



Advanced Maui Optical and Space Surveillance Technologies Conference **September 15-18**
2015

A program of Maui Economic Development Board, Inc.

Wailea Marriott, Maui, Hawaii
Draft Agenda – Subject to Change (as of 9/2/2015)

Sunday 13 September

2:00 PM - 5:00 PM **ONSITE REGISTRATION** | Aulani Ballroom Foyer

Monday 14 September

2:00 PM - 5:00 PM **ONSITE REGISTRATION** | Aulani Ballroom Foyer

Tuesday 15 September

8:00 AM - 12:00 PM **TECHNICAL SHORT COURSES 1 & 4**

- 1 Satellite Conjunction Assessment: Theory and Practice** | Mauna Loa Ballroom
Presented by CNES, the French Space Agency (for CAESAR, Francois Laporte in coordination with Monique Moury) and NASA GSFC (for CARA, Ryan Frigm and Matt Hejduk in coordination with Lauri Newman)

- 4 Near Earth Object Tracking Using Radar Astrometry** | Ilima Ballroom
Presented by Patrick Taylor, Staff Scientist, National Astronomy and Ionosphere Center, Arecibo Observatory

1:00 PM - 5:00 PM **TECHNICAL SHORT COURSES 2 & 3**

- 2 Advanced Concepts & Techniques for Operational Collision Risk Management** | Mauna Loa Ballroom
Presented by Matthew Duncan, Joshua Wysack, SpaceNav

- 3 Observing and Characterizing Space Debris** | Ilima Ballroom
Presented by Thomas Schildknecht, Professor, Optical Astronomy Group of the Astronomical Institute of the University of Bern, Switzerland, and Director, Swiss Optical Ground Station and Geodynamics Observatory Zimmerwald

8:00 AM - 5:00 PM **EXHIBITOR LOAD-IN** | Aulani Ballroom

8:00 AM - 5:00 PM **ONSITE REGISTRATION** | Aulani Ballroom Foyer

6:00 PM - 7:30 PM **WELCOME RECEPTION** | Luau Gardens
Co-sponsored by The Boeing Company

Wednesday 16 September

- 6:00 AM - 7:15 AM** **BREAKFAST AT LEISURE** | Luau Gardens
- 7:30 AM** **CONFERENCE OPENING** | Aulani Ballroom
Jeanne Unemori Skog, President & CEO, Maui Economic Development Board
- INVOCATION**
Reverend Kealahou Alike, Keawala'i Congregational Church
- KEYNOTE ADDRESS**
Major General Clinton E. Crosier
Director of Plans and Policy, U.S. Strategic Command
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- 8:20 - 9:20 AM** **SSA POLICY FORUM** | Aulani Ballroom
Towards a Combined Space Situational Awareness
Col John Giles, 614th Air and Space Operations Center, USAF; Lt Col (RAF) John Van Der Laan, JSpOC Combat Operations Division; Kay Sears, Intelsat General; Col (select) Thomas Spangenberg, German Space Situational Awareness Center; Lt Col Jeon Hyeon-seock, Korean Space Monitoring Center. Moderated by Cary Chun, Brig Gen (Ret., USAF), Senior Vice President, Client Relations Executive, ASRC Federal
- 9:20** **Invited Remarks**
Frank Rose
Assistant Secretary of State for Arms Control, Verification, and Compliance
U.S. Department of State
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- 9:40 AM - 6:30 PM** **EXHIBITS OPEN** | Aulani Ballroom
- 9:40** **COFFEE BREAK (20 MINUTES)** | Aulani Ballroom
- 10:00** **OPTICAL SYSTEMS SESSION** | Aulani Ballroom
Chair: Jim Mayo, Tau Technologies
- The Fundamental Role of Wide-Field Imaging in Space Situational Awareness
John McGraw, J.T. McGraw and Associates, LLC
- The MetaTelescope, a System for the Detection of Objects in Low and Higher Earth Orbits
Michel Boer, French National Centre for Scientific Research (CNRS)
- Early CAL/VAL Process for an Optical Tracking System by Korea
Jung Hyun Jo, Korea University of Science and Technology, Korea Astronomy and Space Science Institute
- 11:00** **LUNCH (60 MINUTES)** | Lokelani Ballroom
- 12:00 PM** Developing Geostationary Satellite Imaging at the Navy Precision Optical Interferometer
Gerard van Belle, Lowell Observatory
- Night and Daytime Detection of Orbital Objects and Filter Photometry at Short Infrared Wavelengths
Guillaume Langin, Artemis Observatoire de la cote d azur

SPIDER: Next Generation Chip Scale Imaging Sensor
Alan Duncan, Lockheed Martin

1:00

SPACE SITUATIONAL AWARENESS (SSA) SESSION | Aulani Ballroom

Chairs: Lt Col Elizabeth Campbell, SMC/SYAZ and Lt Col Larry Gunn, DARPA

Application of a COTS Resource Optimization Framework to the SSN Sensor Tasking Domain –
Part I: Problem Definition

Triet Tran, Braxton Technologies LLC

Dynamic Steering for Improved Sensor Autonomy and Catalogue Maintenance
Tyler Hobson, The University of Queensland

First Results of Coherent Uplink from a Phased Array of Widely Separated Antennas: Steps Toward A
Verifiable Real-Time Atmospheric Phase Fluctuation Correction for a High Resolution Radar System
Barry Geldzahler, NASA- HQ

Technique for GEO RSO Station-Keeping Characterization and Maneuver Detection
Jake Decoto, Orbital-ATK

2:20

COFFEE BREAK (20 MINUTES) | Aulani Ballroom

2:40

Heimdall System for MSSS Sensor Tasking
Alex Herz, Orbit Logic

Conceptual Design for Expert Centres Supporting Optical and Laser Observations in a Space
Surveillance and Tracking System

Tim Flohrer, ESA/ESOC

A Fast Method for Embattling Optimization of Ground-Based Radar Surveillance Network
Hai Jiang, National Astronomical Observatories, Chinese Academy of Sciences

Operations Analysis of Australian-based Systems for Surveillance of Space
Mark Graham, Defence Science and Technology Group, Department of Defence

Integrated Space Asset Management Database and Modeling
Larry Gagliano, NASA/MSFC

Collaborative Work Environment for Operational Conjunction Assessment
Francois Laporte, CNES

Project UNITY: Cross Domain Visualization Collaboration
Jason Moore, Air Force Research Laboratory

Space Fence Overview
Joseph Haimerl, Lockheed Martin

5:20 - 6:30 PM

EXHIBIT AND POSTER SESSION | Aulani Ballroom

Co-sponsored by the University of Hawaii

6:30 - 9:00 PM

SOAR TEAM RECEPTION | Pacific Terrace Rooftop

By invitation

Thursday 17 September

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

7:30 - 9:00 AM **SSA POLICY FORUM** | Aulani Ballroom

Keynote

John Hill, Principal Director For Space Policy, Office of the Under Secretary of Defense for Policy

SSA for Enhancing Norms of Behavior and Resilience

John Hill, Office of the Under Secretary of Defense for Policy; Eric Desautels, U.S. Department of State; Andrew D'uva, Providence Access Company; Moderated by Victoria Samson, Secure World Foundation

9:00 AM - 6:00 PM **EXHIBITS OPEN** | Aulani Ballroom

9:00 **COFFEE BREAK (20 MINUTES)** | Aulani Ballroom

9:20 **SPACE WEATHER SESSION** | Aulani Ballroom
Chair: Randall Alliss, Northrop Grumman Corporation

Sub-Auroral Ion Drifts as a Source of Mid-Latitude Plasma Density Irregularities
Vladimir Sotnikov, Air Force Research Laboratory

MAMBA All-sky Camera
Edward Pier, Oceanit

Characterizing the Performance of Haleakala as a Ground Site for Laser Communications
Billy Felton, Northrop Grumman

Predicting Space Weather Effects on Close Approach Events
Lauri Newman, NASA

Research to Operations of Ionospheric Scintillation Detection and Forecasting
James Jones, Northrop Grumman

11:00 **LUNCH (60 MINUTES)** | Lokelani Ballroom

12:00 PM **ORBITAL DEBRIS SESSION** | Aulani Ballroom
Chair: Tim Flohrer, European Space Agency

Statistical Track-Before-Detect Methods Applied to Faint Optical Observations of Resident Space Objects
Kohei Fujimoto, Texas A&M University

Streak Detection Algorithm for Space Debris Detection on Optical Images
Thomas Schildknecht, Astronomical Institute, University of Bern

Deploying the NASA Meter Class Autonomous Telescope (MCAT) on Ascension Island
Susan Lederer, NASA JSC

GEO Collisional Risk Assessment Based on Analysis of NASA-WISE Data and Modeling
Capt. Samantha Howard, AFRL Space Vehicles Directorate

Environment Characterisation by Using Innovative Debris Detector
Waldemar Bauer, German Aerospace Center (DLR)

Space debris attitude simulation - IOTA (In-Orbit Tumbling Analysis)
Ronny Kanzler, Hyperschall Technologie Göttingen GmbH

2:00 **COFFEE BREAK (20 MINUTES)** | Aulani Ballroom

2:20 **NON-RESOLVED OBJECT CHARACTERIZATION SESSION** | Aulani Ballroom
Chairs: Doyle Hall, Boeing LTS and Matt Hejduk, Astrorum Consulting

Photometric Monitoring of Non-resolved Space Debris and Databases of Optical Light Curves
Thomas Schildknecht, Astronomical Institute (AIUB), University of Bern

IRTF SpeX Observations of Orbital Object
Brent Buckalew, Cal Poly San Luis Obispo

On-line Flagging of Anomalies and Adaptive Sequential Hypothesis Testing for Fine-feature
Characterization of Geosynchronous Satellites
Anil Chaudhary, Applied Optimization

Active Polarimetry for Orbital Debris Identification
Michael Pasqual, Massachusetts Institute of Technology

Spatio-Temporal Scale Space Analysis of Photometric Signals with Tracking Error
Brien Flewelling, AFRL/RVSVC

NIR Color vs Launch Date: A 20-year Analysis of Space Weathering Effects on the Boeing 376
Spacecraft
James Frith, Univeristy of Texas El Paso

Satellite Photometric Error Determination
Tamara Payne, Applied Optimization Inc.

Automated Algorithm to Detect Changes in Geostationary Satellite's Configuration and Cross-Tagging
Phan Dao, AFRL/RVB

5:00 - 6:00 PM **EXHIBIT AND POSTER SESSION** | Aulani Ballroom
Co-sponsored by SpaceNav

8:00 - 10:00 PM **SATELLITE WATCHING AND STAR PARTY** | Pacific Terrace Rooftop
Sponsored by Analytical Graphics, Inc.

Friday 18 September

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

7:30 - 9:00 AM **SSA POLICY FORUM** | Aulani Ballroom

Keynote

George Nield, Associate Administrator, Commercial Space Transportation, Federal Aviation Administration

SSA Challenges and Opportunities from the Growing Private Sector Presence in Space

Stewart Bain, NorStar-Data, Inc.; Mike Lindsay, OneWeb; Craig Smith, EOS Space Systems; Paul Welsh, Analytical Graphics, Inc.; Moderated by Brian Weeden, Secure World Foundation

9:00 AM - 12:00 PM **SPACE EXPLORATION STUDENT DAY**
(200 middle school students to participate in hands-on STEM activities)

9:00 AM - 2:00 PM **EXHIBITS OPEN** | Aulani Ballroom

9:00 **COFFEE BREAK (20 MINUTES)** | Aulani Ballroom

9:20 **INVITED SPEAKER**
 David Lassner, President, University of Hawai'i

9:40 **AMOS OVERVIEW**
 Joint R&D and Ops: A Working Paradigm for SSA
 Keith Knox, AFRL Det 15

10:00 **ASTRODYNAMICS SESSION** | Aulani Ballroom
 Chair: Moriba Jah, Air Force Research Laboratory

Space-to-Space Based Relative Motion Estimation Using Linearized Relative Orbit Elements
 Trevor Bennett, University of Colorado Boulder

Orbital Element Generation for an Optical and Laser Tracking Space Object Catalogue
 James Bennett, Space Environment Research Centre & EOS Space Systems

Track-to-Track Data Association using Mutual Information
 Islam Hussein, Applied Defense Solutions

11:00 **LUNCH (60 MINUTES)** | Lokelani Ballroom

12:00 PM Improving Space Object Catalog Maintenance Through Advances in Solar Radiation Pressure Modeling
 Jay McMahon, University of Colorado Boulder

Towards Real-Time Maneuver Detection: Automatic State and Dynamics Estimation with the Adaptive Optimal Control Based Estimator
 Daniel Lubey, University of Colorado

Bridging the Gap between Academia and Operations for Orbital Debris Risk Mitigation
 Mark Vincent, Raytheon

Total Probability of Collision as a Metric for Finite Conjunction Assessment and Collision Risk Management
Ryan Frigm, Omitron, Inc.

Coupled Simulations, Ground-based Experiments and Flight Experiments for Astrodynamics Research
Russell Boyce, University of New South Wales

1:40 **COFFEE BREAK (20 MINUTES)** | Aulani Ballroom

2:00 **ADAPTIVE OPTICS AND IMAGING SESSION** | Aulani Ballroom
Chair: Glenn Tyler, the Optical Sciences Company

Resolved Observations of Geosynchronous Satellites from the 6.5 m MMT
Michael Hart, University of Arizona

Italian Air Force Radar and Optical Sensor Experiments for the Detection of Space Objects in LEO Orbit
Giovanni Marco Del Genio, Italian Air Force

Incorporating LWIR Data into Multi-Frame Blind Deconvolution of Visible Imagery
Michael Werth, Boeing

New Aperture Partitioning Element
Steven Griffin, Boeing

From Dye Laser Factory to Portable Semiconductor Laser: Four Generations of Sodium Guide Star Lasers for Adaptive Optics in Astronomy and Space Situational Awareness
Celine d'Orgeville, Australian National University

Adaptive Optics for Satellite Imaging and Space Debris Ranging
Francis Bennet, Research School of Astronomy and Astrophysics, Australian National University

A Comprehensive Comparison of COMBAT Data to Wave-Optics Simulations
Richard Holmes, Boeing LTS

Anisoplanatic Imaging through Turbulence using Principal Component Analysis
Roberto Baena-Gallé, Royal Academy of Sciences and Arts of Barcelona

Fundamental Constraints on Imaging Geosynchronous Satellites
David Mozurkewich, Seabrook Engineering

Multiple-Baseline Detection of a Geostationary Satellite with the Navy Precision Optical Interferometer
Henrique Schmitt, Naval Research Laboratory

5:20 PM **CONFERENCE ADJOURNS**

6:00 - 9:00 PM **CLOSING LUAU DINNER** | Luau Gardens

POSTER PRESENTERS

Commercial Optics for Space Surveillance and Astronomy
Mark Ackermann, Celestron

Thermal Systems Engineering of a Highly Re-usable Host Spacecraft for Space Surveillance
Kevin Anderson, California State Polytechnic University at Pomona

New Approach to Multiple Data Association Processing for Initial Orbit Determination using Optical Observations
Dilmurat Azimov, Mechanical Engineering, University of Hawaii at Manoa

Flat-fielding in Very Wide-field of View Optical Systems: A Comparison Between Twilight Sky and a Flat-fielding Box Approaches for the TFRM Baker-Nunn Camera
Roberto Baena-Gallé, Real Academia de Ciencias y Artes de Barcelona

Object Area-to-mass Ratio Estimation for Better Orbit Predictions
James Bennett, Space Environment Research Centre & EOS Space Systems

Comparison of BRDF-Predicted and Observed Light Curves of GEO Satellites
Angelica Cenicerros, University of Arizona

Architecture Design for the Space Situational Awareness System in the Preparedness Plan for Space Hazards of Republic of Korea
Eun Jung Choi, Korea Astronomy

Adaptive Optics Testbed for the Visible High Resolution Imaging
Young Soo Choi, Agency for Defence Development, South Korea

Robust Wave-front Correction in a Small Scale Adaptive Optics System Using a Membrane Deformable Mirror
Young Soo Choi, Agency for Defence Development, South Korea

Spectral Measurements of Geosynchronous Satellites During Glint Season
Francis Chun, HQ USAFA/DFP

An Asteroid and its Moon Observed with LGS at the SOR
Jack Drummond, AFRL

Detecting GEO Debris via Cascading Numerical Evaluation for Lines in Image Sequence
Koki Fujita, Kyushu University

Innovative Electrostatic Adhesion Technologies
Larry Gagliano, NASA/MSFC

Small Orbital Stereo Tracking Camera Technology Development
Larry Gagliano, NASA/MSFCt

Spaceborne Laser Communication and the Space Data Highway - Enabling Near-Real-Time Surveillance for Earth Observation
David Germroth, PACE GS

Space Situational Awareness Data Processing Scalability Utilizing Google Cloud Services
Dave Greenly, SpaceNav

Efficient Photometry In-Frame Calibration (EPIC) Gaussian Corrections for Automated Background Normalization of Rate-
Tracked Satellite Imagery
Jacob Griesbach, Applied Defense Solutions

10 Steps to Building an Architecture for Space Surveillance Projects
Eric Gyorko, Harris Corporation

Multi-sensor Observations of the SpinSat Satellite
Doyle Hall, Boeing – LTS

Changes of the Electrical and Optical Character of Polyimide Films Due to Exposure to High Energy GEO-like
Electrons and the Chemistry that Drives it
Ryan Hoffmann, AFRL/RVB

Accurate Focus Correction for Large Telescopes
Richard Holmes, Boeing LTS

Advantages of a Geographically Diverse Ground Based Architecture for SSA
Brendan Houlton, Analytical Graphics, Inc.

RSO Characterization from Photometric Data Using Machine Learning
Michael Howard, Charles River Analytics, Inc.

Treemap Visualizations for Space Situational Awareness
John Ianni, Air Force Research Laboratory

The Joint Space Operations Center (JSpOC) Mission System (JMS) and the Advanced Research, Collaboration, and
Application Development Environment (ARCADE)
Kipp Johnson, Scitor Corporation

SSA Sensor Calibration Best Practices
Thomas Johnson, Analytical Graphics Inc.

Multicolour Optical Photometry of Active Geostationary Satellites
Andrew Jolley, Royal Australian Air Force

Imaging of stellar surfaces with the Navy Precision Optical Interferometer
Anders Jorgensen, New Mexico Institute of Mining and Technology

An FPGA-based High Speed Parallel Signal Processing System for Adaptive Optics Testbed
Hong Bong Kim, Hanwha Thales Co. Ltd.

Parametric Excitation of Very Low Frequency (VLF) Electromagnetic Whistler Waves and Interaction with
Energetic Electrons in Radiation Belt
Tony Kim, Air Force Research Laboratory

Reconstructing from Extended Imagery of Space Objects
Andrew Lambert, UNSW Canberra

Real-time Astrometry using Phase Congruency
Andrew Lambert, UNSW Canberra



Benefits of Applying Predictive Intelligence to the Space Situational Awareness (SSA) Mission
Ben Lane, Northrop Grumman

Robotic SLODAR Development for Seeing Evaluation at the Bohyun Observatory
Jun Ho Lee, Kongju National University
Orbit determination and Maneuver Detection Using Event Representation with Thrust-Fourier-Coefficients
Daniel Lubey, University of Colorado

Comparison of IR and Visible Cloud Imagers
W. Jody Mandeville, MITRE Corporation

Moving into the Light: The AEOS Telescope in the Daytime Operating Environment
Jim Mayo, Tau Technologies LLC

Using Big Data Technologies and Analytics to Predict Sensor Anomalies
Rohit Mital, SGT

An Imaging System for Satellite Hypervelocity Impact Debris Characterization
Matthew Moraguez, University of Florida

Iteratively Reweighted Deconvolution through Subspace Projection
James Nagy, Emory University

Space Debris Measurements using the Advanced Modular Incoherent Scatter Radar
Michael Nicolls, SRI International

Autonomous Object Characterization with Large Datasets
Mark Poole, ExoAnalytic Solutions

Efficient Conjunction Assessment using Modified Chebyshev Picard Iteration
Austin Probe, Texas A&M University

Satellite Fingerprints
David Richmond, Lockheed Martin

The Probabilistic Admissible Region with Additional Constraints
Christopher Roscoe, Applied Defense Solutions

Asteroid Detection Results Using the Space Surveillance Telescope
Jessica Ruprecht, MIT Lincoln Laboratory

Photometric Studies of Rapidly Spinning Decommissioned GEO Satellites
William Ryan, New Mexico Institute of Mining and Technology

LEO Debris Ballistic Coefficients Estimated From TLE
Jizhang Sang, Wuhan University

Semianalytic Orbit Propagation Using Multiple Scaling Perturbation Method
Jizhang Sang, Wuhan University

Exploiting Historical Photometric Data for 3 Axis Stabilized Geostationary Satellites
David Sibert, ExoAnalytic Solutions, Inc.

High Speed Large Format Photon Counting Microchannel Plate Imaging Sensors
Oswald Siegmund, Space Sciences Laboratory, University of California, Berkeley

Automatic, Rapid Replanning of Satellite Operations for Space Situational Awareness (SSA)
Dick Stottler, Stottler Henke Associates, Inc.

Improved Space Surveillance Network (SSN) Scheduling using Artificial Intelligence Techniques
Dick Stottler, Stottler Henke Associates, Inc.

Implementation of an Open-scenario, Long-term Space Debris Simulation Approach
Jan Stupl, SGT / NASA Ames

ArgusE: Design and Development of a Micro-spectrometer used for Remote Earth and Atmospheric Observations
Catherine Tsouvaltsidis, Department of Earth and Space Science and Engineering, York University

Mixed-Integer Formulations for Constellation Scheduling
Christopher Valicka, Sandia National Laboratories

Using Simplistic Shape/Surface Models to Predict Brightness in Estimation Filters
Charles Wetterer, IAI-PDS

Light Curve Simulation using Spacecraft CAD Models and Empirical Material Spectral BRDFS
Alex Willison, Royal Military College of Canada

A Method for Improving Two-line Element Outlier Detection Based on a Consistency Check
Yang Zhao, SPACE Research Centre, School of Mathematical and Geospatial Sciences, RMIT University

Real-Time Optical Surveillance of LEO/MEO with Small Telescopes
Peter Zimmer, J.T. McGraw and Associates, LLC

Simpler Adaptive Optics using a Single Device for Processing and Control
Anna Zovaro, The University of Sydney and the Australian National University