Maui Economic Development Board, Inc. Presents

AMOS

Advanced Maui Optical and Space Surveillance Technologies Conference

PROGRAM

September 10-13, 2013

Mahalo to our Sponsors

Po‘okela | striving for the best

BOEING

Laulima | working together

agi
"Official SW Provider"

Lokahi | collaboration and unity

BAE SYSTEMS

LOCKHEED MARTIN

SPACE FOUNDATION

Raytheon

USRA

SECURE WORLD FOUNDATION

UNIVERSITY of HAWAI'I SYSTEM

Kupa‘a | loyal and committed

pds

Sandia National Laboratories

Schafer

STENGER GHAFFARIAN TECHNOLOGIES

Malama | to care for

AO Applied Optimization

Ball Aerospace & Technologies Corp.

EOS SPACE SYSTEMS

ATA Applied Technology Associates

BEAR MACHINERY

HARRIS

leidos

SPACENAV

THE VALUE OF PERFORMANCE
NORTHROP GRUMMAN

Featured Exhibitors

Air Force Research Laboratory | Analytical Graphics, Inc. | Applied Optimization | Applied Technology Associates | Astro Haven | BAE Systems | Bear Machinery | The Boeing Company | EOS Space Systems | Lockheed Martin | Northrop Grumman | Rayleigh Optical Systems | SAIC/leidos | Software Bisque/Officina Stellare | University of Hawaii | Universities Space Research Association

Welina Mai Kakou | welcome

Aloha!

We are pleased that you are participating in the 14th AMOS Conference. Although we will be sitting in a darkened ballroom, intently listening to technical briefings throughout the week, we are, indeed, in a culturally rich and beautiful setting…

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 a private luau buffet and show on Wailea Beach.

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

Warmest Aloha,
Conference Chairs Wes Freiwald, PDS and Paul Kervin, AFRL,
and the AMOS Conference Organizing Committee

Po‘alua | Tuesday, Sep 10

8:00 AM-4:30 PM **SSA POLICY FORUM** | Aulani Ballroom
Presented in partnership with the Space Foundation

10:00 AM-8:00 PM **EXHIBITOR MOVE-IN** | Jade-Plumeria Ballroom

10:00 AM-6:00 PM **EARLY REGISTRATION** | Aulani Foyer

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

Po‘akolu | Wed, Sep 11

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

9:00 AM-6:30 PM **EXHIBIT HOURS** | Jade-Plumeria Ballroom

7:30 AM **CONFERENCE OPENING** | Aulani Ballroom
Jeanne Unemori Skog, President & CEO, Maui Economic Development Board

INVOCATION
Reverend Kealahou Alika, Keawala‘i Congregational Church

KEYNOTE ADDRESSES
Introduction
Colonel L. Kirk Lewis, Ret., Senior Analyst, Institute for Defense Analyses

General William L. Shelton, Commander, Air Force Space Command, U.S. Air Force *(via video teleconference)*

Douglas Loverro, Deputy Assistant Secretary of Defense for Space Policy, U.S. Department of Defense

9:00 **BREAK (20 MINUTES)**

9:20 **FEATURED SPEAKER** | Aulani Ballroom
State of the Space Industry
Elliot Pulham, Chief Executive Officer, Space Foundation

9:50 **FAINT OBJECT DETECTION SESSION**
Chair: Paul Kervin, Air Force Research Laboratory

Image Stacking Method Application for Low Earth Orbit Faint Objects
Makoto Tagawa, Kyushu University

A Probabilistic Approach of Space Objects Detection from Non-resolved Optical Observation
Xiao Bian, North Carolina State University

Blind Search of Faint Moving Objects in 3D Data Sets
Tamara Payne, Applied Optimization Inc.

10:50 **ORBITAL DEBRIS SESSION**
Chair: Thomas Schildknecht, Astronomical Institute University of Bern

What Happened to BLITS? An Analysis of the 2013 Jan 22 Event
T.S. Kelso, Center for Space Standards & Innovation

Observations of Titan IIIC Transtage Fragmentation Debris
Heather Cowardin, ESCG Jacobs

11:30 **LUNCHEON (60 MINUTES)** | Lokelani Ballroom
Co-sponsored by BAE Systems

12:30 PM **ORBITAL DEBRIS SESSION** (continued)

Observed Peaks in Satellite Conjunctions with Debris Populations
Bruce Rabalais, DigitalGlobe, Inc.

Changes of Space Debris Orbits after LDR Operation
Edwin Wnuk, Adam Mickiewicz University, Astronomical Observatory

The Classical Laplace Plane and its use as a Stable Disposal Orbit for GEO
Aaron Rosengren, University of Colorado

Commercial Space Situational Awareness: An investigation of Ground-based SSA Concepts to Support Commercial GEO Satellite Operators
Mark Skinner, The Boeing Company

Towards an Artificial Space Object Taxonomy
Matthew Wilkins, Applied Defense Solutions

2:10 **BREAK (20 MINUTES)**

2:30 **ORBITAL DEBRIS SESSION** (continued)

Initial Taxonomy and Classification Scheme for Artificial Space Objects based on Ancestral Relation and Clustering
Moriba Jah, Air Force Research Laboratory

LightForce Photon-Pressure Collision Avoidance: Efficiency Assessment on an Entire Catalogue of Space Debris
Jan Stupl, SGT Inc. / NASA Ames Research Center

3:10 **ASTRODYNAMICS SESSION**
Chair: Moriba Jah, Air Force Research Laboratory

What is the "Right" Answer?
David Finkleman, Center for Space Standards and Innovation

Defunct Satellites, Rotation Rates and the YORP Effect
Antonella Albuja, University of Colorado, Boulder

Results and Analyses of Debris Tracking from Mt Stromlo
Ian Ritchie, EOS Space Systems

Multiple Hypothesis Tracking (MHT) for Space Surveillance: Results and Simulation Studies
Navraj Singh, Numerica Corporation

IMPACT - Integrated Modeling of Perturbations in Atmospheres for Conjunction Tracking
Josef Koller, Los Alamos National Laboratory

Improved Estimation of Orbits and Physical Properties of Objects in GEO
Ben Bradley, University of Colorado, Boulder

5:10-6:30 PM **EXHIBIT AND POSTER SESSION** | Jade-Plumeria Ballroom

5:30-6:30 PM **NEW GENERATION "PAU HANA"** | Pacific Terrace Rooftop
NETWORKING RECEPTION, Co-sponsored by the Space Foundation and the Maui Economic Development Board *(by invitation only)*

Po‘aha | Thu, Sep 12

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

8:30 AM-12:30 PM **SPACE IN THE CLASSROOM**, Co-sponsored by the Space Foundation (300 middle school students to participate in Audience with an Astronaut and hands-on STEM activities)

9:00 AM-5:00 PM **EXHIBIT HOURS** | Jade-Plumeria Ballroom

7:30 AM **SPECIAL TOPICS** | Aulani Ballroom
Chair: Paul Kervin, Air Force Research Laboratory

Virtual Satellites: The Intersection of SSA and Regulatory Considerations for Access to the Geostationary Satellite Orbit
Audrey Allison, The Boeing Company

8:00 Utilization of a Curved Focal Surface Array in a 3.5m Wide Field of View Telescope
Lt Col Travis Blake, DARPA

Asteroid Detection with the Space Surveillance Telescope
Eric Pearce, MIT Lincoln Laboratory

Image Analysis of the 2012 Pluto (Near) Occultation
Keith Knox, Air Force Research Laboratory

9:00 **BREAK (20 MINUTES)**

9:20 **ASTRODYNAMICS SESSION** (continued)

Parallel Track Initiation for Optical Space Surveillance Using Range and Range Rate Bounds
Paul Schumacher, Air Force Research Laboratory

Astrometric and Photometric Data Fusion for Mass and Surface Material Estimation using Refined Bidirectional Reflectance Distribution Functions-Solar Radiation Pressure Model
Charles Wetterer, Pacific Defense Solutions

Force Modeling and State Propagation for Navigation and Maneuver Planning for the Proximity Operations Nano-Satellite Flight Demonstration Mission
Christopher Roscoe, Applied Defense Solutions

Orbit Determination Using a Decametric Line-of-Sight Radar
Mark Rutten, Defence Science and Technology Organisation

10:40 **OPTICAL SYSTEMS SESSION**
Chair: Stacie Williams, Air Force Research Laboratory

Affordable Options for Ground-based, Large-aperture Optical Space Surveillance Systems
Mark Ackermann, Sandia National Laboratories

11:00 **LUNCHEON (60 MINUTES)** | Lokelani Ballroom
Co-sponsored by Universities Space Research Association

12:00 PM **OPTICAL SYSTEMS SESSION** (continued)

Development of Coherent Laser Radar for Space Situational Awareness Applications
Narasimha Prasad, NASA Langley Research Center

12:20 Sizing of a Raven-class Telescope Using Performance Sensitivities
Ryan Coder, Georgia Institute of Technology

Lens Systems for Sky Surveys and Space Surveillance
John McGraw, University of New Mexico

A Non-linear Curvature Wavefront Sensor to detect GEOs without the use of a Laser Guidestar
Mala Mateen, Air Force Research Laboratory

GPU-accelerated Faint Streak Detection for Uncued Surveillance of LEO
Peter Zimmer, Go Green Termite/University of New Mexico

1:40 **BREAK (20 MINUTES)**

2:00 **NON-RESOLVED OBJECT CHARACTERIZATION SESSION**
Chair: Doyle Hall, Boeing LTS

Photometric Data from Non-Resolved Objects for Space Object Characterization and Improved Atmospheric Modeling
Richard Linares, Los Alamos National Laboratory

A Derivation of the Analytical Relationship between the Projected Albedo-Area Product of a Space Object and its Aggregate Photometric Measurements
Tamara Payne, Applied Optimization Inc.

Analysis of Faint Glints from Stabilized GEO Satellites
Doyle Hall, Boeing LTS

A Point Pairing Method based on the Principle of Material Frame Indifference for the Characterization of Unknown Space Objects using Space-based Non-resolved Photometry Data
Anil Chaudhary, Applied Optimization, Inc.

Unmixing Space Object's Moderate Resolution Spectra
William Ryan, New Mexico Tech University

RSO Feature Identification Using Hierarchical Mixtures of Experts
David Gaylor, Emergent Space Technologies, Inc.

4:00-5:00 PM **AIR FORCE MAUI OPTICAL AND SUPERCOMPUTING (AMOS) SITE CAPABILITIES BRIEFING**
Laura Ulibarri, Air Force Research Laboratory

4:00-5:00 PM **EXHIBIT AND POSTER SESSION** | Jade-Plumeria Ballroom
Co-sponsored by SpaceNav

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

WILLIE K DINNER SHOW AT MULLIGANS ON THE BLUE
Thu, Sep 12 at 5:30 p.m.

Mulligans is the home of "The Best Dinner Show on Maui" with Uncle Willie K! Dinner show includes a 4-course dinner starting at 5:30 p.m. Space is limited. For reservations, please call (808) 250-8288, and reference the "AMOS Conference" for the group rate of $55 per person (beverage and gratuity is additional). Mulligans on the Blue is located alongside the Wailea Old Blue Golf Course, 100 Kaukahi St.

Po‘alima | Fri, Sep 13

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

8:00 AM-4:30 PM **SPACE IN THE CLASSROOM**, Co-sponsored by the Space Foundation (Teacher Workshop)

9:00 AM-2:00 PM **EXHIBIT HOURS** | Jade-Plumeria Ballroom

7:30 AM **INTERNATIONAL PROGRAMS** | Aulani Ballroom
Chair: Paul Kervin, Air Force Research Laboratory

Report on 2nd International Symposium on Sustainable Development and Utilization for Humankind
Susumu Yoshitomi, Japan Space Forum

7:40 Coordinated Optical GEO Survey for European SSA Precursor Services
Thomas Schildknecht, Astronomical Institute University of Bern

An Overview of Recent Australian Commitments to Space Situational Awareness from a Systems Analysis Perspective
Garry Newsam, Defence Science & Technology Organisation

Toward Microsatellite Based Space Situational Awareness
Lauchie Scott, Defence R&D Canada, Ottawa

8:40 **INTERNATIONAL SSA TECHNICAL INITIATIVES PANEL**
Chair: Lt Col Travis Blake, DARPA

10:00 **BREAK (20 MINUTES)**

10:20 **SPACE-BASED ASSETS SESSION**
Chair: Lauchie Scott, Defence R&D Canada, Ottawa

On-Orbit Results for Canada’s Sapphire Optical Payload
Alan Scott, COM DEV

10:40 FalconSAT-7: Towards Rapidly Deployable Space-based Surveillance
Geoff Andersen, USAF Academy

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

12:00 PM **SPACE-BASED ASSETS SESSION** (continued)

SpinSat Mission Overview
Andrew Nicholas, *Naval Research Laboratory*

GEO-to-GEO Optical Sensors: Estimating the Detection Rate of Uncataloged Debris Objects
Jim Shell, Novarum Tech LLC

Flat Panel Space Based Space Surveillance Sensor
Richard Kendrick, Lockheed Martin

Ground Testing of Prototype Hardware and Processing Algorithms for a Wide Area Space Surveillance System (WASSS)
Neil Goldstein, Spectral Sciences Inc.

GEO Collision Avoidance using a Service Vehicle
Matthew Duncan, SpaceNav

1:40 **BREAK (20 MINUTES)**

2:00 **ADAPTIVE OPTICS AND IMAGING SESSION**
Chair: Michael Hart, Steward Observatory, University of Arizona

Rise of the Machines: First Year Operations of the Robo-AO Visible-light Laser-adaptive-optics Instrument
Christoph Baranec, Caltech

Integrated line-of-sight modeling of the Airborne Aero-Optics Laboratory
Steven Griffin, Boeing

PSF Rotation with Changing Defocus and Applications to 3D Imaging for Space Situational Awareness
Sudhakar Prasad, University of New Mexico

Myopic Deconvolution from Wave Front Sensing for Images Acquired with Large Spectral and Temporal Bandwidth
Douglas Hope, Hart Scientific Consulting International LLC

High-resolution imaging through Strong Atmospheric Turbulence and Over Wide Fields of View
Stuart Jefferies, Institute for Astronomy, University of Hawaii

Unsupervised Blind Deconvolution
Roberto Baena-Galle, Real Academia de Ciencias y Artes de Barcelona

Iteratively Reweighted Blind Deconvolution
Brandoch Calef, Boeing

Joint Multiframe Blind Deconvolution and Spectral Unmixing of Hyperspectral Images
Qiang 'Peter' Zhang, Wake Forest School of Medicine

Image Reconstruction from Sparse Irregular Intensity Interferometry Measurements of Squared Fourier Magnitude
David Gerwe, Boeing

5:00 PM **CONFERENCE ADJOURN**

5:30-8:30 PM **CLOSING LUAU DINNER & SHOW** | Luau Gardens

Po'aono | Sat, Sep 14

7:15 AM & 9:15 AM **OPTIONAL TECHNICAL TOUR** | Departs from the Wailea Marriott

Poster Presentations

ALTAIR: Calibrated Balloon-Borne Light Sources for High-Precision Photometry, *Justin Albert, University of Victoria*

Atmospheric Cloud Forecasting in Support of Space Based Applications, *Randall Alliss, Northrop Grumman Corporation*

Holographic Adaptive Laser Optics System (HALOS): Fast, Autonomous Aberration Correction, *Geoff Andersen, HUA Inc.*

Structural, Thermal Optical Modeling of CUBESAT LEO Based Orbit Instrumentation Payload, *Kevin Anderson, California State Polytechnic University at Pomona*

Palomar Ultraviolet Laser for the Study of Exoplanets, *Christoph Baranec, Caltech*

Tracking A Very Near Earth Asteroid, *Robert Bruck, BAE Systems*

Toward the Automated Control of Disparate Network of Optical Telescopes for SSA, Exoplanet Research, and Near-Earth Object Detection, *Mike Butterfield, GEOST, Inc.*

Observations and Modeling of GEO Satellites at Large Phase Angles, *Rita Cognion, Oceanit*

Improvements to Optical Track Association with the Direct Bayesian Admissible Region Method, *Kohei Fujimoto, University of Colorado, Boulder*

Optical-Infrared Colors of GEO Satellites, *Brooke Gibson, Oceanit*

Proximity Operations Nano-Satellite Flight Demonstration (PONSFD) Rendezvous Proximity Operations Design and Trade Studies, *Jacob Griesbach, Applied Defense Solutions*

Application of Passive Damping to Increase Performance of the Sodium Guidestar on the AEOS 3.6 m Telescope, *Steven Griffin, Boeing*

Influence of Wind Buffeting on the 3.6 m Telescope, *Steven Griffin, Boeing*

Taming the 1.2 m Telescope, *Steven Griffin, Boeing*

Cycle 1 Science Status and How to Propose Time on SOFIA, *Helen Hall, Universities Space Research Association*

SSA Sensor Tasking Approach for Improved Orbit Determination Accuracies and More Efficient Use of Ground Assets, *Alexander Herz, Orbit Logic*

Scintillation of Light from Distant Objects due to Anisotropic and Non-Kolmogorov Turbulence, *Richard Holmes, Boeing LTS*

Parallel Implementation of a Frozen Flow Based Wavefront Reconstructor, *Keith Kelly, Emory University*

Collaborative Commercial Space Situational Awareness, *T.S. Kelso, Center for Space Standards & Innovation*

Groebner Basis Solutions to Satellite Trajectory Control by Pole Placement, *Zuzana Kukelova, Czech Technical University in Prague*

The NASA Meter Class Autonomous Telescope: Ascension Island, *Susan Lederer, NASA/JSC*

Sensitivity of Attitude Determination on the Model Assumed for ISAR Radar Mappings, *Stijn Lemmens, European Space Agency*

Conjunctions and Collision Avoidance with Electrodynamic Tethers, *Eugene Levin, Electrodynamics Technologies, LLC*

Design of a Radar Based Space Situational Awareness System, *Toni Liebschwager, German Armed Forces*

Observer Interface Analysis for Standardization to a Cloud Based Real-Time Space Situational Awareness (SSA), *Jan Eilers, German Aerospace Center*

A Minimum Fuel Based Estimator for Maneuver and Natural Dynamics Reconstruction, *Daniel Lubey, University of Colorado*

Image Enhancement for Astronomical Scenes, *Jacob Lucas, The Boeing Company*

Modified Chebyshev Picard Iteration for Efficient Numerical Integration of Ordinary Differential Equations, *Brent Macomber, Texas A&M University*

Fast Gravitational Field Model Using Adaptive Orthogonal Finite Element Approximation, *Brent Macomber, Texas A&M University*

Thermal Modeling of Space Debris via Finite Element Analysis, *Paul McCall, Florida International University*

Poster Presentations

CubeSat Integration into the Space Situational Awareness Architecture, *Keith Morris, Lockheed Martin*

Cooling a Supercomputer with Warm Water at the AFRL MHPCC DSRC, *Dave Morton AFRL MHPCC DSRC*

Generic Observatory Control System, *Matt Pearson, EOS Space Systems*

Human Decision Processes: Implications for SSA Support Tools, *Paul Picciano, Aptima*

F.I.D.O. Focused Integration for Debris Observation, *John Ploschnitznig, Riverside Research*

Shape, Pose, and Material Recovery of Solar-Illuminated Surfaces from Compressive Spectral-Polarimetric Image Data, *Sudhakar Prasad, University of New Mexico*

Space Situational Awareness Architecture Vision, *David Richmond, Lockheed Martin*

EOS Space Systems Wide Field Imager for SSA Applications, *Ian Ritchie, EOS Space Systems*

Remote Control Southern Hemisphere SSA Observatory, *Ian Ritchie, EOS Space Systems*

Ground-Based Near-Earth Object Studies in the post-Russian (Chelyabinsk) Meteor Airburst World, *Eileen Ryan, New Mexico Institute for Mining and Technology*

RANSACing Optical Image Sequences for GEO and near-GEO Objects, *Radim Sara, Czech Technical University in Prague*

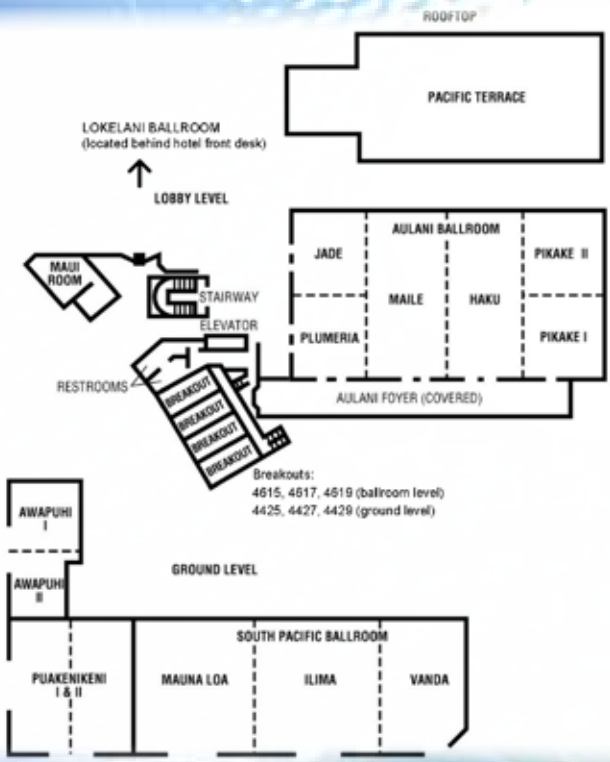
Programming Constructs for Exascale Computing in Support of Space Situational Awareness, *Mark Schmalz, University of Florida*

Large Area Flat Panel Imaging Detectors for Astronomy and Night Time Sensing, *Oswald Siegmund, University of California*

Minimum-time, Constant-thrust Orbit Transfers with Non-circular Boundary Conditions, *James Thorne, Institute for Defense Analyses*

Performance of Hybrid Adaptive Optics Systems, *Michael Werth, Boeing*

Hands on Education Through Student-Industry Partnerships, *Mark Wolfson, Lockheed Martin Space Systems Company*



Presented by

maui economic DEVELOPMENT BOARD

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