



22ND

AMOS

Advanced Maui Optical
and Space Surveillance
Technologies Conference

2021 PROGRAM

SEPTEMBER 14-17 | MAUI, HAWAII



PRESENTED BY

mauieconomic
DEVELOPMENTBOARD



WELINA MAI KAKOU | WELCOME



Aloha!

We are pleased that you are participating in the 22nd AMOS Conference. After a virtual 2020 it is gratifying to once again meet on Maui and embrace the Aloha as we continue the important dialogue on space situational and domain awareness.

It is our pleasure to share with you a few of the things that make Maui unique. We have sprinkled elements throughout the week to remind us of our Hawaiian "Sense of Place."

Among them are the leis worn at the welcome reception, our traditional Native Hawaiian invocation opening the conference, and receptions with live local bands.

With priority on COVID-19 health and safety protocols, meals will be different this year--from presentation, to the options available. Working with our venue host, Wailea Beach Resort, Marriott, we have done all we can to create an appetizing experience for you.

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



VIRTUAL EXHIBIT HALL

Visit the Exhibit Hall on the virtual AMOS platform at <https://bit.ly/AMOSv21> to view and connect with sponsors and exhibitors. View collateral, participate in drawings and schedule meetings while here on Maui or virtually.

PLUS check out digital giveaways from sponsors in the Digital Swag Bag sponsored by



MAHALO TO OUR SPONSORS & EXHIBITORS

PO'OKELA | STRIVING FOR THE BEST



LAULIMA | WORKING TOGETHER



LOKAHI | COLLABORATION AND UNITY



KUPA'A | LOYAL AND COMMITTED



MALAMA | TO CARE FOR



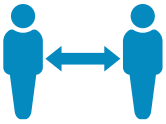
HEALTH & SAFETY PROTOCOLS

Participants' daily participation will be on the agreement that they have not been in recent contact with a COVID-19 positive case and they are not exhibiting any symptoms of COVID-19 including raised temperature, cough or shortness of breath.



WEAR A MASK WHEN IN PUBLIC

Wear a mask with two or more layers to help stop the spread of COVID-19. The mask must cover your nose and mouth and be secure under your chin. Masks should be worn by people two years and older.



MAINTAIN RECOMMENDED DISTANCE

Avoid close contact with people. The conference offers social distancing ribbons to indicate comfort level. Please be respectful of each other's choices.

Pay attention to signs and directions.



WASH YOUR HANDS OFTEN

Use soap & water for at least 20 seconds.

Hand sanitizing stations will be provided throughout the conference space



AVOID TOUCHING YOUR EYES, NOSE, AND MOUTH

Avoid touching your eyes, nose, and mouth with unwashed hands.



COVER YOUR COUGHS AND SNEEZES



REMAIN IN YOUR HOTEL ROOM IF YOU START TO FEEL ILL

If you need immediate attention call the hotel operator at extension '0' or emergency extension '7911' or call 911.

OVERFLOW EXPERIENCE



Our overflow room located downstairs in the Ilima Ballroom is an extension of what is happening in the main ballroom while maintaining social distancing measures.

VIRTUAL PLATFORM



Visit the link

<https://bit.ly/AMOSv21> OR



ACCESS TO PLATFORM

All attendees will have access to the platform. Log in by scanning the QR code with a mobile device or by visiting <https://bit.ly/AMOSv21>. You must use the email address & password utilized at time of registration. If you need help resetting your password visit our hospitality desk in Aulani Foyer.

DIGITAL POSTERS

View the Poster Presentations on the Virtual Platform and leave comments and questions. Please view a submission's designated office hours to video chat with the poster presenter during select times.

ON-DEMAND TECHNICAL PRESENTATIONS

Technical Session presentations will be available upon completion of the in-person session.

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TRUSTED SPACE

The 4th annual EMER-GEN® Program is a joint initiative of the AMOS Conference and SGAC. 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)

7:00 AM - 11:00 AM (HST)

Virtual Course A - CANCELLED
Imaging of Space-Based Objects through Atmospheric Turbulence

Presented by: ~~Szymon Gladysz, Fraunhofer Institute of Optronics, System Technologies and Image Exploitation-IO SB~~

Virtual Course B
Introduction to ESA's Space Debris Software tools (DRAMA, MASTER, DISCOS, PROOF)

Presented by: **Tim Flohrer**, ESA Space Debris Office and **Francesca Letizia**, European Space Agency

Virtual Course C
Observing and Characterizing Space Debris

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

12:00 PM - 4:00 PM

Virtual Course D
Polarimetry

Presented by: **Russell Chipman**, Professor of Optical Sciences, University of Arizona

Virtual Course E
Telescopes and Optics for Ground-Based Optical SSA

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

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



IN-PERSON TECHNICAL SHORT COURSES

(Separate registration fee required)

8:00 AM - 12:00 PM

SC 1: Conjunction Assessment Risk | *Vanda Room*

Presented by: **Francois Laporte**, CNES; **Lauri Newman**, Senior Engineer, Goddard Space Flight Center - NASA; and **Matthew Hejduk**, NASA Robotic CARA, Astrorum Consulting LLC

SC 2: Deep Learning Methods for Space Domain Awareness | *Ilima Room*

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

SC 3: SSA Optical Systems Modeling and Simulation | *Lokelani II Ballroom*

Presented by: **Patrick North**, **Jeff Baxter**, and **Alex Ridgeway**, AGI, An Ansys Company

SC 4: Statistical Orbit Determination for Space Surveillance and Tracking | *Mauna Loa Room*

Presented by **Moriba Jah**, University of Texas at Austin

SC 5: Supervised Learning: Review and Applications with Real Space Domain Awareness (SDA) Data | *Lokelani III Ballroom*

Presented by: **David Brough**, **Navraj Singh**, **Cam Key** and **Alex Ferris**, Numerica Corporation

1:00 PM - 5:00 PM

SC 6: Demystifying Machine and Deep Learning | *Ilima Room*

Presented by: **Joseph Coughlin**, The Aerospace Corporation; **Rohit Mital**, KBR, Inc.; **Weston Faber**, L3Harris

SC 7: How to Kill Your Own Satellite | *Mauna Loa Room*

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

SC 8: Next Generation Data Management for Space Data | *Lokelani II Ballroom*

Presented by: **Mark Brady**, U.S. Space Force

SC 9: Space Weather Impacts on Near-Earth Space Operations | *Vanda Room*

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

SC 10: The Dynamic Co-Evolution of Space Policy and Technology: Historical Overview and Lessons for Assessing Future Trends | *Lokelani III Ballroom*

Presented by: **Nancy Hayden**, **Mark Ackermann**, **David Cox**, and **Mike Vannoni** Sandia National Laboratories

6:00 PM - 7:30 PM | Kahoolawe Lawn
WELCOME RECEPTION

Co-sponsored by



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.





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*

Major General DeAnna M. Burt
Commander, Combined Force Space Component Command, United States Space Command; Vice Commander, Space Operations Command, United States Space Force

KEYNOTE Q&A | Q&A sponsored by



8:10AM
SPECIAL PRESENTATION* | T.S. Kelso Space Safety Award

8:30AM
SSA POLICY FORUM* | Lessons Learned from Recent Satellite Servicing Missions

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

Joseph Anderson, Vice President of Operations & Business Development, SpaceLogistics

Ralph Dinsley, Executive Director, Northern Space & Security Ltd.

Mike Lindsey, Chief Technology Officer, Astroscale

Lt Col Alfred Maynard, Commander, 20th Space Control Squadron, United States Space Force

9:30AM | Conference Platform
VIRTUAL EXHIBITS AND NETWORKING BREAK | Sponsored by



10:00AM | Aulani Ballroom
INVITED TALK* | The Space S&T Challenges from LEO to Cislunar
Col Eric Felt, Director, Space Vehicles Directorate, Air Force Research Laboratory

Col Joseph Roth, Director, Innovation & Prototyping, Air Force Space & Missile Systems Center

10:30AM
CISLUNAR SSA | Sponsored by 
Co-chaired by **James Frith**, Air Force Research Laboratory and **Jesse Greaves**, University of Colorado Boulder

Tracking Objects in Cis-Lunar Space: The Chang'e 5 Case | **Roberto Furfaro**, University of Arizona

Hiding in Plain Sight: Observing Objects in Low Lunar Orbit and the L2 Dark Cone from a Lunar Surface Observatory | **Jeffrey Van Cleve**, Ball Aerospace

Risk Maps for Conjunction Potential Throughout the Cislunar Domain | **Alexander Koenig**, Massachusetts Institute of Technology

Cislunar Multiscale Dynamics and Implications for SSA | **Aaron J. Rosengren**, University of California San Diego

Robust Cislunar Initial Orbit Determination
Sam Wishnek, University of Colorado Boulder

11:45AM | Lokelani Ballroom
LUNCH
Sponsored by 

12:45PM | Aulani Ballroom
CONJUNCTION/RENDEZVOUS AND PROXIMITY OPERATIONS
Co-chaired by **James Blake**, University of Warwick, **Darren McKnight**, LeoLabs, and **Matthew Stevenson**, LeoLabs



ASK A QUESTION

Login at
<https://bit.ly/AMOSv21>,
click the session name,
and enter your question



SCAN ME

Overcoming the Operational Challenges Encountered during a Decade of Conjunctions | **Mark Vincent**, Raytheon

Electric Propulsion Intelligent Control (EPIC) Toolbox for Proximity Operations in Low-Earth Orbit (LEO) | **Axel Garcia Burgos**, Massachusetts Institute of Technology

Space Situational Awareness (SSA) Activities Explored through the ELSA-d Mission | **Toby Harris**, Astroscale

An Investigation into Potential Collision Maneuver Guidelines for Future Space Traffic Management | **Mariel Borowitz**, Georgia Institute of Technology

In-Space Inspection Maneuver Analysis Using Trajectory Optimization | **Ian Connerney**, Virginia Polytechnic Institute and State University

PHANTOM ECHOES 2: A Five-Eyes SDA Experiment on GEO Proximity Operations | **Simon George**, Defence Science and Technology Laboratory

SSA Positional and Dimensional Accuracy Requirements for Space Traffic Coordination and Management | **Salvatore Alfano**, COMSPOC Corporation

2:30PM | Conference Platform

VIRTUAL EXHIBITS AND NETWORKING BREAK

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



2:50PM | Aulani Ballroom

ASTRODYNAMICS

Co-chaired by **Tom Kelecý**, The Stratagem Group and **Sam Wishnek**, University of Colorado Boulder

RSO Proper Elements for Space Situational and Domain Awareness | **Di Wu**, University of California San Diego

Application of the AST-UKF to Autonomous Space Domain Awareness | **Jonathan Kadan**, Virginia Tech

* Session is livestreamed

Improved Orbital Predictions using Pseudo Observations - Maximizing the Utility of SGP4-XP | **Anthony Holincheck**, Sceptre Analytics, Inc.

Improving Orbital Uncertainty Realism through Covariance Determination in GEO | **Alejandro Cano Sanchez**, GMV

Fragmentation Detection via Track-to-track Association of Optical Observations | **Alejandro Pastor**, GMV

4:05PM

FEATURED PRESENTATION

Introduction by **Paul Kervin**, AMOS Conference Chair

Semi-Empirical Metrics to Measure the Effects of Satellite Mega-Constellations on Astronomy | **Doyle Hall**, Omitron Inc.

4:20PM

DYNAMIC TASKING

Co-chaired by **David Brough**, Numerica and **Gabe Egolf**, Parsons

Expanding the Space Surveillance Network with Space-Based Sensors Using Metaheuristic Optimization Techniques | **Cameron Harris**, Virginia Polytechnic Institute and State University

A Deep Reinforcement Learning Application to Space-based Sensor Tasking for Space Situational Awareness | **Peng Mun Siew**, Massachusetts Institute of Technology

SNARE (Sensor Network Autonomous Resilient Extensible): Decentralized Sensor Tasking Improves SDA Tactical Relevance | **Bob Carden**, MITRE

Multi-Space-Object Tracking with the Poisson Labeled Multi-Bernoulli (PLMB) Filter & Probabilistic Admissible Region Constraints | **Martin Adams**, Universidad de Chile

5:30PM | Pacific Terrace Rooftop

POSTER RECEPTION

Meet the poster presenters while enjoying a cocktail. All posters are digital and can be viewed on the Virtual Conference Platform.

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SEP 16 THURSDAY | PO'AHA

6:00AM - 7:15AM | Luau Gardens

BREAKFAST AT LEISURE



7:30AM | Aulani Ballroom

KEYNOTE ADDRESS*

Colonel Scott D. Brodeur

Director of the National Space Defense Center and Director of Operations, Joint Task Force Space Defense
United States Air Force

8:00AM

SSA POLICY FORUM* | Large Constellations and Right-of-Way in Space

Moderated by: **Daniel Porras**, Director of Strategic Partnerships and Communications, Secure World Foundation

Emmanuelle David, Executive Manager, EPFL Space Center

Zack Donohew, Scholar in Residence, Leeds School of Business, University of Colorado Boulder

David Goldstein, Principal Guidance Navigation and Control Engineer, SpaceX

Dan Oltrogge, Director, Integrated Operations and Research, COMSPOC Corporation

Ruth Stilwell, Executive Director, Aerospace Policy Solutions LLC

9:00AM | Conference Platform

VIRTUAL EXHIBITS AND NETWORKING

BREAK | Sponsored by



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9:20AM | Aulani Ballroom

FEATURED PRESENTATION |

EMER-GEN® Briefing

9:30AM

2021 AMOS STUDENT AWARD WINNER

Application of SoleiTool for Density Estimation using CubeSat GPS Data |

Shaylah Mutschler, University of Colorado Boulder

9:45AM

OPTICAL SYSTEMS & INSTRUMENTATION

Sponsored by **NORTHSTAR**
EARTH & SPACE

Co-chaired by **Bradford Barrett**, Air Force Office of Scientific Research, **Matthew Bold**, Lockheed Martin, and **Stacie Williams**, Air Force Office of Scientific Research

Reducing Weight of Imaging Systems with Flat Lenses | **Rajesh Menon**, Oblate Optics

Operations Update for the Deformable Mirror Demonstration Mission (DeMi) CubeSat | **Rachel Morgan**, MIT Department of Aeronautics and Astronautics

Analysis of Wavefront Sensing Techniques for Extended Scene Imaging | **Justin Knight**, University of Arizona

Transformation of SST into a Dedicated Sensor in the Space Surveillance Network | **Jonathan Hutfilz**, Space Systems Command

Design and Predicted Performance of 4-m Baseline Habitable-zone Exoplanet Observatory Telescope | **Stahl H Philip**, NASA

Characterization of The Eugene Stansbery-Meter Class Autonomous Telescope on Ascension Island | **Corbin Cruz**, Jacobs

11:15AM | Lokelani Ballroom

LUNCH

12:15PM | Aulani Ballroom

OPTICAL SYSTEMS & INSTRUMENTATION (cont.)

Synthetic-Aperture Silhouette Imaging (SASI): Laboratory Demonstration Traceable to Ground-Based Imaging of GEO Satellites | **Richard Paxman**, Maxar

Polarimetric 3D Imaging in Degraded Environments | **Kashif Usmani**, University of Connecticut



Optomechanical Design and Fabrication of a Wide Field of View 250-mm-aperture Freeform Imaging System | **Matthew A. Davies**, The University of North Carolina at Charlotte

Event-based Sensor Model for Space Domain Awareness | **Rachel Oliver**, U.S. Space Force

Development and Testing of a Novel Low-Cost LEO Optical Surveillance Sensor | **Borja Del Campo Lopez**, Deimos Space UK Ltd.

1:30PM

FEATURED PRESENTATION

The National Science Foundation's Daniel K. Inouye Solar Telescope | **Thomas Rimmele**, National Solar Observatory

1:45PM

ATMOSPHERICS/SPACE WEATHER

Co-chaired by **Randall Alliss**, Northrop Grumman and **Brandon "BT" Cesul**, KBR

Decorrelating Density and Drag-coefficient Through Attitude Variations | **Vishal Ray**, CU Boulder

Solar Flare Prediction With Recurrent Neural Networks | **Jill Platts**, AFRL/RISA

Accelerated AI Powered Atmospheric Predictions for Space Domain Awareness Applications | **Danny Felton**, Northrop Grumman

The Solar Particle Access Model (SPAM): A New Tool for Monitoring Solar Energetic Particle Impacts to Satellite Operations | **Janet Green**, Space Hazards Applications, LLC

2:45PM | Conference Platform

VIRTUAL EXHIBITS AND NETWORKING BREAK

3:05PM | Aulani Ballroom

NON-RESOLVED OBJECT CHARACTERIZATION

Co-chaired by **Heather Cowardin**, NASA Johnson Space Center, **Weston Faber**, L3 Harris, and **Zach Gazak**, Odyssey Systems

Inversion of the Shape of Space Debris from Non-Resolved Optical Measurements within SPOOK | **David Vallverdu Cabrera**, Airbus Defence and Space GmbH

Spectral Characterization of 2020 SO | **Vishnu Reddy**, University of Arizona

Space Object Identification, Discrimination, and Tracking | **Steve Williams**, Kratos

Automated Multi-Sensor Data Fusion Using the Unified Data Library | **Tamara Payne**, Applied Optimization Inc.

Comparing Photometric Behavior of LEO Constellations to SpaceX Starlink using a Space-based Optical Sensor | **Chance Johnson**, USAF/CAF

Studying the Potential of Hyperspectral Unmixing for Extracting Composition of Non-resolved Objects using Simulation Models | **Miguel Velez-Reyes**, The University of Texas at El Paso

Extending Laboratory BRDF Measurements towards Radiometric Modeling of Resident Space Object Spectral Signature Mixing | **Gregory Badura**, Georgia Tech Research Institute

Using AI to Analyse Light Curves for GEO Object Characterisation | **Emma Kerr**, Deimos Space UK Ltd.

Rapid Discrimination of Resident Space Objects Using Near-Infrared Photometry | **Harrison Krantz**, University of Arizona Steward Observatory

5:30PM | Pacific Terrace Rooftop

POSTER RECEPTION

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SCAN ME



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

7:30AM | Aulani Ballroom
KEYNOTE ADDRESS*

Carine Claeys, Special Envoy for Space /
Head of the Space Task Force European
External Action Service

8:00AM
**SSA POLICY FORUM* | Results of the
Recent UN Resolution on Norms of
Behavior in Space**

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

David Edmondson, Policy Head,
Space Security and Advanced Threats,
Security Policy Department, United
Kingdom Foreign, Commonwealth and
Development Office

Eric Desautels, Acting Deputy Assistant
Secretary of State for Emerging Security
Challenges and Defense Policy, Bureau of
Arms Control, Verification and Compliance,
United States Department of State

Audrey Schaffer, Director for Space Policy,
National Security Council

Jessica West, Senior Researcher, Project
Ploughshares

Wen Zhou, Legal Adviser, Arms Unit,
International Committee of the Red Cross

9:00AM | Conference Platform
**VIRTUAL EXHIBITS AND NETWORKING
BREAK** | Sponsored by **PRIVATEER**

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more.

9:20AM | Aulani Ballroom
**INVITED TALK* | AFRL Support to
Space S&T**
*Introduction by **Lt Col J. Chris Zingarelli**,
Commander & Materiel Leader, Air Force
Maui Optical and Supercomputing, Air
Force Research Laboratory Detachment 15*



Dr. Kelly Hammett, Director, Directed
Energy Directorate; Deputy Technology Ex-
ecutive Officer (TEO) for Space Science and
Technology, Air Force Research Laboratory

9:40AM
**SPACE SITUATIONAL/DOMAIN
AWARENESS** | Sponsored by



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

**Safety Norms for Space Security: How
the Development of STM Norms Can
Strengthen Security in Space** | **Daniel
Porras**, Secure World Foundation

Test on the New SSA System of JASDF |
Ryotaro Sakamoto, Japan Air Self Defense
Force

**Swedish National Interests in Space
Situational Awareness** | **Torbjörn Sundberg**,
Swedish Defence Research Agency

**The Australian Space Agency's Inaugural
SSA Technology Roadmap: Context,
Methodology and Learnings** | **Aude
Vignelles**, Australian Space Agency

**Report on 2020 Megaconstellation
Deployments and Impacts to Space
Domain Awareness** | **Ryan Hiles**, Omitron,
Inc.

**Doppler and Angle of Arrival estimation
from Digitally Modulated Satellite Signals
in Passive RF Space Domain Awareness.** |
Mohd Noor Islam, Clearbox Systems

**Daytime Optical Contributions Toward
Timely Space Domain Awareness in Low
Earth Orbit** | **Jeff Shaddix**, Numerica
Corporation

11:45AM | Lokelani Ballroom
LUNCH

12:25PM | Aulani Ballroom
**SPACE SITUATIONAL/DOMAIN
AWARENESS (cont.)**

**Geosynchronous Satellite Maneuver
Identification and Characterization using
Passive RF Passive Ranging** | **Austin Beer**,

Kratos
System Approach to Analyse the Performance of the EU Space Surveillance and Tracking System | **Jose Maria Hermoso**, CDTI

Adapting New Processes to Support Improved Space Based Surveillance Ground Operations | **Thomas Kelecyc**, Stratagem Group

Enhanced Standard Data Format for Reporting Electro-Optical Data Products for Space Domain Awareness | **Tamara Payne**, Applied Optimization Inc.

1:25PM

PANEL* | Space Research Opportunities with the U.S.

Moderated by: **Geoff P. Andersen**, Deputy Chief Scientist, United States Space Force

Thomas W. Cooley, Chief Scientist, Space Vehicles Directorate, Air Force Research Laboratory

Lindsay Millard, Principal Director for Space, Office of the Under Secretary of Defense for Research and Engineering

Joel Mozer, Chief Scientist, United States Air Force

William P. Roach, Chief Scientist, Air Force Office of Scientific Research **CXLD**

Donald A. Shiffler, Jr., Chief Scientist, Directed Energy Directorate, Air Force Research Laboratory

Ezinne Uzo-Okoro, Asst Director for Space Policy, The White House Office of Science and Technology Policy

2:25PM | **Conference Platform**

VIRTUAL EXHIBITS AND NETWORKING BREAK

2:45PM | **Aulani Ballroom**

MACHINE LEARNING FOR SSA APPLICATIONS | Sponsored by



Co-chaired by **Islam Hussein**, Trusted Space and **Charlotte Shabarekh**, MIT Lincoln Laboratory

Toward Deep-Space Object Detection in Persistent Wide Field of View Camera Arrays | **Garrett Fitzgerald**, United States Space Force / University of Dayton

Geosynchronous Satellite Maneuver Classification via Supervised Machine Learning | **Thomas G. Roberts**, Massachusetts Institute of Technology

Toward Using Machine Learning Models for Data Association and Maneuver Classification of Resident Space Objects | **Triet Tran**, Cornerstone Consulting LLC

Inferring Space Object Orientation with Spectroscopy and Convolutional Networks | **Matthew Phelps**, USSF SMC/SPG Program Support

Detection & Identification of On-Orbit Objects Using Machine Learning | **Marcos Perez**, LMO

Pixelwise Image Segmentation for RSO Detection of GEO Spacecraft | **Tim Smith**, The Aerospace Corporation

Incremental Learning of Novel Resident Space Object Spectral Fingerprints | **Zach Gazak**, Odyssey Systems

Time Forecasting Satellite Light Curve Patterns using Neural Networks | **William Dupree**, Aptima, Inc.

4:45PM

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 fourth annual AMOS Conference Best Paper and Student Awards.

5:05PM | **Mei Court**

PAU HANA RECEPTION

Commemorate the end of the 22nd AMOS Conference with live music, cocktails, and friends as we say *Aloha* and *A Hui Hou*

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DIGITAL POSTER PRESENTERS

Light Curve Analysis of Deep Space Objects in Complex Rotation States | **Michael Abercrombie**, The Boeing Company

Geostationary Satellite Telemetry on a Budget | **Abdu-Abomalima**, ANU **CXLD**

SDA Environmental Toolkit for Defense -- Enabling Attribution for Orbital Assets and Electro-magnetic Spectrum Links through Streamlined R2O | **Sage Andorka**, U.S. Space Force

On the Impact of Tactical Track Loading on Volume Revisit Performance and the Role of Augmenting Hosted Payloads - A GEO Space Domain Awareness Challenge | **Jeff Asher**, JHU/APL

A Visible Spectroscopic Atlas of Geostationary Satellites | **Adam Battle**, University of Arizona

Radar-Derived Spin States of Defunct GEO Satellites and Rocket Bodies | **Conor Benson**, University of Colorado Boulder

NGSatSentry: On-Orbit Detection System for Space Domain Awareness | **Nicholas Bertrand**, Northrop Grumman

A Study of Measuring Beam Wander from Stars for Ground-based Laser Illumination | **Nazim Bharmal**, Durham University

Artificial Debris Collision Risk Following a Catastrophic Spacecraft Mishap in Lunar Orbit | **Nathan Boone**, Air Force Institute of Technology

Bayesian Approach to Light-Curve Inversion of 2020 SO | **Tanner Campbell**, University of Arizona

Simplified Conjunction Analysis using a Graph Database for Identifying High Risk Objects | **Janet Cathell**, Sceptre Analytics

Cislunar Orbit Determination Behavior: Processing Observations of Periodic Orbits with Gaussian Mixture Model Estimation Filters | **C. Channing Chow II**, Cloudstone Innovations LLC

Utilization Potential for Distinct Orbit Families in the Cislunar Domain | **Phillip Cunio**, ExoAnalytic Solutions

A Space Operations Domain Architecture Framework (SODAF) for Multinational Constructive Engagement and Future Conflict Uncertainty Mitigation | **Nathaniel Dailey**, MITRE & JHU School of Advanced International Studies **CXLD**

Development and Testing of a Novel Low-Cost LEO Optical Surveillance Sensor | **Borja Del Campo Lopez**, Deimos Space UK Ltd.

Maximizing the Utility of Non-Traditional Sensor Network Data for SSA/SDA | **Neil Dhingra**, Orbit Logic Incorporated

Machine Learning for Launch Assessment: The Similarity-Based Launch Classification Tool (SLCT) | **Michal Dichter**, Applied Technology Associates, a BlueHalo Company

Compact Solutions for Detecting Space and Ground Based Optical Threats to Satellites | **Cameron Dickinson**, MDA Space Robotics & Operations

Qualifying and Reducing Neutral Density Uncertainty for Precise Orbit Determination using Physics-Based Data Assimilations | **Nicholas Dietrich**, University of Colorado Boulder

Preliminary Orbit Determination Using the Transit of Satellites in Front of Space-Based Illumination Sources | **Daniel Dombrowski**, Air Force Institute of Technology

Poster Receptions | Pacific Rooftop Wed, Sept 15 & Thu, Sept 16 5:30PM - 7:00PM

Amorphous Closed Loop Feedback Control for SDA Payloads | **David Ellis**, Ball Aerospace

A Regional Greedy Algorithm for Space Domain Awareness Resource Allocation | **Naomi Owens Fahrner**, Ball Aerospace

Spooky Coordinated Tasking and Estimation on Uninformative Priors | **Samuel Fedeler**, University of Colorado at Boulder

Nonlinear Filtering with State-dependent Probability of Detection | **Gunner Fritsch**, Texas A&M University

Detection of Background Stars over an Artificial Satellite Pass using Blob Detection Algorithms | **Andre Gaudin**, University of Canterbury

Characterization of Orbital Debris Attributes Using Functional Data Analysis | **Emily Gerber**, L3 Harris

Relative Estimation in the Cislunar Regime using Optical Sensors | **Jesse Greaves**, University of Colorado Boulder

Establishing Consensus Between Implicitly Updated Decentralized Probability Distribution Functions | **Juan Gutierrez**, KBR

Photometric Characterization and Trajectory Accuracy of Starlink Satellites | **Grace Halferty**, University of Arizona

An Adaptive, Non-singular Measurement Model for Angles-only Orbit Determination and Estimation | **James Hippelheuser**, University of Central Florida

Dynamic Model Integration and Simulation Engine (DMISE) Assisted Design of Future Sensor Networks in Support of Space Traffic Management | **Douglas Hope**, Georgia Tech Research Institute

Headline-based Human-Computer Interface to Aggregate Space Indications and Warnings | **John Ianni**, AFRL

Asteroid Detection and Risk Prediction for the Earth | **Tulika Jain**, Shah & Anchor Kutchhi Engineering College

Observations of Satellites Using Near-Simultaneous Polarization Measurements | **Audra Jensen**, USAFA

The Advancement and Importance of Cubesats in Space Sector: A Botswana Perspective in the African Space Agenda | **Tumo Fortunate Kedumele**, Space Generation Advisory Council In Support of the United Nations Programme on Space Applications

Novel Closed Form Solution for Orbit Segment Altitude Extrema Over Spherical and Oblate Central Bodies | **Darin Koblick**, Raytheon Intelligence and Space

Small-Satellite Tracking Using Passive-Radar Retro-reflectors | **Shawn Kocis**, Naval Information Warfare Center-Pacific **CXLD**

Use of Ground Stations of ERS Data Reception in the Interest of Space Situational Awareness | **Oleksandr Kozhukhov**, National Space Facilities Control and Test Center of State Space Agency of Ukraine

Characterizing the All-Sky Brightness of Satellite Mega-Constellations and the Impact on Astronomy Research | **Harrison Krantz**, University of Arizona Steward Observatory



DIGITAL POSTER PRESENTERS CONT.

Space Command and Control Program
- Kobayashi Maru | **Edward Jones**, SMC/
ECXC

Light Scattering Properties of a Solar
Panel Including Wavelength and
Polarization Dependencies in the
Visible Spectrum | **Joe Kurtz**, University
of New South Wales - Canberra

Improving Orbit Propagation
With In-Situ Atmospheric Density
Measurements | **Andrew Kurzrok**,
Space Generation Advisory Council
CXLD

The Efficacy of Limiting Catastrophic
Fragmentations in Low Earth Orbit
by Regulating Probability of Collision
with Large Objects | **Mike Lindsay**,
Astroscale

Discovering 3-D Structure of LEO
Objects Using Neural Radiance Fields |
Jacob Lucas, The Boeing Company

Developing A Virtual Assistant for
Space Operations | **Jeremy Ludwig**,
Stottler Henke Associates, Inc.

Observations of Space Object 2020 SO
Using 8-inch f/2 Schmidt Astrograph
| **Tim McLaughlin**, Pine Park
Engineering Corp

Earthshine: A Paradigm Shift for
Daylight Imaging and Custody of LEO
Satellites | **Scott Milster**, AFRL/RV

A Subset Simulation Based Technique
for Calculating the Probability of
Collision | **Utkarsh Mishra**, Texas A&M
University

Graph Point Generation: Observer's
Projection-Reflection Dynamics of
Perception | **Nancy Mogire**, UH Manoa
CXLD

Self-Supervised Auxiliary Task Learning
for Estimating Satellite Orientation |
Klaus Okkelberg, The Boeing Company

A New Statistical Estimate of the Radar
Coverage of the Low Earth Orbit Debris
Environment | **Chris Ostrom**, HX5

Threats Prediction to a Satellite by
Detected Asteroids | **Linesh Patil**, Shah
& Anchor Kutchhi Engineering College

Enhanced Standard Data Format
for Reporting Electro-Optical Data
Products for Space Domain Awareness
| **Tamara Payne**, Applied Optimization
Inc.

Introduction of New Strategies and
State of the Art Investigation on Space
Debris Catalogue Creation for Optical
Sensor Networks | **Guido Pedone**,
Airbus Defence and Space GmbH

Debris Cloud Structure in Medium
Earth Orbit | **Marielle Pellegrino**,
University of Colorado Boulder

Clustering-Based Uncorrelated Track
Association | **Louis Penafiel**, Aptima,
Inc.

Detection & Identification of On-Orbit
Objects Using Machine Learning |
Marcos Perez, LMO

Polarimetric Space Situational
Awareness using the Aero-Optical
Prediction Tool | **Christopher Persons**,
IERUS Technologies

Share My Space Multi-telescope
Stations Performance Assessment |
Alexis Petit, Share My Space

Dual Use Star Tracker and Space
Domain Awareness Sensor In-
Space Test | **Elozor Plotke**, LinQuest
Corporation

Real-Life Performance of Rendezvous
and Proximity Operation (RPO)
Imagers in GEO | **Matt Pyrak**, Northrop
Grumman Space Systems

Orbital Diversity and Inclination
Optimization for Large Count LEO
Constellations in Non-polar Orbits |
Chuck Quintero, JHU/APL

Poster Receptions | Pacific Rooftop Wed, Sept 15 & Thu, Sept 16 5:30PM - 7:00PM

Multi-Target Ensemble Gaussian Mixture Tracking with Sparse Observations | **Benjamin Reifler**, The University of Texas at Austin

Patterns of Life and Maneuver Detection for Cislunar Trajectory Maintenance | **Karina Rivera**, University of Colorado Boulder

Future Space Domain Awareness Hosted Payloads | **Anthony Rosati**, U.S. Space Force AFSPC SMC/SPG

A Worldwide Network of Radar for Space Domain Awareness in Low Earth Orbit | **James Rowland**, LeoLabs

Photometric and Spectral Calibration of the Falcon Telescope Network | **Nikola Ruby**, Murray State University

Modeling Energy Dissipation and Detumbling of a Defunct a Satellite Using a Finite Element Method | **Ryotaro Sakamoto**, University of Colorado Boulder

Optical Satellite Tracking in Earth's Shadow with Non-traditional Illumination | **Kevin Schafer**, MITRE

Ablative Collision Avoidance for Space Debris in the Lower Earth Orbit by a Single Multi-kJ Pulse from a Ground-based Laser | **Stefan Scharring**, DLR

Space Domain Characterization and Control System (SDCCS) -- A User Workflow Centered Persistent Analytical Framework | **Michael Sellick**, Centauri, LLC. **CXLD**

Re-entry Event of CZ-3B R/B Observed by All-sky Meteor Cameras AMOS | **Jiri Silha**, Comenius University, Faculty of Mathematics, Physics and Informatics

Systems and Methods for Hybrid Lunar Surface and Space Domain Situational Awareness | **Elvis Silva**, Ball Aerospace

A Three-dimensional Photometric Model of a Satellite in Geostationary Orbit | **Jovan Skuljan**, Defence Technology Agency

Excitation of VLF Waves in the Ionosphere | **Vladimir Sotnikov**, AFRL

Identifying the Statistically-Most-Concerning Conjunctions in LEO | **Matthew Stevenson**, LeoLabs

Decentralized Space Information Sharing as a Key Enabler of Trust and the Preservation of Space | **Ruth Stilwell**, Aerospace Policy Solutions, LLC

Data Fusion of Historical Space Weather Outliers and Satellite Anomalies | **Richard Stottler**, Stottler Henke Associates, Inc.

A Spoken Language Interface for SSA/SDA Based on Modern Speech Processing Technology | **Richard Stottler**, Stottler Henke Associates, Inc.

Toward Intuitive Understanding of Complex Astrodynamics using Distributed Augmented Reality | **Daniel Stouch**, Charles River Analytics

Design Trades for Environmentally Friendly Broadband LEO Satellite Systems | **Mark Sturza**, 3C Systems Company

Speckle Interferometry of Binary Stars with a 1m Telescope, Grounded with AO from a 1.5m | **Tanya Tavenner**, AFRL/RDS

Investigating the Risks of Debris-generating ASAT Tests in the Presence of Megaconstellations | **Sarah Thiele**, The University of British Columbia

Cislunar Orbit Determination and Tracking via Simulated Space-Based Measurements | **Michael Thompson**, Advanced Space



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Detecting Dim Targets in Cislunar Space using GEO/HEO-based Optical Sensors | **Darren Thornton**, Air Force Institute of Technology

The Machine Learning Enabled Thermosphere Advanced by HASDM (META-HASDM) System in Development That Will Support Space Traffic Management and Conjunction Assessment | **W. Kent Tobiska**, Space Environment Technologies

Agile Space Object Custody for Electro-Optical Sensors | **Johnathan Tucker**, University of Colorado Boulder

Daytime Sky Brightness Measurements and Comparison to Analytical Models | **Vincent Vella**, L3 Harris

Designing a Compressive All-Sky Tracking Camera for Space Situational Awareness | **Esteban Vera**, Pontificia Universidad Catolica de Valparaiso
CXLD

Establishment of a Space Operations Squadron at the Japan Air Self-Defense Force in 2020: Current Status and Future Prospects | **Quentin Verspieren**, The University of Tokyo

An Artificial Intelligence enabled Dynamic Coalition Architecture for Space Traffic Management | **W. Thomas Vestrand**, Los Alamos National Laboratory

Superresolution Imaging via Wavefront Projections | **Edwin Walker**, The Boeing Company
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Faint Satellite Detection from Radon Transformations using Machine Learning Techniques | **Thomas Walker**,

Lockheed Martin Australia Preliminary Viability Assessment of Cislunar Periodic Orbits for Space Domain Awareness Mission Architectures | **Adam Wilmer**, Air Force Institute of Technology

Semantic Segmentation of Low Earth Objects using Convolutional Neural Networks | **Julia Yang**, The Boeing Company

The Future of Global Space Situational Awareness | **Makena Young**, Center for Strategic and International Studies

Establishing a Chain of Digital Forensics for Space Object Behavior Using Distributed Ledger Technology | **Waqar Zaidi**, L3Harris

A Complete SSA Scheme for a Sustainable Low Earth Orbit: Space Data Aggregation and IA Combined with In-orbit Inspection | **Selma Zamoum**, SpaceAble

AGO70: Passive Optical System to Support SLR Tracking of Space Debris on LEO | **Matej Zigo**, Comenius University in Bratislava

Cislunar SSA/SDA from the Lunar Surface | **Peter Zimmer**, J.T. McGraw and Associates, LLC (JTMA)

Overcoming the Challenges of Daylight Optical Tracking of LEOs | **Peter Zimmer**, J.T. McGraw and Associates, LLC (JTMA)



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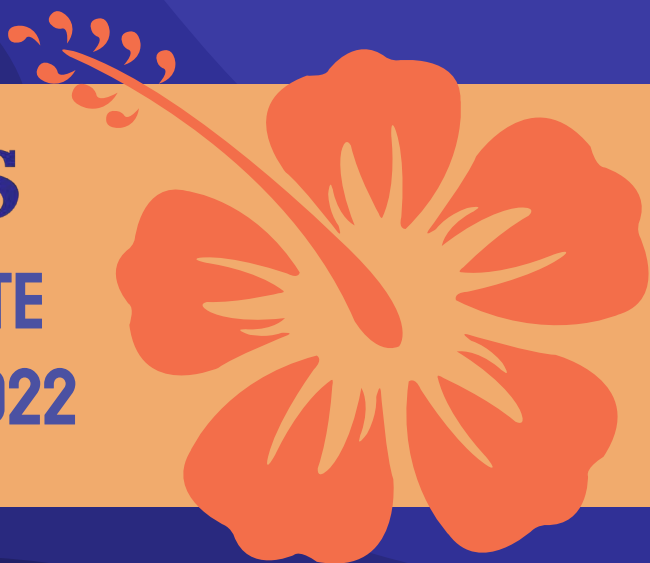


The logo for AMOS, featuring the letters 'A', 'M', and 'O' in a serif font, followed by a circular emblem containing a four-pointed star, and the letter 'S' in the same serif font.

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The logo for the Maui Economic Development Board, consisting of the letters 'me' stacked above 'db' in a stylized, blocky font.

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