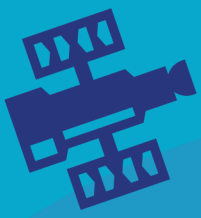

23RD AMOS

Advanced Maui Optical and Space Surveillance Technologies Conference

2022 PROGRAM

SEPTEMBER 27-30 | MAUI, HAWAII

PRESENTED BY

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WELINA MAI KAKOU | WELCOME

Aloha!

We are pleased that you are participating in the 23rd AMOS Conference. It is gratifying to welcome our largest attendance yet to Maui to continue the important dialogue on space situational/domain awareness.

We have sprinkled elements throughout the week to remind us of our uniquely Hawaiian "Sense of Place." Among them are the leis worn at the welcome reception, our traditional Native Hawaiian invocation opening the conference, and local entertainment.

With priority on COVID-19 health and sanitation protocols, working with our venue host, Wailea Beach Resort, Marriott, we have done our best to create a safe experience for everyone. **Your conference name badge is required for entry to all events.** One (1) guest is invited to join you for the Welcome Reception on Tuesday night and should be indicated on your registration. All other events are for registered conference participants only.

If there is anything our Conference Team can do to make your week more productive and enjoyable, please let us know.

Warmest Aloha,
The AMOS Conference Team

HEALTH & SAFETY PROTOCOLS

Safety protocols are based on the prevailing CDC guidelines, Hawaii State regulations and hotel protocols, reflecting that they will be assessed and updated as required. Participants are expected to comply with Hawaii Tourism Authority

- Guests will be encouraged to **wear masks** at all times in indoor venues.
- Hand Sanitizing Stations will be provided throughout the venue.
- Participants' daily participation will be on the agreement that they are not exhibiting any symptoms of COVID-19 including raised temperature, cough, or shortness of breath.

OVERFLOW EXPERIENCE

There has been record demand to attend AMOS this year with many placing value on the numerous networking opportunities provided. In anticipation of numbers and limited seating, the conference will be streamed live to an overflow room and to the virtual platform and mobile app. Once the conference ballroom reaches capacity, attendees will be directed to the overflow room.

The overflow room located downstairs in the Ilima Ballroom is an extension of what is happening in the main ballroom. The overflow room will be available Wednesday & Thursday 8am - 12pm. Those unable to find a seat, or needing space to spread out may use the online viewing options.

VIRTUAL PLATFORM AND CONFERENCE MOBILE APP

Use the online platforms to complement your live experience of AMOS. **Easily connect with fellow attendees and exhibitors, customize your agenda; interact on the social feed and ask presenters questions**. You will be able to view livestreams of all sessions on both, as well as replays, plus see all the posters. The virtual platform is browser based, and the App can be downloaded to your mobile device. Choose which works best for you!

Best for Desktop Viewing

Visit the the conference virtual platform

https://bit.ly/22AMOScp

Best for Mobile Viewing

Download the AMOS App

Available on the iPhone App Store

ANDROID APP ON Google play

App Co-sponsored by

SN SpaceNav

Q&A TIPS

- **Login** using your email address & password used at registration
- Find the **session / presentation**
- **Tag the presenter** you are directing your question to
- Enter your question

FEATURED EXHIBITORS

Advanced Scientific Concepts
The Aerospace Corporation
AFRL
Astro Haven Enterprises
AWS
Ball Aerospace
Blue Canyon Technologies
CACI
Celestron
COMSPOC
General Atomics
GEOST
Hawaii Air National Guard
JHU Applied Physics Lab
Kayhan Space
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LeoLabs
Lipoa/Maui Research & Tech Park
Lockheed Martin
Northstar Earth & Space
Planewave Instruments
Privateer Space
Rocket Communications
SAIC
Sierra Nevada Corp
Slingshot Aerospace
SpaceMap
TOPTICA Photonics

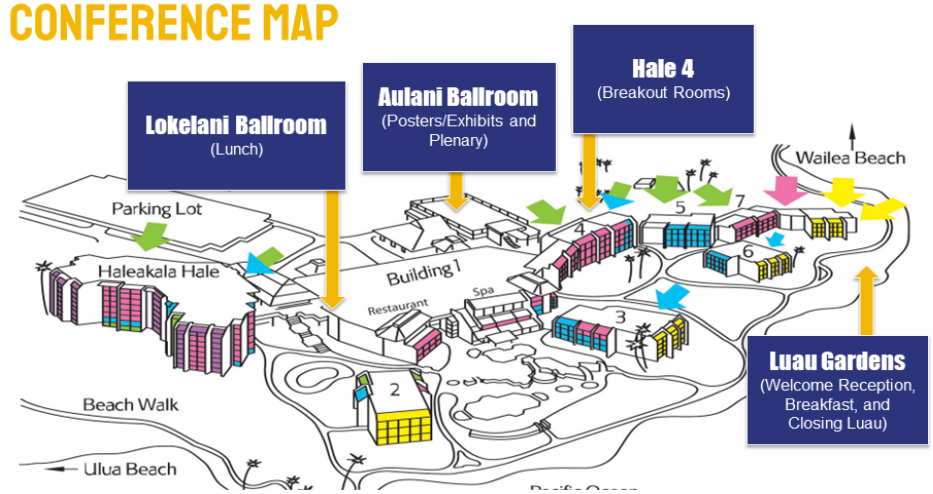
EXHIBIT HOURS

Load-in | Tue, 8:00AM - 5:00PM
Wednesday | 9:30AM - 7:15PM
Thursday | 9:00AM - 7:00PM
Friday | 9:00AM - 3:00PM
Load out| Fri, 3:00PM - 5:00PM

Download the AMOS App

Visit the virtual Exhibit Hall on the virtual AMOS platform at https://bit.ly/22AMOScp or app to view and connect with sponsors and exhibitors. View collateral, participate in drawings and schedule meetings while here on Maui or virtually.

CONFERENCE MAP



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PASSWORD: AMOS2022

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SEP 26 MONDAY | PO'AKAHI

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The **5th annual EMER-GEN® Program** is a joint initiative of the AMOS Conference and SCAC. The program is designed especially for young professionals and students enthusiastic about careers in space. **Learn more at www.emer-gen.com.**

With the help of advisers from industry, government, academia and NGOs, the EMER-GEN experience offers:

- **Mentoring** with renowned space specialists from the public sector (military and civil), private sector, and nongovernmental organizations
- **Networking** with other young professionals
- **Technical Short Course** presented by specialists in space situational awareness
- **Professional Development** sessions to enhance effectiveness in a global environment

VIRTUAL TECHNICAL SHORT COURSES

(Separate registration fee required)

8:00 AM - 12:00 AM (HST)

Virtual Course A

Space Domain Awareness (SDA) Workshop

Presented by: **Wiley Larson**, CEI; **Pamela Magee**, Space Technology Series and **Moriba Jah**, University of Texas at Austin

Virtual Course B

Space Weather Impacts on Orbital Operations

Presented by: **Thomas Berger**, University of Colorado / Space Weather Technology, Research and Education Center (SWx TREC) and **Vishal Ray**, University of Colorado Boulder

Virtual Course C

Telescopes and Optics for Ground-Based Optical SSA

Presented by: **Peter Zimmer** and **Mark Ackermann,** J.T. McGraw and Associates, LLC (JTMA)

1:00 PM - 5:00 PM (HST)

Virtual Course D

LeoLabs Cloud-based SDA Platform

Presented by: **Victor Gardner**, **Edward Lu,** and **Darren McKnight**, LeoLabs Federal, Inc

Virtual Course E

The International Framework for Space Behavior: Present Foundations and Future Prospects

Presented by: **Mark Skinner, Angie Buckley** and **Robin Dickey**, Aerospace Corporation

Virtual Course F

In-orbit data processing - Writing SpaceCloud applications

Presented by: **Fredrik Bruhn, Oliver Petri, Oskar Flordal,** Unibap and **Miguel Nunes,** Hawaii Space Flight Laboratory

Courses will be presented on Zoom.
Login details will be emailed.

SEP 27 TUESDAY | PO'ALUA

IN-PERSON TECHNICAL SHORT COURSES

(Separate registration fee required)

8:00 AM - 12:00 PM

SC 1: Conjunction Assessment (CA) Risk Assessment | *Vanda*

Presented by: **Francois Laporte,** CNES; **Lauri Newman**, NASA; and **Matthew Hejduk,** Aerospace Corporation

SC 2: The Dynamic Co-Evolution of Space Policy and Technology: Historical Overview and Lessons for Assessing Future Trends

Lokelani III

Presented by: **Nancy Hayden, Mark Ackermann,** Sandia National Laboratories and **Victor Gamiz,** Tau Technologies

SC 3: Deep Learning Methods for Space Domain Awareness

Lokelani II

Presented by: **Roberto Furfaro,** University of Arizona; **Richard Linares,** Massachusetts Institute of Technology **Weston Faber,** L3Harris

SC 4: Optical Modeling and Simulation for SSA/SDA | *Ilima*

Presented by: **Patrick North** and **Novarah Kazmi Policht,** AGI, an Ansys Company

SC 5: Navigating the Sea of Space Law| *Mauna Loa*

Presented by: **Liberty Shockley,** U.S. Space Force

1:00 PM - 5:00 PM

SC 6: Demystifying Machine and Deep Learning | *Vanda*

Presented by: **Joseph Coughlin**, The Aerospace Corporation; **Rohit Mital,** KBR, Inc.

SC 7: Observing and Characterizing Space Debris | *Lokelani II*

Presented by: **Thomas Schildknecht,** Astronomisches Institut Universität Bern

SC 8: An Introduction to Event-Based Sensors for SDA: A Hands-On Tutorial

Mauna Loa

Presented by: **Gregory Cohen,** Western Sydney University; **Brian McReynolds,** U.S. Air Force; **Rachel Oliver**, Cornell University; **Zachry Theis,** AFRL Space Vehicles; **Grant Thomas** and **David Howe,** Air Force Institute of Technology

SC 9: Space Law & The Space Law Games: Legal Liability and Mapping the Future in LEO Operations | *Ilima*

Presented by: **Ralph Dinsley,** Northern Space and Security Ltd; **Christopher Newman** and **Lauren Napier,** Northumbria University

SC 10: Astrodynamics for xGEO Space Domain Awareness | *Lokelani III*

Presented by: **Aaron J. Rosengren,** University of California San Diego and **Shane D. Ross,** Virginia Tech

6:00 PM - 7:30 PM | Luau Gardens

WELCOME RECEPTION

Co-sponsored by BOEING

The conference kicks off with a welcome reception providing participants with a unique networking opportunity. Surrounded by tropical breezes participants and their guests will be greeted with a shell lei, a beverage and appetizers, all while listening to music by the U.S. Air Force Band of the Pacific. Conference badge required at entry.

SEP 28 WEDNESDAY | PO'AKOLU

6:00AM - 7:15AM | Luau Gardens
BREAKFAST AT LEISURE

7:30AM | Aulani Ballroom
CONFERENCE OPENING
Leslie Wilkins, President & CEO, Maui Economic Development Board, Inc.

CULTURAL INVOCATION
Kahu Kealahou Alika

WELCOME & INTRODUCTIONS

7:45AM
OPENING KEYNOTE ADDRESS
Lieutenant General Michael A. Guetlein
Commander, Space Systems Command
United States Space Force

KEYNOTE Q&A
Q&A sponsored by KRATOS

ASK A QUESTION
Login at
https://bit.ly/22AMOScp
click the session name, and
enter your question

8:15AM
SSA POLICY FORUM | Using SSA to Verify Future Space Security Agreements

Moderated by **Victoria Samson,** Washington Office Director, Secure World Foundation

Almudena Azcarate Ortega, Associate Researcher, Space Security and Weapons of Mass Destruction Programmes, United Nations Institute for Disarmament Research

Daniel Ceperley, Founder & CEO, LeoLabs

Michael Gleason, Senior Project Engineering, Center for Space Policy and Strategy, The Aerospace Corporation

Douglas Hendrix, CEO, ExoAnalytic Solutions

Benjamin Silverstein, Research Analyst, Carnegie Endowment for International Peace (CEIP)

9:15AM | Exhibit Hall + Conference Platform
VIRTUAL EXHIBITS AND NETWORKING BREAK | Sponsored by SpaceNav

10:00AM | Aulani Ballroom
MACHINE LEARNING FOR SSA APPLICATIONS | Sponsored by CACI
Co-chaired by **Islam Hussein,** Trusted Space and **Charlotte Shabarekh**, MIT Lincoln Laboratory

Adaptive Stress Testing Applied To Space Domain Awareness Systems | **Jackson Wagner,** University of Colorado Boulder

Development of a Versatile LiDAR Point Cloud Simulation Testbed for Advanced RSO Algorithms | **Lane Fuller,** Advanced Scientific Concepts

General-sum Game Modeling of Generative Adversarial Networks for Satellite Maneuver Detection | **Dan Shen,** Intelligent Fusion Technology, Inc

Applications of Artificial Intelligence Methods for Satellite Maneuver Detection and Maneuver Time Estimation | **Nicholas Perovich**, MIT Lincoln Laboratory

Light Curve Completion and Forecasting using Fast and Scalable Gaussian Processes (MuyGPs) | **Imene Goumiri,** Lawrence Livermore National Laboratory

Recurrent Neural Network Autoencoders for Spin Stability Classification of Irregularly Sampled Light Curves | **Gregory Badura,** Georgia Tech Research Institute

Space Data Model Modernization for Proactive, Machine-Assisted Analytics **Alexandra Wright,** Massachusetts Institute of Technology

11:45AM | Lokelani Ballroom
LUNCH

12:45PM | Aulani Ballroom
INVITED TALK | Space Delta 2: Mission Federation and Realignment for a Contested and Congested Domain

Colonel Marc A. Brock, Commander, Space Delta 2, US Space Force

1:05PM

SPACE SITUATIONAL/DOMAIN AWARENESS Sponsored by Peraton

Co-chaired by **Moriba Jah**, University of Texas at Austin and **Danielle Wood**, Space Enabled Research Group, MIT Media Lab

System Approach to Analyse the Performance of Current and Future EU Space Surveillance and Tracking system at Service Provision level | **Igone Urdampilleta,** CDTI

ExoALERT: 1 Year of AI-Enabled Space Traffic Management Services at GEO | **Doug Hendrix,** ExoAnalytic Solutions

Increasing Capabilities in a Growing Radar Network | **Owen Marshall,** LeoLabs

European Expert Centre providing Services and Support for Space Surveillance and Traffic Management | **Thomas Schildknecht,** Astronomisches Institut Universität Bern

Target Behaviour Analysis based on Bistatic Radar Systems | **Simão da Graça Marto,** University of Strathclyde

Advanced Space Surveillance with the Imaging Radar IoSiS | **Simon Anger,** German Aerospace Center (DLR)

Improving the Resolution of Low Earth Orbit Objects by Multi-Exposure Imaging and Deconvolution | **Andrew Lambert,** UNSW Canberra

A Sensor Network for Integrated Space Traffic Management for Australia | **Edwin Peters,** University of New South Wales

3:05PM |Exhibit Hall + Conference Platform

VIRTUAL EXHIBITS AND NETWORKING BREAK

Relax and recharge in the conference lobby at the Recharging Station, brought to you by PRIVATEER

3:25PM | Aulani Ballroom

SPACE SITUATIONAL/DOMAIN AWARENESS (cont.)

SSA/SDA Technology Policy Panel

Employing a Shared Space Information Sharing Ecosystem as a Mechanism for Promoting Constructive U.S. China Space Relations | **Nathaniel Dailey,** MITRE & Space Force Association

Partnering not Bossing: Better Leveraging of International Capabilities for Space Domain Awareness | **Lauren Hale,** The Aerospace Corporation

A Survey of International Telecommunication Union (ITU) Space Station License Applications in the Geosynchronous Orbital Regime (GEO) **Thomas G. Roberts,** Massachusetts Institute of Technology

Unnecessary Risks Created By Uncontrolled Rocket Reentries | **Ewan Wright**, The University of British Columbia

4:25PM

SPACE DEBRIS

Sponsored by NORTHSTAR EARTH & SPACE

Co-chaired by **Heather Cowardin**, NASA and **Carolin Frueh**, Purdue University, **Thomas Schildknecht**, University of Bern

Stability of the LEO Environment as a Dynamical System | **Daniel Jang,** Massachusetts Institute of Technology

Report on 2021 COSMOS 1408 Event and Impact to Space Domain Awareness Mission| **Deshaun Hutchinson,** 18th Space Control Squadron

LEO Capacity Modeling for Sustainable Design | **Mark Sturza,** 3C Systems Company

Long-Term Evolution of Debris Clouds in Low Lunar Orbit | **Nathan Boone,** Air Force Institute of Technology

A Statistical Approach to Identify Fragmentation Epoch from a Single Fragment Surveillance Radar Observation **Marco Felice Montaruli,** Politecnico di Milano

5:45PM | Exhibit Hall

EXHIBITION AND POSTER RECEPTION

Posters co-chaired by **Darren McKnight,** LeoLabs and **Matthew Stevenson,** LeoLabs

Meet select poster presenters while enjoying a cocktail and interacting with exhibitors and fellow attendees.

Co-sponsored by SAIC

SEP 29 THURSDAY | PO'AHA

6:00AM - 7:15AM | Luau Gardens
BREAKFAST AT LEISURE

7:30AM | Aulani Ballroom
KEYNOTE ADDRESS
Ezinne Uzo-Okoro
Assistant Director for Space Policy
White House Office of Science and Technology Policy

ASK A QUESTION
Login at https://bit.ly/22AMOScp click the session name, and enter your question

8:00AM
SSA POLICY FORUM | Is Orbital Carrying Capacity a Useful Metric?

Moderated by: **Ian Christensen**, Director of Private Sector Programs, Secure World Foundation

John Janka, Chief Officer, Global Government Affairs & Regulatory, Viasat Inc.

Francesca Letizia, Space Debris Engineer, European Space Agency

Hugh Lewis, Professor, Engineering and Physical Sciences, University of Southampton

Richard Linares, Associate Professor of Aeronautics and Astronautics, Massachusetts Institute of Technology

Akhil Rao, Assistant Professor of Economics, Middlebury College

9:00AM | Exhibit Hall + Conference Platform
EXHIBITION AND NETWORKING BREAK | Sponsored by PRIVATEER

Explore the Exhibit Hall on-site and online. Interact with our conference partners, view demos, access resources, schedule meetings, and more.

9:40AM | Aulani Ballroom
INVITED TALK | National Space Council Policy Update 2022: Embracing Opportunity

Diane Howard, Director of Commercial Space Policy, National Space Council

10:05AM
SPACE-BASED ASSETS
Co-chaired by **John Ianni**, Air Force Research Laboratory and **Pat Patterson**, Space Dynamics Laboratory

Pole-Sitter Based Space Domain Awareness
Roberta Ewart, SSC/ST

Formation Flying and Change Detection for the UNSW Canberra Space 'M2' Low Earth Orbit Formation Flying CubeSat Mission
Melrose Brown, UNSW Canberra Space

On Orbit Sensing of Objects Beyond GEO
Rachel Derbis, Air Force Institute of Technology

Sensor Management for Space-based Sensing Constellations | **Joshua Davis,** Defence Science and Technology Laboratory

Hyperspectral Thermal Imaging CubeSat for SSA Applications | **Miguel Nunes,** Hawaii Space Flight Laboratory

11:20AM
FEATURED PRESENTATION | EMER-GEN® Briefing

11:30AM
2022 AMOS STUDENT AWARD WINNER
Optimal Cislunar Architecture Design Using Monte Carlo Tree Search Methods
Michael Klonowski, University of Colorado at Boulder

11:45AM | Lokelani Ballroom
LUNCH

12:45PM | Aulani Ballroom
OPTICAL SYSTEMS & INSTRUMENTATION
Co-chaired by **Jeff Sherk,** Aerospace Corporation and **Stacie Williams,**

Air Force Office of Scientific Research Adaptive Optics for Meter-Class Telescopes **Michael Hart,** HartSCI LLC

Operational Acceptance and Employment of the Space Surveillance Telescope in 2022 **Jonathan Hutfilz,** Space Systems Command

Augmentation of a Southern Hemisphere Deep Space Bistatic Radar with Small Optical Systems to Detect Near Earth and other Space Objects | **Ed Kruzins,** UNSW Canberra Space

Ground-based Planetary Radars: Current and Future Prospects in the Cislunar Arena **Joseph Lazio,** Jet Propulsion Laboratory, California Institute of TechnologySpace Force

Magdalena Ridge Observatory Interferometer: An Overview of an Astrophysics Facility for Supporting SDA Efforts | **Van Romero,** New Mexico Tech

LARADO: A Sensor for On-orbit Optical Detection of Lethal Non-Trackable Debris **Andrew Nicholas,** Naval Research Laboratory

All-Sky Electro-Optical Tracking of Mega-Constellations in Low Earth Orbit | **Cam Key,** Slingshot Aerospace

Event-Based Sensor Multiple Hypothesis Tracker For Space Domain Awareness **Rachel Oliver**, Cornell University

Ultrafast Image Retrieval from a Holographic Memory Disc for HighSpeed Operation of a Shift, Scale, and Rotation Invariant Target Recognition System **Julian Gamnboa,** Northwestern University

Automatic Detection and Characterization of Closely-Spaced Objects | **Brandoch Calef,** The Boeing Company

Upcoming Satellite Detection and Tracking Capabilities of the Australian National University | **Doris Grosse,** Australian National University

3:30PM | Exhibit Hall + Conference Platform

EXHIBITION AND NETWORKING BREAK | Sponsored by PRIVATEER

3:50PM

ASTRODYNAMICS

Co-chaired by **John Gaebler**, KBR, and **Tom Kelecy,** The Stratagem Group

AURORAS: The Next Evolution of Orbit Determination Using Passive Optical Observations | **Jeffrey Bloch,** Applied Research Associates

Generalized Labeled Multi-Bernoulli Filter with Kernel-based Ensemble Gaussian Mixture Filtering for Orbit Determination with Sparse Data | **Benjamin Reifler,** The University of Texas at Austin

Geometric Solution to Probabilistic Admissible Region (G-PAR) | **Utkarsh Mishra,** Texas A&M University

Rapidly and Automatically Estimating Reachability of Electric Propulsion Spacecraft | **Prashant Patel,** Institute for Defense Analyses

Maneuver Estimation from Optical Observations of a Spiraling Trajectory: The Case of MEV-2 | **Laura Pirovano,** University of Auckland, Te Pūnaha Ātea - Space Instit

Catalogue-based Atmosphere Uncertainty Quantification | **Alejandro Cano Sanchez, GMV,** Universidad Carlos III de Madrid / GMV

Improvements to the SGP4 Propagator (SGP4-XP) | **Timothy Payne,** USSF/SPOC/DCG-T/S9I

5:45PM | Exhibit Hall

EXHIBITION AND POSTER RECEPTION

Co-sponsored by NORTHROP GRUMMAN

Posters co-chaired by **Darren McKnight,** LeoLabs and **Matthew Stevenson,** LeoLabs

Meet select poster presenters while enjoying a cocktail and interacting with exhibitors and fellow attendees.

SEP 30 FRIDAY | PO'ALIMA

6:00AM - 7:15AM | Luau Gardens
BREAKFAST AT LEISURE

7:30AM | Aulani Ballroom
KEYNOTE ADDRESS
Richard DalBello
Director, Office of Space Commerce National Oceanic and Atmospheric Administration U.S. Department of Commerce

8:00AM
SSA POLICY FORUM | The European Perspective on Space Traffic Management

Moderated by: **Brian Weeden**, Director of Program Planning, Secure World Foundation

Pascal Faucher, Chair, European Union Space Surveillance and Tracking; Defense & Security, CNES

Sebastien Moranta, Research Manager, European Space Policy Institute

Rodolphe Muñoz, Legal Officer, European Commission, Directorate- General for Defence Industry and Space

Regina Peldszus, Space Policy Officer (Space Security, Space Situational Awareness), European External Action Service

9:00AM | Exhibit Hall + Conference Platform
EXHIBITION AND NETWORKING BREAK | Sponsored by LOCKHEED MARTIN

Explore the Exhibit Hall on-site and online. Interact with our conference partners, view demos, access resources, schedule meetings, and more.

9:00AM - 1:00PM | South Pacific Ballroom + Exhibit Hall
STUDENT SPACE EXPLORATION DAY

The AMOS Conference welcomes 150 Maui County middle school students and their STEM educators to meet astronaut Scott "Scooter" Altman and visit exhibit booths for hands-on STEM activities.

9:30AM | Aulani Ballroom
CONJUNCTION/RPO | Sponsored by LEO LABS

Co-chaired by **Zach Funke,** AFRL Maui and **Jim Shell**, Novarum Tech LLC

Conjunction Assessment: NASA Best Practices and Lessons Learned | **Lauri Newman,** NASA

Design And Development of a Decision Support Tool for Risk Assessment & Manoeuvre Planning in Collision Avoidance **Alexander Ryan,** Industrial Sciences Group

Opportunistic Conjunction Screening with Maneuvering Spacecraft | **Max Geissbuhler,** Slingshot Aerospace

Predicted Intent Inferred from Real-time Rendezvous and Proximity Behavior | **Thomas Kelecy,** The Stratagem Group

Analysis of Orbit Residual Behavior to Determine Contact in Rendezvous and Proximity Operations at Geosynchronous Orbit | **Jaycie Bishop,** ExoAnalytic Solutions

10:45PM
ATMOSPHERICS/SPACE WEATHER
Co-chaired by **Randall Alliss,** Northrop Grumman Corporation and **Tom Berger,** University of Colorado/Space Weather Technology, Research, and Education Center (SWx TREC)

The Impact of Space Weather Disturbances on Very Low Earth Orbit (VLEO) Satellites **Vishal Ray,** University of Colorado Boulder

Impact of Space Weather on Space Assets and Satellite Launches | **Julia Briden,** Massachusetts Institute of Technology

Validation of Atmospheric Characterization and Prediction over Haleakala during the Laser Communications Relay Demonstration | **Mary Ellen Craddock,** NGC

A High Power, Large Aperture Doppler He Lidar for Upper Atmospheric Sensing | **Peter Dragic,** University of Illinois at Urbana-Champaign

11:45AM | Lokelani Ballroom
LUNCH

12:45PM | Aulani Ballroom

NON-RESOLVED OBJECT CHARACTERIZATION

Co-chaired by **Zach Gazak,** Odyssey and **Emily Gerber,** Stratagem Group

Shadow Imaging of Geostationary Satellites: Experimental Demonstration with Accurate Polychromatic Modelling of Diffraction and Atmospheric Disturbances | **Hanae Labriji,** DTIS, ONERA, Université Paris Saclay, F-91123 Palaiseau – France

Simulation and Analysis of Event Camera Data for Non-Resolved Objects | **Conor Benson,** University of Colorado Boulder

What is That Object Out There? Automated Satellite Modeling and Alternate Reality (AR) | **Zachary Bergen ,** Ball Aerospace

Spectral Characterization of Modern Spacecraft Materials | **Heather Cowardin,** NASA

Spectropolarimeter for Satellite Identification | **Louis Lischwe,** Delft University of Technology

Space Object Identification and Change Detection Methods for the Cislunar Orbit Regime | **Tamara Payne,** Applied Optimization, Inc.

Remote Sensing of Satellite Activity through Optical and Infrared Temporal Differential Spectrophotometry Informed by Analysis of Noise | **John Kielkopf,** University of Louisville

2:30PM | Exhibit Hall + Conference Platform

EXHIBITION AND NETWORKING BREAK

2:50PM |Aulani Ballroom

INVITED TALK | Challenging Space: Strategic S&T from LEO to Cislunar

Colonel Jeremy A. Raley, Director, Space Vehicles Directorate, Air Force Research Laboratory

David A. Ehrlich, Principal Deputy, Innovation & Prototyping Acquisition Delta, Space Systems Command

3:20PM

CISLUNAR SSA

Sponsored by LOCKHEED MARTIN

Co-chaired by **Channing Chow,** Cloudstone Innovations LLC and **Jaime Stearns,** AFRL Space Vehicles Directorate

An Analytical Approach for Cislunar Information Gain | **Patrick Miga,** University of Colorado

Probabilistic Initial Orbit Determination and Object Tracking in Cislunar Space Using Optical Sensors | **Islam Hussein,** Trusted Space, Inc.

Optical Observation Regions in Cislunar Space Using the Bicircular Restricted Four Body Problem Geometry | **Carolin Frueh,** Purdue University

Cislunar SDA with Low-Fidelity Sensors and Observer Uncertainty | **Joshua Block,** Air Force Institute of Technology

Classifying State Uncertainty for Earth-Moon Trajectories | **Juan Gutierrez,** KBR

Capacity-based Cislunar SDA Architecture Optimization | **Josh Wysack,** Ball Aerospace

Utilization of Space-Based TDoA and FDoA for Cislunar Orbit Determination | **Michael Thompson,** Advanced Space

5:20PM | Exhibit Hall

CONFERENCE CLOSING & AWARDS CEREMONY

In collaboration with the Space Surveillance Technical Committee of the American Astronautical Society (AAS), the AMOS Conference recognizes outstanding efforts in the field of Space Situational/Domain Awareness by presenting the fifth annual AMOS Conference Best Paper and Student Awards. Also awarded are Best Presentation for each technical session and a series of Poster Awards.

5:30PM | Mei Court

PAU HANA RECEPTION

Co-sponsored by L3HARRIS™ FAST. FORWARD.

POSTER PRESENTERS

Please visit the mobile app or virtual platform to view all In-person and virtual posters in the online Poster Hall. Zoom in on figures, watch brief presenter videos accompanying each poster, and leave your comments and questions for the presenters on their discussion boards. Presenters who have scheduled Office Hours throughout the conference week will be available to live video chat during selected times.

IN-PERSON

PITCH PERFECT! Listen to 30 second pitches from poster presenters at the start and mid points of each Poster Session and learn who will be awarded the inaugural poster prizes – *Newcomer, Most Creative & Golden Ticket!*

Machine Learning for Satellite Characterisation | **Alexander Agathanggelou**, Defence Science and Technology Laboratory

ARES: A Versatile Benchtop Testbed for Evaluating Techniques for Imaging through Atmospheric Turbulence | **Fabien Baron,** Georgia State University

Updates on the Visible Spectroscopic Atlas of Geostationary Satellites | **Adam Battle,** University of Arizona

Imperfect Information Games and Counterfactual Regret Minimization in Space Domain Awareness | **Tyler Becker,** University of Colorado Boulder

Space and Ground-Based SDA Sensor Performance Comparisons | **Amelia Bloom**, Ball Aerospace

An Autonomous Geographically Distributed Ground Network that Scales **Matthew Britton,** Aerospace Corporation

Stingray: Photometric Survey of the GEO Belt | **Tanner Campbell,** University of Arizona

Cislunar Orbit Determination: Improvements in Uncertainty Realism and Data Fusion | **C. Channing Chow II**, Cloudstone Innovations LLC

Synthetic Dark Current Correction for Space Situational Awareness Sensors **Thomas Chrien,** Millennium Space Systems, A Boeing Company

Goniometric and Polarized Imaging Spectroscopic Lab Measurements of Spacecraft Materials | **Heather Cowardin,** NASA

Projected Orbital Demand and LEO Environmental Capacity | **Andrea D'Ambrosio,** Massachusetts Institute of Technology

Feasibility of a Virtual Constellation using Small Aperture, Wide Field of View Optical Systems for Space Domain Awareness and Applications | **Siddharth Dave,** York University

Novel Algorithms for Novel Data: Machine Learning for Neuromorphic Data from the International Space Station | **Stefan Doucette,** MITRE Corporation

Modeling Radar Measurement Uncertainty for Look Angle Optimization | **Daniel Dowd,** USSF, HQ Space Operations Command (SpOC)

Survey of Geosynchronous Satellite Polarization Signatures | **Blake Eastman,** United States Air Force Academy

A Systems Theory Approach for Evaluating the Cascading Collision Potential of Orbital Shells | **Valentin Eder,** Space Analyses GmbH

Detecting Space Objects in Event Camera Data through 3D Point Cloud Processing | **Panna Felsen,** The Aerospace Corporation

Reformulating Compressed Sensing to be used with Semi-Resolved Images and Light Curves for Space Object Imaging: LEO and High Altitude | **Carolin Frueh,** Purdue University

Poster Session | Exhibit Hall
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A Consolidated Multi-State Orbit Estimation Paradigm for Improved RSO Track Custody | **Emily Gerber,** Stratagem Group, Inc

~~The Internet Of Things - Astronomical (IoTA): A New Architecture For A Global SDA Capability | **Lauren Glina,** UNSW Canberra Space~~ **CXLD**

Monitoring and Managing Space Weather Impacts to Satellite Constellations | **Janet Green,** Space Hazards Applications, LLC

Polarimetry and Spectroscopy on Geostationary Satellites with the Nordic Optical Telescope | **Per Hägg,** Swedish Defence Research Agency

Comparison of Vertical Profile Turbulence Structure Measurements at John Bryan Observatory | **Brian Haimbaugh,** AFRL

Calculating Optical Observation Residuals from GPS Satellites | **Nathan Holzrichter,** The MITRE Corporation

Risk-Based Decision-Making for Space Traffic Management | **Islam Hussein,** Trusted Space, Inc.

Uplooking Local Resolution Due to Atmospheric Turbulence | **Amber Iler,** KBR

~~The Use of OrbDetPy Open-Source Orbit Determination Software for Assessment of the Mission Extension Vehicle-2 Conditioned on Optical Measurements from the Russian-led International Scientific Optical Network (ISON)~~ **Moriba Jah,** ~~The University of Texas at Austin~~ **CXLD**

High Resolution Imaging of Satellites and Objects in Space with IoSiS | **Matthias Jirousek,** German Aerospace Center (DLR)

Buying Space: Trends in U.S. SDA Acquisition | **Kaitlyn Johnson,** Center for Strategic and International Studies

Pseudorange Measurement and Sun Phase Angle Estimation using CNN-based Image Processing Algorithm for HERA Mission | **Aurelio Kaluthantrige,** University of Strathclyde

SpaceMap: Real-time Web Server for Safer, more Sustainable and Efficient Space **Douglas Deok-Soo Kim,** SpaceMap

Cislunar Orbit Determination Benefits of Moon-Based Sensors | **Darin Koblick,** Raytheon

Towards Realistic COOLFluiD Global Coronal Model for EUHFORIA 2.0 Space Weather Forecast: Magnetograms Reconstruction and Comparison with Observations | **Blazej Kuzma,** Centre for Mathematical Plasma Astrophysics, KU Leuven

Hybrid Sensor for Joint Space Domain Awareness and Lunar Surface Intelligence **Anna Lawitzke,** Ball Aerospace

A Modular Approach for Rendezvous and Proximity Operations Missions: from Simulations to Operations | **Thibault Lebeke,** Exotrail

Efficient High-fidelity Propagation and Visualization for Large Numbers of RSOs **Bill McClintock,** Stratagem Group

A Map of the Statistical Collision Risk in LEO | **Darren McKnight,** LeoLabs

Enabling Intelligent SDA Data Exploitation **Ian McQuaid,** KBR

Novel Image Alignment Technique for Extraction of Astrometry and Photometry from Small Field of View Astronomical Sensors | **Calum Meredith,** Defence Science and Technology Laboratory

Assessment of Onboard Processing Algorithms for Cislunar Space Domain Awareness | **Kyle Merry,** Sandia National Labs

Bullseye: A Leakproof Search Strategy for Space Domain Awareness | **Daniel Mulligan,** Science Applications International Corporation (SAIC)

Multi-Phenomenology Characterization of Space Objects Using Reinforcement Learning | **Jorge O'Farrill,** MTSI

POSTER PRESENTERS CONT.

Comparison of Predicted and Observed Spacecraft Encounters from Russian ASAT Test | **Daniel Oltrogge,** COMSPOC

Assessing Passive Radar for LEO SSA **James Palmer,** Silentium Defence

Early Identification and Tracking of Fragments from Break-up Events **Alejandro Pastor,** GMV

DRAGON Army: An Innovation Pipeline for Space Operations | **Rishi Patel,** United States Air Force

A Software Defined Radio Based Method for Accurate Frequency Estimation for Real-time Passive RF Space Domain Awareness. | **Edwin Peters,** University of New South Wales

Improving Spectral-Based Estimation of Space Object Orientation | **Matthew Phelps,** USSF SSC/ECZGA

Prototype Infrastructure for Autonomous On-board Conjunction Assessment and Collision Avoidance | **Austin Probe,** Emergent Space Technologies

Use of a Commercial GEO Servicing Vehicle for Space Domain Awareness Data Collection | **Matt Pyrak,** Northrop Grumman

Detection Methods for the Statistical Analysis of the Population of Satellites and Space Debris from Astronomical Images **Elisabeth Rachith,** EPFL

XGEO Collection Methods Using New Satellite Observing Techniques on the James Webb Space Telescope **Kaitlyn Raub,** MITRE

SSA Technology Development Status for LEO Observations at the German Aerospace Center (DLR) | **Wolfgang Riede,** Cislunar Space Situational Awareness

Sensor Tasking using Deep Reinforcement Learning Agents | **Peng Mun Siew,** Massachusetts Institute of Technology

Passive RF in Support of LEO Orbit Determination | **Kameron Simon,** Kratos

High-precision Astrometric Measurements of Calibration Satellites | **Jovan Skuljan,** Defence Technology Agency

~~Conjunction Risks Facing Large Constellations and Risk Refinement through BEACON | **Jason Stauch,** Slingshot Aerospace~~ **CXLD**

Mirror Recoating of Large Primary Optics **Zachary Stein,** The Boeing Company

Towards Graph-Based Machine Learning For Conjunction Assessment | **Emma Stevenson,** Universidad Politécnica de Madrid

On-board, Autonomous, Hybrid Spacecraft Subsystem Fault and Anomaly Detection, Diagnosis, Root Cause Determination, and Recovery | **Richard Stottler,** Stottler Henke Associates, Inc.

The Next Generation Planetary Radar System on the Green Bank Telescope **Patrick Taylor,** National Radio Astronomy Observatory, Green Bank Observatory

An Effective Machine Learning Approach To Detect Satellite Signals In Passive RF Space Domain Awareness | **Kriti Tripathi,** Clearbox Systems

A Year in the Life of the Shackleton Space Domain Awareness Station | **Jeffrey Van Cleve,** Ball Aerospace

SpeckleNet: Learned Speckle Interferometry Exploitation | **Andrew Vanden Berg,** AFRL/RDSM

Exploring a New Class of Bright, Ultra-fast, Glints from Resident Space Objects **W. Thomas Vestrand,** Los Alamos National Laboratory

Cislunar Maneuver Detection and Classification | **Charles J. Wetterer,** KBR/ Pacific Defense Solutions

Low-Orbit, High Stakes: Winning the LEO Broadband Competition | **Makena Young,** Center for Strategic and International Studies

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Scattering of High Frequency Waves in the Presence of Whistler Wave Turbulence in the Ionosphere | **Nathan Zechar,** Riverside Research Institute

VIRTUAL

Visit the mobile app or virtual platform to view posters and ask questions to the virtual presenters.

~~Quality Assurance for the DebriSat Project **Samantha Allen,** University of Florida~~ **CXLD**

From Ozone Depletion to Orbital Debris: Applying Lessons Learned from the Montreal Protocol to Orbital Debris | **Asha Balakrishnan,** Science and Technology Policy Institute

Passive Ranging Solution Design to Improve CA Services | **Marc Belmonte,** GMV

Angular Velocity Vector Determination of Spacecraft in Flat-Spin Attitude States using Inverse Modelling with a Synthetic Light Curve Model | **Laurence Blacketer,** Northern Space & Security Ltd.

The Global Network On Sustainability In Space (GNOSIS): Activities, Initiatives, and Future Endeavours | **James Blake,** University of Warwick

Lightweight Image Processing Toolpack for Low-power and Low-cost Optical SST Triangulation Stations for Cataloguing in LEO Regime | **Konrad Bojar,** KB-Innotech

Analysis of DebriSat Data Collection and Procedures | **Elizabeth Campa,** University of Florida

Analysis of Induced Color Index Error Due to Sequential Filter Photometry | **Philip Castro,** Applied Optimization, Inc.
Optimization and Automation of the Spectroscopy Pipeline of the Falcon Telescope Network | **Philip Castro,** Applied Optimization, Inc.

Assessing Performance Characteristics of the SGP4-XP Propagation Algorithm **Dave Conkey,** a.i. solutions, Inc.

SDA Environmental Toolkit for Defense -- Enabling Space Environment and Weather Support for SDA Ground-based Optical and Radar Sensors | **Jeffery Cox,** The Aerospace Corporation

Data-Driven Lifetime Risk Assessment and Mitigation Planning for Large-Scale Satellite Constellations | **Paul Diaz,** SpaceNav

~~Continuing Progress on a Compact, Extremely Accurate Star Tracker | **Greg Finney,** IERUS Technologies~~ **CXLD**

Modeling and Testing of COTS Observation Systems for Night and Daytime Satellite Detection | **Ellen Glad,** Millennium Space Systems, A Boeing Company

U.S. Commercial Space Regulation: The Rule of Three | **John Goehring,** National Geospatial-Intelligence Agency

Fitting Doppler Predictions to Observations for High Precision Orbit Estimation Using Geometrically and Temporally Diverse Observations | **Jake Gunther,** Utah State University

Optimal Sensor Planning for SSA using System Identification Concepts | **Per Hägg,** Swedish Defence Research Agency

Advances of ArianeGroup Capabilities for Laser Optical Observation of LEO Objects **Laurent Hennegrave,** ArianeGroup

Optimization Framework for Active Debris Removal Missions with Multiple Selected Targets | **Joanna Hon,** Turion Space Corp.

Identifying Near-Earth Objects on Wide-Field Astronomical Surveys Using a Convolutional Neural Network **Belén Yu Irureta-Goyena,** EPFL

Modeling Small Orbital Debris Remediation in Low Earth Orbit **James Jones,** Northrop Grumman
Impact of the 2022 Hunga Tonga–Hunga Ha'apai Eruption on Cislunar Space Situational Awareness | **Mitchell Kirshner,** University of Arizona System and Industrial Engineering

Earth Gravity Assisted Inclination Change to Reduce Lunar Constellation Deployment Delta-V | **Darin Koblick,** Raytheon

POSTER PRESENTERS CONT.

New Twin-Tubes Telescope for Observation of Near-Earth Space | **Oleksandr Kozhukhov,** National Space Facilities Control and Test Center of State Space Agency of Ukraine

Characterization of LEO Satellites With All-Sky Photometric Signatures | **Harrison Krantz,** University of Arizona Steward Observatory

Alternate Ranging Strategy for Space Delta Operations | **Leon Lala,** The Aerospace Corporation

Training Neural Networks to Detect Resident Space Objects using Space Based Optical Payloads and Low-SWAP On Board Processing | **Dominique Low,** MDA

Extraction of Light Curves from Passive Observations During Survey Campaign in LEO, MEO and GEO Regions | **Romain Lucken,** Share My Space

The Experiment for Space Radiation Analysis (ESRA): Technology Maturation of Next Generation Charged Particle Detectors in GTO | **Carlos Maldonado,** Los Alamos National Laboratory

Event-based Detection, Tracking, and Recognition of Unresolved Moving Objects **Scott McCloskey,** Kitware

The Impact of Orbit Accuracy-Based Tasking on Sensor Network Efficiency **Pol Messalles Ripoll,** SpaceNav

Widely-Spaced Large Reflector Transmit Arraying for Space Surveillance **Kathleen Minear,** Specialized Arrays Inc Trending and Analysis of Payload vs. All Low Earth Conjunction Data Messages below 1,000km, from 2016 through 2021 **Daniel Moomey,** U.S. Space Force

Observations of Small Debris from the Cosmos 1408 Anti-Satellite Test using the HUSIR and Goldstone Radars **James Murray,** Jacobs

Bi-static Radar Interferometric Localization of MEO and GEO Space Debris using Australia Telescope Compact Array **Hamed Nosrati,** CSIRO Space & Astronomy Australia

A Novel Analytical Method to Determine Future Close Approaches between Satellites | **Austin Ogle,** Fulbright Grant

Anthropogenic Change Detection On and Close to the Moon for Space Domain Awareness | **David Osterman,** Ball Aerospace

Peacock: A Persistent Wide-Field-Of-View Simultaneous Multispectral System Based on COTS Hardware | **Tamara Payne,** Applied Optimization Inc.

Measurements and Interpretation of Near-IR Spectra of Satellites | **Eric Pearce,** University of Arizona Steward Observatory

Geometry Sensitivity Study of a Recently-Maneuvered Satellite | **Dylan Penn,** Virginia Tech

Daytime Resolved Imaging of Space Objects from Ground Stations | **Marine Pyanet**, ArianeGroup

Reducing Decision Time for On-orbit Operations with Virtualized Ground Stations and Machine Learning **Carmen Reglero Andres,** Amazon Web Services

Automated Satellite Track Detection and On-sky Position Extraction Pipeline for Wide Field of View Surveys | **Willem Rood,** Delft University of Technology

xGEO Space Domain Awareness: Parametrization and Characterization of Cislunar Space | **Aaron Rosengren,** University of California San Diego Centralized Scheduler Interface for Communication Link Between SpaceLink's Relay Satellites and LEO Assets | **Jim Schwenke,** SpaceLink

Cislunar SSA/SDA Data Communication Autonomous Distributed Scheduling **Richard Stottler,** Stottler Henke Associates, Inc.

Memo on Space Debris Summit and Active Debris Removal | **Frederick Tarantino,** SAF/SQS

Improvements to HASDM in Support of Space Traffic Management | **W. Kent Tobiska,** Space Environment Technologies

Ensemble Machine Learning (ML) Models for Data Association and Maneuver Classification of Resident Space Objects (RSO's) | **Triet Tran,** Cornerstone Consulting, LLC

Sharing Operationally Relevant Space Cyber Information | **Nick Tsamis,** The MITRE Corporation

Sharing Operational Risk Information in the Space Domain to Facilitate Norms Development and Compliance Monitoring **Nick Tsamis,** The MITRE Corporation

Understanding Non-Resolved Space Object Signatures for Space Domain Awareness | **Miguel Velez-Reyes,** The University of Texas at El Paso

Design and Test of Optical Surveillance Strategies for EU-SST Network Performances Studies | **Sebastien Vourc'h,** ArianeGroup

Deep-space Object Detection in Persistent Wide Field of View Camera Arrays **Brian Williams,** Slingshot Aerospace

Near-Rectilinear Halo Orbit Surveillance using Cislunar Periodic Orbits | **Adam Wilmer,** Air Force Institute of Technology

Analysis of Photometric Signatures of DTV-10 Collected 8 Years Apart | **Kody Wilson,** US Air Force Academy

Cislunar Orbit Optimization for Orbit Repetition and Eclipse Mitigation **Sam Wishnek,** University of Colorado at Boulder

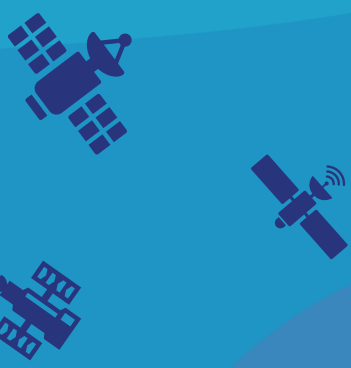
An Automated System to Discover and Track Unknown Geosynchronous Objects using a Ground-based Optical Telescope **Yifan Zhou,** University of Liverpool

Let's Find Eagle: Cislunar Space Domain Awareness Meets Archeoastronomy **Peter Zimmer,** J.T. McGraw and Associates, LLC (JTMA)

Daylight Optical Measurements of LEO Satellites | **Peter Zimmer,** J.T. McGraw and Associates, LLC (JTMA)

The Need for Speed – Just in Time Data Relay through Optical Communications Links | **Robert Zitz,** SpaceLink

Single and Double Pass Optical LEO Survey and Tracking | **Michał Żołnowski,** Remote Observatories for Asteroids and Debris Searching



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