65th International Astronautical Congress
Toronto, Canada
September 29 – October 3, 2014
Student Researcher

Drew Bittner
West Virginia University
debittner@mix.wvu.edu

Presentation:
Date: October 1, 2014
Time: 16:45
Room: 801A

Research Title:
Development of an Alignment Technique for a Large Number of Redundant Inertial Measurement Units

Biographical Sketch

Drew Bittner is a second year mechanical engineering master's candidate working in the Applied Space Exploration Laboratory (ASEL) at West Virginia University. His research is focused on investigating the viability of MEMS IMU swarms for precision navigation through design, software development, implementation, and testing of such a system. Drew received his B.S. from The Pennsylvania State University-Altoona College, majoring in Electro-Mechanical Engineering Technology. At Penn State he worked in the Advanced Combustion and Energetics Laboratory (ACEL) characterizing the ignition delay process of gelled hypergolics, using high speed cinematography and an injector apparatus.

Research and Education Activities

- "Development of an Alignment Technique for a Large Number of Redundant Inertial Measurement Units". Developed a technique that efficiently removes IMU errors (Misalignment, Bias, and Scale Factor) from a cluster of inertial measurement unit measurements in order to reveal the useful actual parameters hidden within the errors.
- "SmallSat Precision Navigation with Low-Cost MEMS IMU Swarms" .Testing and software development of an IMU cluster to verify its viability in use for small satellite precision navigation.
- "Fault Detection, Isolation, and Recovery (FDIR) for large clusters of IMUs". Development of a FDIR technique that can be applied to a cluster of IMUs to help determine erroneous measurements from good measurements in a real-time data stream.
- "Undergraduate Student Implementation Project (USIP)". Mentoring undergraduate students in order to design, implement, and fly an experimental payload within an array of aerospace navigation sensors on board a sounding rocket and weather balloon flight in June 2014 and April 2015.

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Student Researcher

Christopher Carlsen
University of Maryland, College Park
ccarlsen@ssl.umd.edu

Presentation:
Date: October 2, 2014
Time: 9:45am
Room: 715B

Research Title:
RAVEN II : A Novel Multiphase Mission Architecture

Biographical Sketch

Chris Carlsen is a second-year Masters student at the University of Maryland, majoring in Aerospace Engineering with a concentration in Space Systems. He has worked at the Space Systems Laboratory at the University of Maryland, College Park for five years, studying robotic systems and mechanisms. Chris received his Bachelors in Mechanical Engineering from the University of Maryland. He plans to continue his research at the Space Systems Laboratory and eventually pursue a Doctoral degree.

Research and Education Activities

- “Small-Satellite Design and Testing” Designed and built neutral buoyancy, flat-floor, and parabolic flight analogs of a free-flying inspection vehicle for the International Space Station.
- “Autonomous Submersible Vehicles” Lead a student club that competed in the AUVSI RoboSub Competition.
- “Extreme Environment Robotics” Designed and built components of the only all electric robotic arm capable of operating at full ocean depth.
- “High Altitude Balloon Payloads” Designed, built, and operated high altitude balloon systems and experiments. This included a high-capacity data drop system which released data modules from large balloon payloads for quick data retrieval on long duration flights.
- “Extra-Planetary Rover Wheels” Designed, built, and tested an alternative all metal, airless tire for use on other planets.
- “Robotic Manipulators with Highly Coupled Dynamics” Designed, built, and tested a free-flying vehicle with a large robotic manipulator to study how to control a robotic system with an ungrounded base.

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Student Researcher

Joshua Fogel
University of Southern California
Joshuafo@usc.edu

Presentation:
Date: October 1, 2014
Time: 13:15
Room: Prefunction

Research Title:
Mission Design study of an RTG powered Ion Engine equipped Interstellar Spacecraft

Biographical Sketch

Joshua Fogel is a first-year Ph.D. student at the University of Southern California (USC). His research is focused on mission and electric propulsion system design for the Interstellar Precursor Mission. He has held internships at Millennium Space Systems and Applied Defense Solutions, and was a participant in NASA's RASC-AL 2012 Planetary Rover Competition, in which his team from the University of Maryland placed third. Joshua received his B.S. from the University of Maryland, majoring in aerospace engineering, and his M.S. from the University of Southern California, in astronautical engineering.

Research and Education Activities

- "Interstellar Precursor Mission Design Study": Constructed and ran a 4th-order Runge-Kutta based orbit simulator to investigate how various electric propulsion system designs impact an interstellar probe's solar system escape trajectory.
- "Propulsion System Selection for Station-keeping Operations": Explored the trade-space for typical LEO small satellites employing different chemical and electric propulsion engines. The performances of different combinations of spacecraft design attributes, including propulsion system mass, cost and operational lifetime, were assessed to better understand the sensitivities of the design variables.
- "The UMD Space Systems Laboratory": Undergraduate Research Assistant, Space Robotics Research.
- "The USC Information Sciences Institute Space Engineering Research Center": Graduate Research Assistant, CubeSatellite Development, Integration & Operations Research.

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Student Researcher

Gwendolyn Vines Gettliffe
Massachusetts Institute of Technology
gvg@mit.edu

Presentation:
Date: September 30, 2014
Time: 9:45
Room: 717A

Research Title:
System Concept Development For Multifunctional Electromagnetically Actuated and Supported Space Structures

Biographical Sketch

Gwendolyn Gettliffe is in the third year of a PhD program in space systems engineering at MIT, having received her S.M. in aeronautics and astronautics from MIT in 2012 and her B.S.E in mechanical engineering and materials science from Duke University in 2010. Her graduate research is focused on the use of high-temperature superconducting electromagnets to support and actuate large space structures such as observatories, antennas, and booms. Additionally, as an artist, Gwendolyn is the creator of the sci-fi webcomic *November Shift* and designs satellite and payload mission patches.

Research and Education Activities

- MAGESTIC: Magnetically Enabled Structures Using Interacting Coils - Modeled dynamics and studied the stability of tethered high-temperature superconducting (HTS) coils for electromagnetic deployment and structural support functions in large space structures; designed example HTS structures and conducted trade analyses of structural options.
- Application of AC Magnetic Field for the Reduction of Screening Currents in HTS Insert Coil – Designed, wound, and tested AC superconducting “shaking coil” to observe the demagnetization of an HTS insert coil with the application of AC cycles.
- MicroMAS: Micro-sized Microwave Atmospheric Satellite - Created thermal model, defined subsystem requirements, conducted integration and test planning, directed thermal-vacuum testing for test unit and managed risk for MicroMAS (Micro-sized Microwave Atmospheric Satellite), a 3U dual-spinning CubeSat with a constant-rate whiskbroom microwave radiometer payload.
- Space Systems Engineering (16.89, graduate class) – Teaching Assistant.
- **U**ndergraduate Research Opportunities Program (UROP) **–** Supervisor and mentor for 6+ undergraduate researchers over period of three years.

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Aziza Glass
Cornell University
ag794@cornell.edu

Presentation:
Date: October 1, 2014
Time: 13:15
Room: Prefunction

Research Title:
Wound Healing Response to Lunar Dust Exposure in the Rat Cornea

Biographical Sketch

Aziza Glass is a fourth-year Doctor of Veterinary Medicine candidate at Cornell University. She has held apprenticeships from the National Space Biomedical Research Institute at NASA Johnson Space Center. Her research is focused on studying gene response within ocular tissue using hindlimb suspension and exposure to lunar dust. Aziza received her B.S. in Agriculture from Prairie View A&M University, majoring in agriculture with a concentration in animal science. Her goal is to combine the fields of veterinary medicine and space life sciences.

Research and Education Activities

- "Wound Healing Response to Lunar Dust Exposure in the Rat Cornea." Collected nuclear material from tissue samples and analyzed results using a microarray assay to identify signaling pathways associated with wound healing and oxidative stress in response to lunar dust exposure.
- "Mechanical Stress and Antioxidant Protection in the Retina of Hindlimb Suspended Rats." Collected nuclear material from tissue samples in test groups exposed to hindlimb suspension and antioxidant enriched diets, performed qPCR with housekeeping and identified genes of interests, and conducted statistical analysis of results.
- Cornell University Black Graduate and Professional Student Association – Vice President

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Nicholas M Limparis
University of Maryland, College Park
nlimpari@umd.edu

Presentation:
Date: October 3, 2014
Time: 13:30
Room: 714A

Research Title:
Micro-sat Based Dexterous Robotic Satellite Servicing: A Case for Miniaturization

Biographical Sketch

Nicholas Limparis is a PhD candidate at the Space Systems Laboratory at the University of Maryland, College Park. He received his B.S. in Electrical Engineering and a M.S. in Aerospace Engineering from the University of Maryland in 2008 and 2012 respectively. His research involves the study and application of robotics for the space environment as well as the deep ocean environment. Currently his focus of study is on highly coupled dynamics between a space manipulator and a similarly massed host spacecraft in order to generate better dynamical models to improve the viability of small and inexpensive robotic satellite servicing missions.

Research and Education Activities

- Air Force Office of Scientific Research University Nanosat Program 7, Developed a high performance dexterous manipulator system to study the effects of highly coupled spacecraft dynamics
- Exo-SPHERES was one of four INSPIRES competed contracts to extend capabilities of SPHERES. The goal: Develop technology for free-flying robotic vehicles in close proximity of International Space Station
- NASA Flight opportunity T0105-P “DYMAFLEX: DYnamic MAnipulation FLight Experiment” Parabolic flight program to verify dynamics models and control algorithms for a high performance dexterous manipulator
- AUVSI and ONR’s RoboSub competition, the goal of RoboSub is to advance the development of Autonomous Underwater Vehicles (AUVs) by challenging a new generation of engineers to perform realistic missions in an underwater environment

Unique J. Luna
Case Western Reserve University
unique.luna@case.edu

Presentation:
Date: October 1, 2014
Time: 13:15
Room: Prefunction

Research Title:
Assembly of Colloidal Clusters and Networks: A Dissipative Particle Dynamics Study

Biographical Sketch

Unique Luna, originally from Washington, D.C., is currently a graduate student pursuing her Ph.D. in Macromolecular Science and Engineering at Case Western Reserve University. Unique is also a Pathway Intern at NASA Glenn Research Center, wherein she collaborates with Procter & Gamble to model the assembly of colloidal networks by using a course-grained simulation method. Unique received her Bachelor of Science and Engineering in Chemical Engineering from the University of Michigan in May 2009 and has been a recipient of the Gates Millennium Scholarship since 2004.

Research and Education Activities

- "Assembly of Colloidal Clusters and Networks" – Using Core-Modified Dissipative Particle Dynamics (DPD) to simulate the characteristic structures assembled in the limit of strong interaction forces for mono-dispersed mixtures of spheres in microgravity.
- "Modeling of Solute-Exclusion Zone" – Using DPD to understand, properly characterize, and simulate the large solute-exclusion zone that occurs in water between functionalized microspheres and hydrophilic polymer gels.
- "National Lab Day (May 19, 2014) at NASA Glenn Research Center" - Volunteered and conducted hands-on demonstrations of the Liquid Cooling Garment used by astronauts.

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Peter Schulte
Georgia Institute of Technology
pzschulte@gatech.edu

Presentation:
Date: October 2, 2014
Time: 9:45
Room: 801A

Research Title:
Development of an Integrated Spacecraft Guidance, Navigation, & Control Subsystem for Automated Proximity Operations

Biographical Sketch

Peter Schulte is a second-year Master's student studying Aerospace Engineering in the Space Systems Design Lab at Georgia Tech in Atlanta. His research involves development of the Guidance, Navigation, and Control (GN&C) subsystem for the Prox-1 student satellite project with advisor Professor David Spencer. He has completed three co-op tours and three summer internships at Johnson Space Center (JSC) in Houston, TX with NASA, Jacobs Technology, and Odyssey Space Research. He plans to continue with his Ph.D. at Georgia Tech after completing his M.S. degree. Peter received his B.S. in Aerospace Engineering from The University of Texas at Austin (UT).

Research and Education Activities

- "Space Systems Design Lab." Graduate Research Assistant. Leading GN&C subsystem team for Georgia Tech's Prox-1 student satellite project. Integrated and tested navigation filters, guidance algorithms, non-linear attitude controllers, and decision logic in a MATLAB/Simulink simulation environment for autonomous rendezvous and proximity operations.
- "Utilization of a Solar Sail to Perform a Lunar CubeSat Science Mission." Worked with Prof. Glenn Lightsey to create the trajectory design for a Jet Propulsion Lab (JPL) lunar CubeSat science mission concept. Developed simulation models for solar sail thrust determination and control. Presented at 2nd Interplanetary CubeSat Workshop, Ithaca, NY, May 2013.
- "Verification and Validation of Requirements on the CEV Parachute Assembly System Using Design of Experiments." Performed analysis of parachute performance for Orion Capsule Parachute Assembly System (CPAS) project at Jacobs Technology (JSC) using a new technique to validate simulation tools. Published paper (AIAA-2011-2558) at 21st AIAA Aerodynamic Decelerator Systems Conference and Seminar, Dublin, Ireland, May 2011.
- "Satellite Design Laboratory." Undergraduate Research Assistant. Contributed to two student satellite projects at UT. Performed simulations to characterize GPS receiver performance for absolute and relative navigation (FASTRAC satellite). Assisted with integration, assembly, and testing of space flight hardware (Bevo-1 satellite).

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Joshua Lokomaika'I Verkerke
North Carolina State University
jlverker@ncsu.edu

Presentation:
Date: October 2, 2014
Time: 14:45
Room: 715A

Research Title:
Burn area delineation via single image polarimetric synthetic aperture radar backscatter classification

Biographical Sketch

Joshua Lokomaika'i Verkerke will be starting his Ph.D. in Forestry and Environmental Resources at North Carolina State University in the Fall of 2014. His research centers on applications of remote sensing technology to wildland fire effects and emissions monitoring. He is a student contractor for the Environmental Sciences Division of the Environmental Protection Agency's Office of Research and Development where he works on application and development of remote sensing tools. Joshua received his B.A. from Pomona College in Claremont, California, majoring in Environmental Analysis, and his M.S. in Natural Resources from North Carolina State University.

Research and Education Activities

- "Burn area delineation via single image polarimetric synthetic aperture radar backscatter classification." Examines the utility of a ratio-based interpretation of physical scattering mechanisms for fire effects monitoring.
- Verkerke, J. L., Williams, D. J., & Thoma, E. (2014). Remote sensing of CO2 leakage from geologic sequestration projects. *International Journal of Applied Earth Observation and Geoinformation*, *31*, 67-77.

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Daniel Wibben
University of Arizona
dwibben@orex.lpl.arizona.edu

Presentation:
Date: October 2, 2014
Time: 9:00
Room: 717A

Research Title:
Model-Based Systems Engineering Approach for the Development of the Science Processing and Operations Center of the NASA OSIRIS-REx Asteroid Sample Return Mission

Biographical Sketch

Daniel Wibben is a Ph.D. student in the Systems and Industrial Engineering Department at the University of Arizona. His research is focused on nonlinear guidance, navigation, and control schemes for planetary landing and asteroid proximity operations. He is currently working on the NASA OSIRIS-REx asteroid sample return mission as the Science Processing and Operations Center Systems Engineer where he is utilizing model-based systems engineering techniques for development of the OSIRIS-REx ground system. Daniel received his B.S., majoring in aerospace and mechanical engineering, and his M.S., in Systems Engineering, from the University of Arizona

Research and Education Activities

- “Model-Based Systems Engineering for the OSIRIS-REx Science Processing and Operations Center (SPOC)”. Developing and managing systems architecture and requirements, and responsible for the verification and validation of all requirements for the OSIRIS-REx SPOC.
- “Integrated Guidance and Attitude Control Laws using Higher Order Sliding Modes.” Developed and analyzed various sliding surface control techniques for integrated spacecraft guidance and attitude control, specifically for applications to lunar landing and asteroid proximity operations.
- “Optimal Lunar Landing Guidance and Retargeting using a Hybrid Control Strategy”. Developed a framework utilizing hybrid control theory for the integration of multiple guidance commands.
- “Fundamentals of Guidance for Aerospace Systems”. SIE 556 Course Assistant (2011).