novel concepts for hardware and software technologies that support but are peripheral to the main computing core. Example topics include: novel instrument or payload hardware and software technologies; network connections architectures; high speed interconnects; mixed signal and systems-on-a-chip technologies; onboard signal, data, and command processing; telecommand reception, decoding, and distribution; payload data pre-processing; dedicated accelerators for data processing; transmission and storage (e.g. compression, encoding, parallel processing for payloads (GIPs, GFLOPs), etc.); fault-tolerance mechanisms; autonomous operations, reconfigurable approaches, and failsafe strategies; emerging and novel designs and tests for high performance embedded computing platforms; temporal and spatial reuse of systems' resources; sensor, detector, and imager readout circuits; high resolution/ high speed ADCs and DACs; resource efficient (mass/ volume) miniaturized multi-channel/ parallel systems; circuit designs for analog and digital processing functions; and designs for integrated communications systems applications on a chip.

Patrick Phelan **pphelan@swri.org**

Manager - R&D, Southwest Research Institute

Mark Post **mark.post@york.ac.uk**

Lecturer, University of York

Michael Epperly **mepperly@swri.edu**

Senior Program Manager, Southwest Research Institute

Session 7.03 Assembly, Integration, and Test for Electrical Space Systems

This session explores all aspects of assembly, integration, and test of electrical space systems. This includes assembly, integration, and test efforts at the board-level for RF, analog, or digital card assemblies; box-level for command, telemetry, data handling, data processing, control, power, or mixed-purpose avionics; subsystem-level for instruments/payloads; or system-level for entire spacecraft electrical subsystems. Papers can address innovative uses of test software, test scripts, mission simulation, human-computer interface, electrical support ground equipment, and harnessing to accomplish integration and test. Papers also address unique system engineering and configuration control approaches to manage test, and transition from system test to launch and mission operations.

Eric Bradley **eric.bradley@nrl.navy.mil**

Computer Engineer, Naval Research Lab

Eric Rossland **eric.rossland@nrl.navy.mil**

Electronics Engineer, Naval Research Laboratory

Session 7.04 Avionics for Small Satellites, Nano-Satellites, and CubeSats

This session presents a survey of newly designed and heritage electrical and avionics subsystems for application in smaller spacecraft, including CubeSats. Example topics include: attitude determination and control; telemetry systems; command and data handling; power systems; thermal systems; and guidance and navigation systems, all scoped for small satellites (<50kg). Participants include fundamental research organizations, such as universities and national laboratories, as well as system providers, such as defense departments, and industry partners.

John Dickinson **jrdicki@sandia.gov**

Manager, Research & Development, Exploratory Real-Time Sensing, Sandia National Laboratories

Session 7.05 Power Electronics for Aerospace Applications

This session explores advanced power electronics designs and systems for space and avionics applications. Example topics include: power devices; wide bandgap power semiconductors; power electronics; electro-magnetic devices; photo-voltaic modules; energy storage and battery management systems and power systems. Papers discuss technical aspects of power electronics including extreme thermal and power requirements, radiation hardening, efficiency and power management, tolerance to aerospace environments, and reliability.

Christopher Iannello **chris.iannello@nasa.gov**

NASA Technical Fellow for Electrical Power, NASA - NESC

Peter Wilson **prw30@bath.ac.uk**

Professor, University of Bath

Session 7.06 Electronics for Extreme Environments

This session explores innovations in electronics technologies and packaging that help enable operation of electronics in extreme environments, including space. Technologies resilient to extremes in temperature, radiation, and launch vehicle environments are relevant. Example topics include: materials and techniques for assembling and testing microelectronics; component packaging, attachment, and connectors; thermal/mechanical/electrical/radiation performance comparisons; reliability and failure analyses; adaptation of manufacturing methods for space applications; and integration of diverse modules such as MEMS, power electronics, sensors, optics, RF and microprocessors.

Mohammad Mojarradi **mohammad.m.mojarradi@jpl.nasa.gov**

Manger, Componnent Engineering and Assurance, Jet Propulsion Laboratory

Gary Bolotin **gary.bolotin@jpl.nasa.gov**

Principal Engineer, NASA Jet Propulsion Lab

Session 7.07 Fault Tolerance, Autonomy, and Evolvability in Spacecraft and Instrument Avionics

This session explores adaptation, including Fault Tolerance, Autonomy, and Evolvability, in space electronics. Adaptation reflects the capability of a system to maintain or improve its performance in the presence of internal or external changes, such as faults and degradations, uncertainties and variations during fabrication, modifications in the operational environment, or incidental interference. This session addresses all aspects of adaptivity for spacecraft and instrument avionics with the scope of papers encompassing theoretical considerations, design solutions, and actual techniques applied to space flight operations.

Tom Hoffman **thoffman@jpl.nasa.gov**

Project Manager, Jet Propulsion Laboratory

Didier Keymeulen **didier.keymeulen@jpl.nasa.gov**

Principal, Member Technical Staff, Jet Propulsion Laboratory

Session 7.08 Guidance, Navigation, and Control Technologies for Space Applications

This session explores sensor, actuator, and processing innovations related to the guidance, navigation, and control of space vehicles. This session welcomes manuscripts that discuss technologies applicable to satellites, probes, landers, launchers, and other space-related missions.

John Enright jenright@ryerson.ca

Associate Professor, Ryerson University

Giovanni Palmerini giovanni.palmerini@uniroma1.it

Professor, Guidance and Navigation, Sapienza Universita' di Roma

Session 7.09 Emerging Technologies for Space Applications

This session explores a wide range of advanced, novel, and cutting edge avionics and electronic device technologies for space. Example topics include: advanced MEMS devices; 3D circuit printing; innovative embedded electronics applications (including multi-functional components); as well as the leveraging of advanced commercial electronics for space application. This session also serves as a catch-all for unique advanced technology topics that do not fit cleanly into other sessions or are inherently multi-disciplinary in nature.

William Jackson william.jackson01@l3harris.com

Senior Scientist, L3Harris Technologies

Michael Mclelland michael.mclelland@swri.org

Executive Director, Space Systems Directorate, Southwest Research Institute

Session 7.10 COTS Utilization for Reliable Space Applications

This session explores the use of commercial, off-the-shelf electronics and technologies in a space environment. Using commercial electronics not intended for an application in a space environment is becoming increasingly common. Topics of interest include: adaptations of COTS electronics for fault tolerance and environmental resilience; flight proven COTS electronics; novel implementations of electrical functions using COTS components; and results of COTS component use. Papers address theoretical considerations, design solutions, and actual techniques applied to space flight operations.

Harald Schone harald.schone@jpl.nasa.gov

Chief Technologist, Jet Propulsion Laboratory

Douglas Carssow douglas.carssow@nrl.navy.mil

Electronics Engineer, Naval Research Laboratory

Session 7.11 Designing Spacecraft Hardware for EM Compatibility, Signal and Power Integrity in Space Applications

This session explores the advanced and innovative techniques recently developed that ensure spacecraft hardware are designed and hardened for electromagnetic compatibility (EMC) with emphasis on signal integrity and power integrity (SI/PI) of the unit electronics. Topics of interest include: risks posed by Electromagnetic Interference (EMI), SI/PI, DC magnetic cleanliness and Electrostatic Discharge (ESD) present in spacecraft instruments, International Space Station instruments, spacecraft & space launch vehicle systems, robotics, and crewed vehicles. Papers address a wide range of topics and present innovative modeling and hardware solutions to EMC on the part, board, box, system, multi-system, planetary, and interplanetary levels. The harshness of the space environments necessitates a broader view of EMC issues than traditional terrestrial projects, often leading to creative methods and solutions that can benefit our society's efforts elsewhere on Earth.

Jeffrey Boye jeffrey.boye@jhuapl.edu

Engineer, JHUAPL

Pablo Narvaez pablo.narvaez@jpl.nasa.gov

Principal Engineer/Section Manager, NASA Jet Propulsion Lab

James Lukash emiguy@gmail.com

Principal Systems Engineer, Lockheed Martin Space

Track 8 Spacecraft & Launch Vehicle Systems & Technologies

Robert Gershman
robert.gershman@jpl.nasa.gov

MSR Senior Staff. Previously at JPL: Assistant Program Manager, Exploration Systems Engineering; Planetary Advanced Missions Manager; Deputy Manager, Galileo Science & Mission Design; Supervisor, Mission Engineering. At MDAC: Saturn & Skylab propulsion systems, Launch Team member for 3 Apollo missions.

Bret Drake
bret.g.drake@aero.org

Lead system engineering and programmatic assessments of advanced space systems. Previously at NASA, led design and analysis studies of human exploration in missions to the Moon, Near-Earth Objects, and Mars. BS., Aerospace Engineering, University of Texas at Austin.

Session 8.01 Human Exploration Beyond Low Earth Orbit

This session seeks papers addressing the broader aspects of human and scientific exploration including planning, development, system concepts, and execution of missions beyond low Earth orbit toward the lunar surface and on to Mars. Sample topics include systems architecture studies of human missions to cislunar space, the Moon and Mars, design reference mission analyses, strategic concepts, and broader trade study and systems engineering analyses for any aspect of human and scientific space exploration systems beyond low-Earth orbit. Lunar landers, surface systems and sustainable concepts for lunar exploration extensibility toward Mars exploration missions are in focus.

Bret Drake **bret.g.drake@aero.org**

Associate Director, The Aerospace Corporation

Kevin Post **kevin.e.post@nasa.gov**

Mission Design Engineer, Booz Allen Hamilton

Session 8.02 Human Exploration Systems Technology Development

This session seeks papers dealing with technology development for human exploration of space. This can include development efforts with technology readiness levels anywhere from laboratory to full-scale flight demos. It can also include assessments of technology needs of programs, program elements, or individual mission concepts.

Andrew Petro **andrew.j.petro@nasa.gov**

Program Executive, NASA - Headquarters

David Reeves **david.m.reeves@nasa.gov**

-, NASA - Langley Research Center

Session 8.03 Advanced Launch Vehicle Systems and Technologies

This session seeks papers covering on-going development and future advances in space transportation from Earth to orbit and distant destinations. Topics including transportation architectures, launch vehicles, infrastructure, transportation business and enabling technologies are of interest.

Melissa Sampson **msampson@ball.com**

Manager, Ball Aerospace

Randy Williams **randall.l.williams@aero.org**

Systems Director, The Aerospace Corporation

Session 8.04 Human Factors & Performance

This session seeks papers on human performance, integration, and operations within complex spacecraft systems. Suggested human factors topics may include cockpit and flight deck displays and controls, autonomous crew performance, handling qualities and flight performance, human-robotic interaction and performance, team performance and dynamics, training, countermeasures technologies/systems, and behavioral health and performance during short- and long-duration spaceflight. Papers including operations to experimental and modeling approaches, both in the laboratory and in spaceflight analog locations are of interest.

Jessica Marquez **jessica.j.marquez@nasa.gov**

Human System Engineer, NASA Ames Research Center

Kevin Duda **kduda@draper.com**

Group Lead, Space & Mission Critical Systems, The Charles Stark Draper Laboratory, Inc.

Session 8.05 Space Human Physiology and Countermeasures

This session focuses on the physiological aspects of humans in space and current or future countermeasures to maximize human health and performance in the space environment. Suggested topics include (but are not limited to) bone loss, muscle atrophy, psychological effects, sensory-motor deconditioning, extravehicular activity, cardiovascular adaptation, Spaceflight Associated Neuro-ocular Syndrome (SANS), decompression sickness, radiation, exercise, or artificial gravity. Physiological and psychological aspects of missions at Space Analogue sites are also of interest. Both experimental and modeling approaches are welcome.

Ana Diaz Artiles adartiles@tamu.edu

Assistant Professor, Texas A&M University

Andrew Abercromby andrew.abercromby-1@nasa.gov

Lead - Human Physiology, Performance, Protection and Operations (H-3PO) Laboratory, NASA Johnson Space Center

Session 8.06 Mechanical Systems, Design and Technologies

This session seeks papers on spacecraft configurations, structures, mechanical and thermal systems, devices, and technologies for space flight systems and in situ exploration. Papers addressing mechanical systems design, ground testing, and flight validation are also encouraged.

Lisa May lisa.may@aeroconf.org

Deputy Space Exploration Architect, Lockheed Martin Space

Alexander Eremenko alexander.e.eremenko@jpl.nasa.gov

Mechanical Systems Engineer, Jet Propulsion Laboratory

Session 8.07 Spacecraft Propulsion and Power Systems

This session seeks papers on the development and infusion of in-space propulsion and power technologies for future NASA deep space science missions and Earth orbiting applications. The session's primary focus is on in-space robotic satellite applications and is not intended for human spaceflight topics or launch vehicles.

Erica Deionno erica.deionno@aero.org

Principal Director, The Aerospace Corporation

Richard Hofer richard.r.hofer@jpl.nasa.gov

Supervisor, Electric Propulsion, Jet Propulsion Laboratory

Session 8.08 Nuclear Space Power Generation

The Nuclear Space Power Generation session invites papers on all things nuclear and related to space power: concepts for dynamic power systems and static generators at all scales, conversion technologies, fuel processing, reactors for manned and unmanned space missions, lessons learned and best practices, plans for future devices, models and simulations, test results, government policies, nuclear launch safety, infrastructure, and technologies on any scale that address the future success of space missions.

Carl Sandifer carl.e.sandifer@grc.nasa.gov

Deputy Chief, Space Science Project Office, NASA Glenn Research Center

Michael Smith smithmb@ornl.gov

Staff Researcher, Oak Ridge National Laboratory

Session 8.09 Systems and Technologies for CubeSat/Smallsats

This session seeks papers covering technologies and systems for very small spacecraft (secondary platforms such as CubeSat, ESPA and ASAP-class) that enable "big" science and technology missions on a small budget. Papers that evaluate flight or testing results are strongly encouraged.

Michael Swartwout mswartwo@slu.edu

Assistant Professor, Saint Louis University

Justin Boland justin.s.boland@jpl.nasa.gov

System Engineer, JPL

Session 8.10 Systems and Technologies for Ascent from Planetary Bodies, a Multidisciplinary Problem

This session covers both the individual technologies, the system level interactions and trades, and the issues that influence the design of ascent systems leaving the surface of planetary bodies, such as the Moon, Mars, Phobos and others within our solar system. It addresses issues like the impacts of thermal constraints, propulsion design and performance, GN&C, aerodynamic impacts, and packaging constraints on ascent vehicle design.

Tara Polsgrove tara.polsgrove@nasa.gov

Lead Systems Engineer, Human Landing System, NASA Marshall Space Flight Center

Ashley Karp ashley.c.karp@jpl.nasa.gov

Technologist, Jet Propulsion Laboratory

Track 9 Air Vehicle Systems and Technologies

Christian Rice
christian.rice@navy.mil

Chief Test Engineer, Rotary Wing. BS, Aerospace and Ocean Engineering; MS, Aviation Systems.

Christopher Elliott
christopher.m.elliott@lmco.com

Technical Fellow, Flight Control and Vehicle Management Systems Team and Quantum Information Science Research Team, Lockheed Martin Skunk Works, Fort Worth. Over 20 years experience. Adjunct Professor, Texas Christian Univ. and UT, Arlington. AIAA Associate Fellow. BS, MS and PhD, Aerospace Engineering, Univ. of Texas.

Session 9.01 Air Vehicle Flight Testing

Session focuses on the technology, techniques, and procedures of fixed and rotary wing aircraft flying qualities, performance, and mission systems testing at the installed full-system system level.

Brian Kish **bkish@fit.edu**

Assistant Professor, Florida Institute of Technology

Session 9.02 UAV Systems & Autonomy

This session includes papers on all aspects of Unmanned Aerial Vehicle (UAV) systems and autonomy. All aspects of UAVs — from design to execution, from experimental to operational — are included. Autonomy related to UAVs and policy discussions related to UAVs are also represented.

Luis Gonzalez **felipe.gonzalez@qut.edu.au**

Associate Professor, Queensland University of Technology

Frances Zhu **zhu@higp.hawaii.edu**

Assistant Research Professor, University of Hawaii at Manoa

Will Goins **wgoinsaerospace902@gmail.com**

Sr. Principal Electronics Engineer, Dynetics Inc

Session 9.03 Aircraft Systems & Avionics

The focus of this session is to introduce innovative concepts in the areas of aircraft systems and avionics development, integration and testing for improving aircraft performance, airframe systems performance, survivability, situational awareness, energy state awareness, and airspace awareness.

Andrew Lynch **vvtp01@gmail.com**

Acquisition Lead, Naval Air Systems Command

Session 9.04 Air Vehicle Flight Controls

This session focuses on the development, testing, and technologies of air vehicle flight controls, including fixed wing, rotary wing, and unmanned aerial vehicles.

Tom Mc Ateer **thomas.mcateer@navy.mil**

System of Systems Test and Evaluation, NAVAIR

Christopher Elliott **christopher.m.elliott@lmco.com**

LM Fellow, Lockheed Martin Aeronautics Company, Texas Christian University, The University of Texas at Arlington

Olivier Toupet **otoupet@jpl.nasa.gov**

Robotic Aerial Mobility Group Supervisor, Jet Propulsion Laboratory

Track 10 Software and Computing

Kristin Wortman
kristin.wortman@jhuapl.edu

Principal professional staff, Space Exploration Sector's Space Mission Assurance group, APL. Lead software assurance engineer for DART and Dragonfly NASA missions. Adjunct professor, Computer Sciences Department, University of Maryland. B.S., Computer and Information Science; M.S., Software Engineering, University of Maryland.

Virgil Adumitroaie
virgila@jpl.nasa.gov

Data Scientist, JPL. Working on planetary atmospheric and magnetospheric modeling. Past research in high-speed turbulent combustion modeling, data dimensionality reduction, neural networks, signaling pathways, decision support, climate data assimilation, and scientific software development. Ph.D., ME, University at Buffalo.

Session 10.01 Computational Modeling

The focus of this session is Computational Modeling in any discipline, with emphasis on the mathematical model of the phenomenology and on the numerical algorithms used for solution. Disciplines include fluid dynamics and fluid/thermal sciences, earth and planetary physics, systems engineering studies, sensor management and sensor modeling, and radar and signal processing.

Darrell Terry — **darrell.terry@att.net**

Principal Radar Engineer, PredaSAR

Virgil Adumitroaie — **virgila@jpl.nasa.gov**

Data Scientist, Jet Propulsion Laboratory

Session 10.02 Innovative Software Engineering and Management Techniques and Practices

Practices followed during development and management of aerospace software systems vary across the industry. This divide seems to be growing as emerging markets, such as commercial space and cubesats, adopt techniques from other software domains while the traditional aerospace market works to tailor existing processes. Suggested topics covering both experience and research in software engineering and management techniques with both flight and ground system development such as: innovative software architectures, code reuse, software project management, COTS integration, alternative design and implementation approaches and new programming languages. Other software engineering topics will also be considered in this session.

Kristin Wortman — **kristin.wortman@jhuapl.edu**

Principal Professional Staff, Johns Hopkins University Applied Physics Laboratory

Ronnie Killough — **rkillough@swri.org**

Director - R&D, Southwest Research Institute

Session 10.03 Software Architecture and Design

Appropriate software architecture is critical to the design, development and evolution of all software systems, and its role in the engineering of software-intensive applications in the aerospace domain has become increasingly important. This session solicits novel ideas on the foundations, languages, models, techniques, tools, and applications of software architecture technology. Topics include software architecture for space mission systems; architecture across software, system and enterprise boundaries; architectural patterns, styles and viewpoints; architecture frameworks; design reasoning, capturing and sharing design decisions; and open architectures, product-line architectures, and systems of systems software architects' roles and responsibilities.

Martin Stelzer — **martin.stelzer@dlr.de**

Research Associate, German Aerospace Center (DLR)

Peter Lehner — **peter.lehner@dlr.de**

Robotics Research Scientist / Engineer, German Aerospace Center (DLR)

Session 10.04 Software Quality, Reliability and Safety Engineering

The focus of this session is to share systematic practices followed in aerospace to ensure an adequate confidence level that a software system conforms to its requirements and will perform in a safe and reliable manner. Software quality, reliability and safety engineering covers methodologies and techniques used for assessment of the development cycle, verification, validation and test programs, standards, models, certifications, tools, data analysis and risk management.

Kristin Wortman — **kristin.wortman@jhuapl.edu**

Principal Professional Staff, Johns Hopkins University Applied Physics Laboratory

Paul Wood — **paul.wood@swri.org**

Staff Computer Scientist, Southwest Research Institute

Session 10.05 Model-based Systems and Software Engineering

This session is concerned with the application, or potential application, of advanced model-based approaches, methodologies, techniques, languages, and tools to the aerospace domain. Topics ranging from theoretical and conceptual work in these areas to specific, concrete applications, in scope from small software systems to large system-of-systems, are welcome. Other driving current themes include: coordination and usage of multiple types of models, e.g., digital twins, descriptive versus behavioral models; the use of MBSE simulations and analyses in support of architecture; the application of information visualization techniques for improved MBSE deliverables; the use of MBSE in specialized domains such as electrical systems engineering. The Session's areas of interest including model-based architecture and analysis, design, control systems, verification and testing, simulation, domain specific languages and transformations, aircraft, spacecraft, instruments, flight systems, ground systems, planning and execution, guidance and navigation, and fault management.

Alexander Murray **alex.murray@jpl.nasa.gov**

Senior Systems Engineer, Jet Propulsion Laboratory

Oleg Sindiy **oleg@jpl.caltech.edu**

Senior Systems Engineer, Jet Propulsion Laboratory

Session 10.06 Implementing Artificial Intelligence for Aerospace

This session considers how to create state-of-the-art single and multi-agent technologies for developing 'intelligent' systems in both hardware and software. It will include papers related to all areas of single- and multi-craft aerospace mission systems and autonomous control (ground station, spacecraft/satellite, unmanned aircraft and ground rovers) and papers related to partially and fully autonomous aerospace systems. Techniques considered will include, but are not limited to genetic algorithms, swarm intelligence, probabilistic AI, machine and reinforcement learning, training & learning tools, and intelligent multi-agent systems. This session invites papers on best practices towards implementing new state-of-the-art autonomy and intelligence systems for aerospace. Papers on clustering, distributed, or formation flying missions and control techniques for low-cost, small-size craft are particularly welcomed.

Jeremy Straub **jeremy.straub@ndus.edu**

Assistant Professor, North Dakota State University

Daniel Clancy **daniel.clancy@gtri.gatech.edu**

Senior Research Engineer, Georgia Tech Research Institute

Session 10.07 Human-Systems Interaction

Humans are the most critical element in system safety, reliability and performance. Their creativity, adaptability and problem-solving capabilities are key to resilient operations across the different aerospace applications. This session focuses on the technologies and techniques leading to effective interfaces and interaction between humans and spacecraft, robots, and other aerospace systems. Specific topics of interests include HCI-HMI, multimodal sensory integration such as vision, haptics and audio, situational awareness, tele-operation interfaces, visualization, virtual and mixed reality environments, augmented reality and natural user interfaces as applied to design, production, operations, and analysis, as well as training and for decision support. Novel solutions from other domains and their application in aerospace domain, specifically contributing to an efficient human systems interaction are also of interest.

Janki Dodiya **jankidodiya@gmail.com**

Senior Research Scientist,

Andreas Gerndt **andreas.gerndt@dlr.de**

Head of Department, German Aerospace Center (DLR)

Session 10.08 Image Processing and Computer Vision

The focus of this session is both theoretical and experimental work on Image Processing and Computer Vision in aerospace applications. The disciplines include, but not limited to image-based navigation, image classification, image reconstruction, image segmentation, feature extraction, image compression, object detection and tracking, image correlation, coding and limitations, computational complexity, adaptive algorithms, video coding (e.g., MPEG, H.265), hardware and bandwidth limitations, key improvements, contributions, and lesson learned.

Amir Liaghati **amir.l.liaghati@boeing.com**

Electricall Engineer, Boeing

Yumi Iwashita **yumi.iwashita@jpl.nasa.gov**

Robotics Technologist, Jet Propulsion Laboratory

Track 11 Diagnostics, Prognostics and Health Management (PHM)

Andrew Hess
andrew_hess@comcast.net

Consultant to government and industry on advanced diagnostics, prognostics, data and predictive analytics, CBM, smart manufacturing, health and asset management of machines and engineering systems. Previously program office lead for the JSF PHM effort. Current President of the PHM Society.

Wolfgang Fink
wfink@email.arizona.edu

Associate Professor and Edward & Maria Keonjian Endowed Chair, University of Arizona with joint appointments in the Departments of ECE, BME, SIE, AME, and Ophthalmology & Vision Science. AIMBE Fellow, PHMS Fellow, SPIE Fellow, UA da Vinci Fellow, UA ACABI Fellow, and Senior Member IEEE. Ph.D., Physics, University of Tübingen, Germany.

Session 11.01 PHM for Aerospace Systems, Subsystems, Components, Electronics, and Structures

Advanced Diagnostics and PHM can be and is applied separately or concurrently at the device, component, subsystem, structure, system and/or total platform levels. This session will give PHM developers, practitioners, integrators, and users a chance to discuss their capabilities and experiences at any or all of these application levels. Discussion of the integration of PHM capabilities across these various levels of application is welcome and encouraged. Applications involving propulsion systems, fuel management, flight control, EHAS, drive systems, and structures are particularly solicited.

Andrew Hess **andrew_hess@comcast.net**

President, The Hess PHM Group, Inc.

Session 11.02 PHM for Autonomous Platforms and Control Systems Applications

This session focuses on diagnostics and prognostics for autonomous system applications and control systems. This would include autonomous system architectures, electronic controls, control systems, and electronic systems for both the item under control and the controlling system. Methods for autonomous decision making, fault detection, rate of progression, and consequence or mission risk are encouraged. The session also is looking for novel technical approaches to use diagnostic and prognostic information to provide control input adjustments that can slow or reverse fault progression.

Derek De Vries **derek.devries@ngc.com**

Senior Fellow, Nothrop Grumman Propulsion Systems

Session 11.03 PHM System Design Attributes, Architectures, and Assessments

Design of complex systems, such as aircraft and space vehicles, requires complex trade-offs among requirements related to performance, safety, reliability, and life cycle cost. The development of effective architectures and implementation strategies are extremely important. This session will focus on the application of methods such as testability, diagnosability, embedding sensors, prognostics, remaining useful life estimates used to design complex aerospace systems, and architectures to design, enable, and implement complex aerospace systems. We invite papers discussing new methodologies, lessons learned in application of health management methods in system design, and operational experience with health management capabilities embedded into systems early in the design process.

Andrew Hess **andrew_hess@comcast.net**

President, The Hess PHM Group, Inc.

Derek De Vries **derek.devries@ngc.com**

Senior Fellow, Nothrop Grumman Propulsion Systems

Session 11.04 Non-Destructive Testing and Sensor Technologies for PHM Applications

This session is designed to bring together researchers and engineers developing sensors applicable to SHM and IVHM. Papers are invited on MEMS, MOEMS, nanotechnology, BIOS, quantum dots, chemical sensors, optical sensors, and imaging sensors that can be integrated with nondestructive testing applications for structural health monitoring and diagnostics. Description of novel and disruptive sensor technologies is solicited.

Morteza Safai **morteza.safai@boeing.com**

Sensors Engineer / Technical Fellow, Boeing Company

Session 11.05 PHM for Non-Aerospace Applications

This session seeks contributions in non-aerospace but related applications, e.g., automotive industry, trains, marine, oil & gas, etc. Both programmatic and technology presentations are solicited, particularly those focused on capabilities, cost benefits, and lessons learned.

Andrew Hess **andrew_hess@comcast.net**

President, The Hess PHM Group, Inc.

Session 11.06 PHM for Commercial Space Applications

This session seeks papers on diagnostics, prognostics, health management (PHM) and autonomous fault management for satellites and other commercial space applications. Papers are sought in the areas of satellites, launch vehicles, and other new space ventures (e.g., tourism, natural resource exploitation). Papers may address research, actual flight experience, and future planning related to satellite and launch vehicle PHM and fault management.

Wolfgang Fink **wfink@email.arizona.edu**

Associate Professor, University of Arizona

Andrew Hess **andrew_hess@comcast.net**

President, The Hess PHM Group, Inc.

Derek De Vries **derek.devries@ngc.com**

Senior Fellow, Nothrop Grumman Propulsion Systems

Session 11.07 PHM for Human Health and Performance

This session is an effort to bridge PHM to Space Medicine as part of Integrated System Health Management (ISHM) and healthcare domains as applied to High Value Human Asset. PHM for HH&P is focused on tracking status of very healthy individuals 24/7, as well as ensuring a sustained top-level performance required on manned space exploration missions. Papers are sought that show how systems engineering with PHM techniques and methodologies, such as predictive analytics, predictive diagnostics, root cause analysis, virtual sensors, data and information fusion, data mining, and big data analytics with computationally generated biomarkers can serve as a scientific and engineering foundation for building both evidence-based and analytics-based individual health maintenance/support for human assets. Objectives include developing and demonstrating PHM capabilities for assessing, tracking, predicting, and ultimately improving long-term individual human health status to ensure mission success.

Alexandre Popov **popov.alexandre@gmail.com**

NASA Emeritus Docent at the U.S. Space and Rocket Center and AIAA Systems Engineering Technical Committee (SETC) Member, AIAA SETC

Wolfgang Fink **wfink@email.arizona.edu**

Associate Professor, University of Arizona

Session 11.08 PHM and Digital Engineering and Transformation

This session solicits contributions in the areas of PHM applications focused around the recent Digital Twin and Digital Thread paradigm, Model Based System Engineering, and Enterprise-wide Digital Transformation in aerospace and associated industries.

Andrew Hess **andrew_hess@comcast.net**

President, The Hess PHM Group, Inc.

Mark Walker **mark.walker@d2ktech.com**

Vice President, Engineering, D2K Technologies

Session 11.09 Panel: PHM from a Practitioner's Perspective – a Potpourri of Capabilities, Issues, Case Studies, and Lessons Learned

Practitioners in the PHM field are solicited to share their experiences and observations as part of a distinguished panel of experts. A short presentation will be required of all participants that describes their focus topic within the PHM and CBM+ domains. This session will cover a broad range of research, lessons-learned experiences and application topics covering the challenges and innovative engineering and/or business approaches associated with the development and implementation of PHM capabilities and CBM+ architectures. The session will feature presentations by senior leaders in the field and a panel discussion. Panel members from PHM communities, academia, government, and industry, will focus on strategies that have or will resolve historical issues, and challenges, and provide insight. Interested parties should contact the session organizers.

Andrew Hess **andrew_hess@comcast.net**

President, The Hess PHM Group, Inc.

Track 12 Ground and Space Operations

Mona Witkowski
mona.m.witkowski@jpl.nasa.gov

Flight Director/Deputy Project Manager, CloudSat Mission, and Operations Mission Manager for the Gravity Recovery and Climate Experiment, Jet Propulsion Laboratory. Over 35 years experience in spacecraft development and operations. Recipient of NASA Exceptional Service Medal and NASA Exceptional Achievement Medal.

Carlos Gomez Rosa
carlos.gomez@nasa.gov

Ground System Manager and future Mission Ops Manager for the GeoCarb Mission, Goddard Space Flight Center. Former Ops Management with Landsat 9, MAVEN, and GOES-O Missions. MS in Engineering, JHU. Robert H. Goddard Award for Exceptional Achievement in Engineering; NASA Honor Award/Exceptional Achievement Medal.

Session 12.01 Spacecraft Flight Operations: Innovative Approaches for Orbital and Surface Mission Operations

This session solicits papers which highlight innovative approaches for conducting spacecraft orbital and surface mission operations. Responding to in-flight anomalies, mission operations challenges, automation, risk reduction and space debris collision avoidance, are also topics that are encouraged. Additional topics solicited include: challenges to managing single or multi-mission operations, operating satellite constellations, small satellite operations, team development, staffing, cost reduction and lessons learned for future missions.

Mona Witkowski **mona.m.witkowski@jpl.nasa.gov**

Flight Director / Deputy Project Manager, Jet Propulsion Laboratory

Heidi Hallowell **hhallowe@ball.com**

Principal GNC Engineer, Ball Aerospace

Session 12.02 Ground Systems, Mission Planning, Payload and Instrument Operations

This session entertains papers on topics related to ground systems design and architectures, flight/ground interfaces, and software tools, as well as current and emerging methods and technologies to support all aspects of mission design, planning, and operations. Papers that discuss aspects of payload, instrument, and sensor operations, including techniques, tools, procedures, and concepts for planning, scheduling, commanding, processing, analyzing, and optimizing command and telemetry data are encouraged. We would also like to hear about ideas and approaches for the design, integration, and automation of efficient ground systems. Additional focus is on development of processes & tools that enhance system robustness, while simultaneously allowing for greater operability as well as flexibility in nominal operations for ongoing & next-generation missions; and plans for risk-mitigation and anomalous scenarios, including onboard fault protection and ground-in-the-loop responses.

Priyanka Sharma **priyanka.sharma@jpl.nasa.gov**

Systems Engineer, Jet Propulsion Laboratory

Kedar Naik **knaik@ball.com**

Senior Engineer, Ball Aerospace

Session 12.03 Human Space Flight Development, Operations and Processing

This session focuses on all aspects of Human Spaceflight processing and operations across all mission regimes. Research topics including the design, and development of manned spacecraft hardware and support systems, as well as operations research focused on pre-flight, in-flight and post-flight activities is encouraged. Additionally, research dedicated to specific areas such as flight operations including IVA and EVA, landing and recovery of crewed spacecraft, and the physiological and psychological effects on human beings during all of these mission types and phases is also encouraged.

Michael Lee **michael.r.lee@nasa.gov**

Deputy Manager, Mission Management & Integration, NASA - Kennedy Space Center

William Koenig **william.j.koenig@nasa.gov**

Production Operations Lead, NASA - Kennedy Space Center

Session 12.04 Information Technology and Cyber Security Roles in Operations

Efficient network design and implementation are necessary for the protection of space system assets and mission execution capabilities. This session welcomes approaches for IT design tailored for the aerospace domain. Security engineering to prevent intrusions and situational awareness tools to monitor the system and detect attacks, are evolving technologies enabling increased protection for the mission. In addition, mission resilience to cyber attack is an emerging field critical for protecting the mission. Other topics include: unique cyber vulnerabilities/solutions for space systems, the implementation of network security and information security techniques, advanced CONOPS, implications for NIST's Risk Management Framework for Space, analytics applied to space systems, and lessons learned.

Jeremy Straub **jeremy.straub@ndus.edu**

Assistant Professor, North Dakota State University

Atif Mohammad **amoham19@uncc.edu**

Professor, University of North Carolina at Charlotte

Session 12.05 Automation and Machine Learning Applications in Spacecraft Operations

This session invites contributions that are concerned with the applications of machine learning and data science techniques to deal with the increasing amounts of data being collected in spacecraft operations on flight and/or ground segments. These techniques could be related to any subsystem of the spacecraft, including telecom, power, thermal, or specific instrument data and that of the ground segments. Topics ranging from theoretical and conceptual treatment in these areas to specific and operational treatments are solicited. The benefits of these techniques are very wide in scope from enhancing operator productivity by providing diagnostic tools that detect and explain causes of anomalous behavior either in real-time or by post-processing, to automating mission operations. These benefits are also crucial for smaller missions, such as the emerging CubeSats missions, that typically have very lean teams.

Mazen Shihabi — **mazen.m.shihabi@jpl.nasa.gov**

Technical Group Supervisor, Jet Propulsion Laboratory

Zaid Towfic — **zaid.j.towfic@jpl.nasa.gov**

Signal Analysis Engineer, Jet Propulsion Laboratory

Track 13 Systems Engineering, Management, and Cost

Jeffery Webster
jeff.webster@aeroconf.org

Retired Senior Systems Engineer. NASA/Jet Propulsion Laboratory: Project Support Lead-Project Support Office; Mission Systems Concepts Section-Mars Trace Gas Orbiter; Project Planner & Systems Engineering; Associate Engineer, Mission & Systems Concepts Section. Publications and awards available upon request.

Torrey Radcliffe
torrey.o.radcliffe@aero.org

Associate Director, Space Architecture Department, The Aerospace Corporation. Background in preliminary spacecraft design, space architecture development and portfolio analysis of manned and unmanned systems. S.B, S.M. and PhD in Aeronautics and Astronautics from MIT.

Session 13.01 Systems Architecture, Engineering and System of Systems

This session is dedicated to papers dealing with the fundamental challenges associated with architecting and high level systems engineering of large-scale systems and systems-of-systems, including development and application of tools and techniques that support both architecting and system engineering processes (e.g., Architecture Descriptions, Model Based Systems Engineering, Architecture Decision Support), maintaining the integrity of "the architecture" across the project lifecycle, and discussions of successful (and not so successful) architecting and systems engineering endeavors with an emphasis on the lessons learned.

Lisa May — **lisa.may@aeroconf.org**

Deputy Space Exploration Architect, Lockheed Martin Space

Daniel Selva — **dselva@tamu.edu**

Assistant Professor, Texas A&M University

Dean Bucher — **dean.a.bucher@aero.org**

Associate Principal Director, The Aerospace Corporation

Session 13.02 Management and Risk Tools, Methods and Processes

This session addresses tools, methods, and processes for managing aerospace system development programs/projects, mission operations, technology development programs, and systems engineering organizations. Topics include analyzing risks; managing all life cycle phases of programs/projects; using project-level management disciplines including project management, systems engineering, scheduling, safety and mission assurance, and configuration management; and improving training and capability retention (passing expertise between generations of systems engineers); and managing aerospace technology development programs.

Jeremiah Finnigan — **jeremiah.finnigan@jhuapl.edu**

Senior Professional Staff, Johns Hopkins University/Applied Physics Laboratory

Robin Dillon Merrill — **rld9@georgetown.edu**

Professor, Georgetown University

Session 13.03 Cost and Schedule Tools, Methods, and Processes

This session addresses cost and schedule analysis tools, methods, processes, and results including design trades for design concepts and technologies throughout a project's life cycle. Topics addressed include cost or schedule model development, regression analysis and other tools, historical studies addressing trends, databases, government policies, industry training, mission cost analysis, operations and supporting/infrastructure cost, mission portfolio analysis, case histories, lessons learned, process control, and economic and affordability analysis that assesses program/project viability.

Stephen Shinn — **stephen.a.shinn@nasa.gov**

Chief Financial Officer (Acting), NASA - Headquarters

Eric Mahr — **eric.m.mahr@aero.org**

Senior Project Leader, The Aerospace Corporation

Session 13.04 Operationally Driven Design, Development, and Testing of Space Systems

This Session addresses operationally driven design, development, and testing methods for space systems. Examples include robotic and human surface assets, ISRU and in-space manufacturing and assembly, teleoperational methods, EVA tools and methods, human space vehicles, unique approaches to deep space missions, and NASA's Moon to Mars Campaign.

Ryan Wall ryan.wall813@yahoo.com

Principal, Rewind

Danielle Richey danielle.richey@lmco.com

Systems Engineer, Advanced Programs, Lockheed Martin Space Systems Company

Session 13.05 Advances in Conceptual Design Methods and Applications

This session is dedicated to the discussion of the topics related to the current state of practice and future advances in the application of conceptual design methods and applications. The goal of the session is to foster the application of MBSE and MBE in conceptual design, advances in concurrent engineering and collaborative engineering practices and approaches across the lifecycle, advances in methods that support team based systems engineering, and novel applications of concept design methods. Examples are optimization techniques, results visualization, and trade space exploration.

Rob Stevens robert.e.stevens@aero.org

Director of Model Based Systems Engineering Office, Aerospace Corporation

Alfred Nash alfred.e.nash@jpl.nasa.gov

Lead Engineer, Team-X, Jet Propulsion Laboratory

Session 13.06 System Simulation and Verification

This session addresses the design, implementation, and use of system-level simulations to measure or verify the performance and utility of space, ground, and related systems.

Virgil Adumitroaie virgila@jpl.nasa.gov

Data Scientist, Jet Propulsion Laboratory

Session 13.07 System Verification & Validation and Integration & Test

This session focuses on the Verification & Validation and Integration & Test processes and case studies for Projects/Flight/Sub systems, and systems of systems.

Benjamin Solish bsolish@jpl.nasa.gov

Systems Engineer, Jet Propulsion Laboratory

Sarah Bucior sarah.bucior@jhuapl.edu

Systems Engineer, Johns Hopkins University Applied Physics Laboratory

Session 13.08 Strategic Technology Planning, Management & Infusion

This session addresses strategic planning, research, development, and infusion of innovative technology to meet the future needs of civil space, commercial space, and national security space users. It includes technology strategy and roadmaps, technology maturation, and mission infusion to overcome the valley of death. This session also focuses on opportunities as well as legal and operational challenges as associated with partnerships, technology transfer, commercialization, and recent developments in aerospace startup accelerators for public and private sectors.

Hemali Vyas hemali@aeroconf.org

Project Development Leadership, Jet Propulsion Laboratory

Rob Sherwood rob.sherwood@aero.org

Principal Director, CTO Strategy Integration Office, Aerospace Corporation

Theodore Bujewski tbujewski@yahoo.com

Director, Science and Technology Integration, US Space Force, Department of Defense

Session 13.09 Promote (and Provoke!) Cultural Change

"Culture Eats Strategy for Breakfast!"* Culture is a byproduct of habits, and this session explores how to create habits, environments, and nutrients that help great things grow. *Peter Drucker, noted management consultant, educator, and author.

David Scott 2davescott@gmail.com

NASA Retiree (for the moment), (Self)

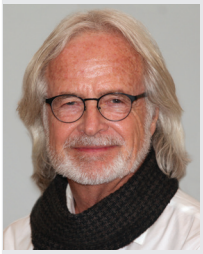
Rob Sherwood rob.sherwood@aero.org

Principal Director, CTO Strategy Integration Office, Aerospace Corporation

John Ryskowski jfryskowski@yahoo.com

President, JFR Consulting

Track 14 Government Plans, Policies and Education



Richard Mattingly richard.l.mattingly@jpl.nasa.gov

Member of the Mars Program Formulation Office at NASA's Jet Propulsion Laboratory, leading numerous architectural studies on Mars Sample Return starting in the early 2000's. Managed systems engineering groups for JPL's projects implemented in partnership with industry, and instrument and payload development. Involved in the formulation and development of many of JPL's planetary and Earth-orbiting spacecraft and payloads since the 1970's.

Session 14.01 PANEL: Technology Development for Science-Driven Missions

Planning for and developing technology is an ongoing process for Planetary Science Missions. The science community and associated technologists are key stakeholders in that process. This panel focuses on a topic of interest each year.

Patricia Beauchamp patricia.m.beauchamp@jpl.nasa.gov

Chief Technologist, Jet Propulsion Laboratory

Session 14.02 PANEL: Emerging Technologies for Mars Exploration

This panel will discuss the unique technology needs for future Mars exploration, including those for robotics explorers as well as groundbreaking technologies for future human missions. Panelists will highlight a variety of emerging technologies that can enable these future pathways for Mars exploration.

Charles Edwards chad.edwards@jpl.nasa.gov

Manager, Advanced Studies, Mars Exploration Program, Jet Propulsion Laboratory

Session 14.03 PANEL: Access To Space and Emerging Mission Capabilities

The high cost of launch continues to be a roadblock to space missions large and small. The development of adapters (ESPA, PPOD, e.g.), the development of new launch vehicles, the acceptance of risk for accommodating secondary or auxiliary payloads, and the explosion of cubesat and smallsat capability have led to some creative approaches to space missions. This panel is meant to showcase how our space colleagues are leveraging these emerging capabilities.

Eleni Sims sam.sims@aero.org

Project Engineer, Aerospace Corporation

Kara O'Donnell kara.a.odonnell@aero.org

Principal Director, Aerospace Corporation

Session 14.04 PANEL: Progress and Plans for the Deep Space Human Exploration Architecture

NASA has been charged with leading a sustainable program of exploration with commercial and international partners to enable human expansion beyond low-Earth orbit (LEO). This panel will discuss current plans and status of the NASA exploration programs implementing the deep space architecture, including progress toward the first flights of SLS and Orion, development of the Gateway, Human Landing System, and plans for lunar surface capabilities.

Marshall Smith marshall.smith@nasa.gov

Deputy Chief Engineer, NASA HQ

Session 14.05 PANEL : Mars Exploration Science: Mars Sample Return and Beyond

The panel will present the science of the Mars Exploration Program, including the latest discoveries from ongoing MRO, Curiosity, and TGO missions and the most recent explorer, InSight, and will address questions driving future missions. What do we hope to learn from the Mars 2020 Rover and the samples returned to Earth? What is the potential for future mission discoveries?

Michael Meyer michael.a.meyer@nasa.gov

Lead Scientist, Mars Exploration Program, NASA HQ

Session 14.06 PANEL : ISS Transition and the Commercialization of LEO

In this discussion, panelists will update NASA's plans for International Space Station Transition and LEO commercialization. The panelists will discuss policy, strategies, and activities in progress and planned on the ISS to enable a commercial LEO economy where NASA is one of many customers. Utilization activities designed to build sustainable demand for low-Earth orbit (LEO) services will be discussed by the Center for Advancement of Science in Space (CASIS), the operator of the ISS National Lab.

Robyn Gatens robyn.gatens@nasa.gov

Acting Director, ISS, NASA - Headquarters

Session 14.07 PANEL: Model-based Engineering – Paradigm Shift or Business as Usual?

The panel will discuss directions and implications of model-based engineering initiatives across large government organizations: policies, processes, technologies, and application domains.

Sanda Mandutianu sanda.mandutianu@jpl.nasa.gov

Sr. Systems Software Engineer, Jet Propulsion Laboratory

Junior Engineering & Science Conference

Yellowstone Conference Center
Big Sky, Montana March 8, 2022

Junior Conference Submission Deadlines

Junior Abstract Deadline : January 18, 2022

Junior Presentation Deadline : February 15, 2022

Who may participate

Any student, 1st through 12th grade, who is registered at the conference as an official guest of a primary registrant, is eligible to present a paper as a Junior Engineering & Science Speaker.

Number of participants

To provide sufficient time for each presentation, the number of participants will be limited to 25. Preference will be given to the earliest submissions.

Topics

Topics with direct or tangential relationship to science, engineering, or mathematics are encouraged.

Student's Research

The presentation should describe one of the following:

1. An original idea accompanied by supportive reasoning and data
2. An experiment, invention or field work
3. A review summarizing a topic of interest.

How to Submit Your Presentation

1. Write a short **abstract** describing your topic.
2. Have your parent or guardian who is registered for the conference register you as a junior engineer, complete a release form, and submit your abstract to Session 15.01 (Junior Conference) on the conference website, www.aeroconf.org (select Session 15.01 Junior Engineering Conference). **The abstract cut-off date is Tuesday, January 18, 2022**. You will receive an email confirmation of acceptance.
3. Prepare a 5–10 slide PowerPoint presentation of your work. The title slide should include your name, age, grade, special interests, and (if you choose) a photo of yourself. You may have help from an adult, but the presentation should be primarily your own work.
4. Once your abstract is confirmed, submit your PowerPoint presentation to the conference website as soon as possible. **The presentation deadline is Tuesday, February 15, 2022**. No late presentations will be included in the conference.
5. Prior to the conference all Junior Engineering & Science presentations will be loaded onto a single laptop. You will have an opportunity to practice before giving your presentation.
6. After the last presentation, all participants will receive an electronic copy of the Junior Engineering & Science Conference Proceedings.

Please check the Junior Conference webpage for additional information: https://aeroconf.org/junior-engineering

2022 Junior Engineering & Science Conference Contacts

Co-Chair Rich Terrile — **E-mail rich.terrile@jpl.nasa.gov**

Co-Chair Christine Terrile — **E-mail christine@aeroconf.org**

Back Cover – *Artist's concept of the Parker Solar Probe spacecraft approaching the Sun. Launched in 2018, Parker Solar Probe provides new data on solar activity and makes critical contributions to our ability to forecast major space-weather events that impact life on Earth.* ***Photo Credit: NASA/Johns Hopkins APL/Steve Gribben.***

2022 IEEE Aerospace Conference

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