Oregon NASA
Space Grant Consortium

2016 Student Symposium
Proceedings
November 10, 2016
9:00 am - 5:00 pm

LaSells Stewart Center
Ag Production/Ag Leaders Rooms
Oregon State University

featuring presentations from
NASA student interns, fellows, research scholars and student teams

2016 NASA Student Symposium

Hosted by
Oregon NASA Space Grant Consortium (OSGC)
November 10, 2016

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Agenda / Presentation Schedule

8-9am	**POSTER SESSION SET-UP** - Breakfast provided for presenters	
9-10am	**OPEN POSTER SESSION**	
	SESSION A - Ag Production Room	**SESSION B - Ag Science Room**
10:00am	**Brandon Gigous -** Oregon State University NASA Ames Research Center Internship *Developing Mobility of a Compliant Quadrupedal Robot*	**Tara Prevo -** Portland Community College NASA Marshall Space Flight Center Internship *Concept Analysis & Design of a Magnetically Damped Check Valve*
10:20am	**Eryn Cangi -** University of Oregon OSGC Faculty Research Award *Flux Ratio Detection of Global Thin Cirrus Clouds*	**Connor Thompson -** Western Oregon University NASA Marshall Space Flight Center Internship *Evaluation of Life Support Candidate Technology for 100% Oxygen Recovery*
10:40am	**Kevin Quintero -** Oregon State University NASA Marshall Space Flight Center Internship *Single Person Spacecraft Assessment*	**Jessica Kuonen -** Oregon State University OSGC Internship: Oregon Sea Grant Seacast Project *Eye of the beholder: Exploring perspectives of ocean risk and uncertainty to improve data accessibility*
11:00am	**Delphine Le Brun Colon and Levi Willmeth -** LBCC OSGC Undergraduate Research Award *RockSat-C 2016*: *LBCC/OSU Team*	**James Luce -** Portland State University NASA Marshall Space Flight Center Internship *Mars Ascent Vehicle Hybrid Motor Structural Analysis*
11:20am	**Sanjay Ramprasad -** Portland State University OSGC Undergraduate Research Fellowship *Reproduction Dynamics in Small Networks of Autocatalytic RNAs*	**Taylor Contreras and Lindsey Oberhelman** - UO OSGC Internship: Pine Mountain Observatory *Commissioning the Robbins for Undergraduate Research*
11:40-1pm	**LUNCH/NETWORKING/POSTERS** - Food and refreshments provided for presenters	
1:00pm	**Charity Woodrum -** University of Oregon NASA Marshall Space Flight Center Internship *Searching for the Electromagnetic Counterpart to Gravitational Wave Events*	**Nathan Schorn -** Oregon State University OSGC Undergraduate Research Award *OSU AIAA Experimental Sounding Rocket Association Intercollegiate Rocket Engineering Competition (ESRA-IREC)*
1:20pm	**Anthony Dunaway -** Oregon State University OSGC Internship: Oregon Sea Grant Seacast Project *Visualizing Ocean Condition Forecasting for Oregon Fishermen*	**Meagan Koeroghlian -**University of Portland NASA Marshall Space Flight Center Internship *Multi-wavelength Study of the High Energy Universe*
1:40pm	**Krista Galloway -** Oregon Institute of Technology NASA Marshall Space Flight Center Internship *Air-Bearing Flight Control Simulation*	**Matthew Twete -** University of Oregon OSGC Faculty Research Award *Analysis of the Occurrence and Rates of Supernovae in Abell Clusters*
2:00pm	**Kyler Stephens -** George Fox University NASA Armstrong Flight Research Center Internship *Fiber Optic Box Improvement*	**Rachel Nelke -** Oregon State University OSGC Internship: OSU Propulsion Lab *Effects of Combustion Products on Detonation Velocities*
2:20pm	**Emma Fraley and Karen Kuhlman -** OSU OSGC Internship: New York Space Grant/Cornell University *CubeSat Design & Build*	**Mickie Cassady, Alexsis Hundley-Kennaday, Kevin Malstrom, and Eric Shaw Stearns -** Oregon Institute of Technology OSGC Undergraduate Research Award *RockOn! 2016: Oregon Tech Wilsonville Team*
2:40pm	**Michelle Neely -** Oregon State University OSGC Graduate Fellowship *2-D Spatial Pattern Analysis of Mars and Earth Small-Scale Bedforms: Challenges and Methodology in Image Processing and Data Acquisition*	
3-5pm	**RECEPTION/NETWORKING/POSTERS** - Food and refreshments provided	

Abstracts

Eryn Cangi, University of Oregon
Oregon NASA Space Grant Faculty Research Award with Greg Bothun/UO
Flux Ratio Detection of Global Thin Cirrus Clouds

Cirrus clouds are high-altitude (higher than 15 km) clouds composed of ice crystals, often appearing "wispy" or like their common folk name, "mares' tails." Cirrus clouds often may be invisible to the naked eye but nonetheless have significant negative feedback to amplify global climate change as result of their large opacity in the infrared. The general consensus in the climate science community is that these clouds are difficult to detect and estimates of their global coverage (or increase over time) are difficult to make. While some new detection methods exist, such as satellite imaging in the 1.38μm band, we are interested in finding a more effective and easier detection method.

We use a commonly available all-sky astrophotography camera with a variety of combinations of bandpass filters to image cirrus clouds. The concept is that these thin clouds, made almost exclusively of ice crystals, directly reflect sunlight and therefore have the same filter flux ratios as the sun. Clouds with higher moisture content will have different filter flux ratios. Standard astronomical photometric techniques are then applied to these all sky images. Preliminary results show that good detection of cirrus clouds occurs with use of the 82a blue, 11 yellow, or LRGB luminance filters alone or in combination. Future work will include more data collection, testing more filters, establishment of a permanent camera installation at the University of Oregon with an automated filter wheel and the inclusion of a cirrus-detecting camera system on a NASA Oregon Space Grant program CubeSat.

Mickie Cassady, Alexsis Hundley-Kennaday, Kevin Malstrom, and Eric Shaw Stearns, Oregon Institute of Technology
NASA Wallops Flight Facility
RockOn! 2016: Oregon Tech Wilsonville Team

Students traveled to NASA Wallops Flight Facility in Virginia to learn how to construct a scientific payload that collects environmental data as it is launched to 100km into the atmosphere. Students wrote code in C++ and soldered components together for 3 days to create a fully functioning payload. Throughout the process, students tested each component to ensure reliable operation. Then, students were immersed into the lives of the technician as they assisted with the integration of the payload into the rocket. Finally, the morning of launch! Data was successfully retrieved on each component of the payload.

Taylor Contreras and Lindsey Oberhelman, University of Oregon
Pine Mountain Observatory
Commissioning the Robbins for Undergraduate Research

We present and summarize our work and research related to the commissioning and operations of a new telescope system at Pine Mountain Observatory (PMO). Throughout the summer of 2016 our team brought this new system on-line, learned to operate it through hands-on experience and the development of operational procedures, and led the initial commissioning and use of the telescope by obtaining the first engineering and science quality data from the integrated system.
The so-named "Robbins" is a 14-inch Meade Cassegrain telescope. Coupled to this is a research-quality CCD camera with multiple filters and an auto-focus system. With a focal length of 2.56 cm, the system has a field-of-view of 35x35 arc minutes, and a pixel scale of 0.7. Initial observations show that it is an extremely sensitive system, which will allow us to perform legitimate undergraduate research at the facility.
This summer we devised an observing log and operations procedures, constructed a flat field box for calibration of the telescope/camera system, and learned how to reduce and stack images with the professional software packages IRAF and Astroconda. Over the course of our work, we became adept at operating and collecting data with the Robbins through our interface software named Maxim DL. In addition to commissioning the Robbins system we were the lead student volunteers for our "Public Nights" program at PMO. Between May and September we led tours, operated telescopes, and were docents for over 1500 observatory visitors.

Anthony Dunaway, Oregon State University
Oregon State University Sea Grant Seacast
Visualizing Ocean Condition Forecasting for Oregon Fishermen

The Seacast project is a collaboration between the Oregon State University College of Earth, Ocean, and Atmospheric Sciences, the College of Engineering, and Oregon fishermen. The Seacast team works directly with the Fishermen who use the system and design Seacast around their needs. The purpose of the Seacast project is to provide Oregon fishermen with predictions of ocean conditions through a free easy to use online system. Seacast provides visual fields made from mathematical models created at OSU and NOAA. The Seacast project is built on a Django framework with Python, Javascript, and MySQL, and is hosted by OSU. The goal of the project this year was to expand the functionality of the Seacast system and improve the reliability of access to Seacast. Wind forecasts as well as wave period forecasts were added to the available fields. The ability to view daily tide predictions from the Seacast website was also added. The Seacast system was made more tolerant to failures, and the feedback system was expanded. Along with the added features some experimentation was performed to test alternative methods of displaying information. The project had a successful year. The fishermen expressed a strong desire for wind forecasts, and now Seacast can finally provide wind fields to users. The new functionality is working well, and an alternative method of displaying the currents was tested and shows promise, but currently it is not implemented. All of the new additions help make Seacast an increasingly useful tool for Oregon fishermen.

Emma Fraley and Karen Kuhlman, Oregon State University
New York Space Grant/Cornell University
2016 CubeSat Design and Build Internship

CubeSats are small, relatively inexpensive satellites characterized by their structure and payload. Currently, there is interest to develop CubeSats capable of deploying postage-stamp-sized satellites within solar or laser sails. Additionally, there is incentive to reduce the cost and development time of CubeSats. The objectives of this project were to create a 1U CubeSat capable of deploying a solar sail payload in a timeframe of ten weeks, within a $10,000 budget, and using only off-the-shelf components. The project consisted of two main phases: design and build. The design phase focused on the determination of systems needed for the satellite, the selection and purchase of components to satisfy respective functions, and the development of a CAD model of the integrated satellite. The build phase consisted of hardware tests (via Arduino software), fabrication of structural components and electronic boards (PCBs), along with the integration of all subassemblies into a standard 1U, 3D printed bus. At the end of ten weeks, a successful demonstration of the unintegrated flight components, structural and electronic hardware and software, was performed, proving satellite functionality on a component and software level. A successful prototype was completed but further work is needed for a flight-ready satellite. The final product demonstrated a prototype satellite can be constructed within a short time frame and for a modest budget, proving space-grade projects are becoming more accessible and achievable. The satellite will undergo a few modifications this fall and winter to become flight-ready and ideally, in the queue for a future NASA launch.

Krista Galloway, Oregon Institute of Technology
NASA Marshall Space Flight Center
Air-Bearing Flight Control Simulation

With CubeSats becoming increasingly popular, NASA Marshall Space Flight Center is enabling the development of an affordable NanoLaunch vehicle for CubeSat mission launches. To achieve Low Earth Orbit (LEO), this rocket employs specialized stabilization maneuvers during flight. These maneuvers are controlled by a low cost avionics flight controller, developed at Ames Research Center, known as Affordable Vehicle Avionics (AVA). AVA uses a closed-loop iterative program to set and correct angular positioning during flight by autonomously firing cold gas thrusters. An existing micro-friction air-bearing assembly was refined to simulate a zero-g environment for flight simulation testing and control system verification. With the addition of lamps to help visualize the control reactions and the implementation of a newly designed counterbalance, the preparation time is greatly decreased for each test, which will allow for more testing. The test results were analyzed to prove the feasibility of affordable flight control. Although certain aspects of the test results were not expected, the test preparation time is now a fraction of the original preparation time and the data can now be analyzed empirically multiple ways, further supporting future testing of AVA. The test was somewhat successful as AVA was able to de-spin the vehicle correctly but AVA was not able to hold the pitch and yaw at the desired location.

Brandon Gigous, Oregon State University
NASA Ames Research Center
Developing Mobility of a Compliant Quadrupedal Robot

From an evolutionary perspective, vertebrates first achieved locomotion through movement of the spine. The evolution of legs occurred later and allowed for enhanced mobility, but movement of the spine remains the central mechanism for locomotion. Most state-of-the-art robots similar to animals are built with a rigid torso and use legs as the primary means of moving around. Current research in tensegrity robots—robots made of compliant structures—shows promise for application in exploratory robotics, especially space exploration. Presented in this work is an extension of a current project, the focus of which is developing a tensegrity quadruped robot called MountainGoat, the first of its kind. To emulate the motion of animals, computational central pattern generators (CPGs) are used, and a neural network is used for feedback control; the Monte Carlo method is used to find efficient patterns of movement. The main contributions in this work are the use of machine learning methods to tune parameters of the tensegrity robot, as well as a restructuring of the CPG control scheme. The results of this research show that some animal-like walking behavior is achieved.

Meagan Koeroghlian, University of Portland
NASA Marshall Space Flight Center
Multi-wavelength Study of the High Energy Universe

The investigation of high energy electromagnetic radiation reveals information about the universe that would otherwise be invisible to humans, as it is outside the spectrum of optical light. Gamma rays are the most energetic type of radiation on the electromagnetic spectrum, billions of times more energetic than optical light. The sources of high energy non-thermal emission include supernova remnants, pulsars, compact stars, and other astronomical phenomena. We expect a continuum of non-thermal radiation from these objects. By correlating data from various observatories we can study the complete picture of such objects. Gamma and X-ray radiation can be produced through photon interactions with the same particle population. We are studying X-ray sources newly discovered in the TeV energy range to further our understanding of these particle interactions. In some cases, the data shows emission from different energies to be coming from the same source objects. The next step would be to perform a more in depth study of the spectral energy distribution in order to model the physical mechanisms responsible for the observed emissions. In addition, a spatial morphology study would reveal information about the environment and interactions around the object, i.e. magnetic field, interstellar medium, shocks in supernovae. The examination of data from various observatories will allow us to determine the optimal location(s) to conduct further investigation.

Jessica Kuonen, Oregon State University
Oregon State University Sea Grant Seacast
Eye of the Beholder: Exploring Perspectives of Ocean Risk and Uncertainty to Improve Data Accessibility

Ocean users and marine scientists both have connections to the sea. This research asks how the nature of this connection leads to different perceptions of ocean risk and comfort with uncertainty, and how these differences might be important to consider when one group has information another group needs. For example, when commercial fishermen take to the sea to earn a living, they seek information about forecasted currents, winds, and waves to cope with the many risks they face. Marine scientists have advanced ocean condition forecasting in recent years, however quantifying and communicating the scientific uncertainty of forecast models has proven difficult, resulting in shorter than preferred forecast lead times for experienced ocean users like commercial fishermen. This situation creates a unique opportunity to examine the differences in perceptions of risk and comfort with uncertainty between the "information provider" and the "information user," and how these perceptions influence the accessibility and usefulness of the data. Using open-ended and semi-structured interviews with both communities, this research will explore participant perceptions by focusing on the concepts of risk exposure, effect, and mitigation. By documenting the "mental models" of these two interdependent communities, there is potential to improve accessibility and usability of ocean condition forecasts and empower better risk management by individuals. Focusing on understanding the nature of perception may have implications for understanding and communicating risk and uncertainty between information providers and information users for other issues ranging from resource management to climate change.

Delphine Le Brun Colon and Levi Willmeth, Linn-Benton Community College
NASA Wallops Flight Facility
RockSat-C 2016: LBCC/OSU Team

In September 2016, Linn Benton Community College and Oregon State University students formed a team to participate in the RockSat-C program. Our mission was to build a proof of concept gamma ray polarimeter to launch on a NASA sounding rocket and successfully identify astral gamma rays in the form of either background radiation or gamma event radiation. This was an ambitious experiment inspired by Oregon State University's astrophysics professor and researcher Davide Lazzati. The measurement of gamma-ray polarization is considered cutting-edge astrophysics. Objects in our Universe that produce gamma photons are so far away that there are limited ways we can study them. With little information about high intensity gamma events such as gamma ray bursts and supernova explosions, successful data from this experiment could spark future experiments. Our design is based on compton scattering. A polarized gamma ray yields a polarized photon when it hits a block of scintillation material. We built our polarimeter with a central dense scattering block surrounded by an array of 12 scintillation detectors. Polarized photons scatter from the central block orthogonal to the gamma ray incident vector, whereas unpolarized photons can scatter in any direction. By looking at these angles we can deduce if the gamma radiation our experiment acquires is polarized or not. A failure of our system did not allow us to record events while in flight. The gamma ray polarimeter is expected to be improved and sent on a NASA High Altitude Student Platform (HASP) in 2019.

James Luce, Portland State University
NASA Marshall Space Flight Center
Mars Ascent Vehicle Hybrid Motor Structural Analysis

Three structural analyses were conducted for a hybrid rocket motor design for use on a notional Mars ascent vehicle (MAV). The MAV is a possible mission intended to return surface samples from Mars to Martian orbit. The hybrid motor design is one of several motor designs being considered.
The first analysis investigated cracks seen in samples of a newly developed fuel. These cracks appeared during environmental testing that replicated the conditions expected on Mars. In order to better understand the causes of the cracks, a model of the fuel grain was created and a structural finite element analysis was conducted to understand the thermal stresses expected in the fuel. This was a comparative analysis, examining the effects of different designs and materials to help aid design decisions and future testing.
The second analysis was conducted to examine stresses in the motor's casing under launch loads and to determine the potential thinness of the casing given expected loads and factor of safety.
The third analysis looked at stresses in the motor's nozzle and the nozzle's casing. This analysis was the most complex, taking into account thermal and firing pressure effects during launch as well as thrust and thrust vector control effects. The goal of this analysis was weight reduction and was done in an iterative cycle with design and thermal engineers.

E. Michelle Neely, Oregon State University
Oregon NASA Space Grant Graduate Fellowship
2-D Spatial Pattern Analysis of Mars and Earth Small-Scale Bedforms: Challenges and Methodology in Image Processing and Data Acquisition

Approximately 30% of the Earth's surface is arid or semi-arid environment, where sediment transport and deposition of aeolian-eroded material occurs at local and global scales. Understanding aeolian processes is important to understanding arid environments. Particle erosion, transport, and deposition by aeolian processes results in various depositional features such as dunes and ripple bedforms. Aeolian processes and a range of depositional bedforms are observed on Mars today. Understanding the spatial patterns of populations of aeolian bedform fields can inform understanding of formational wind processes. The overall goal of this study is to conduct a geospatial statistical analysis of 2-D patterns of remotely sensed images of comparable bedforms on Earth and Mars, and to eventually compare the terrestrial analysis to local wind regime data to infer formational Mars wind regimes. This presentation focuses on remotely sensed imagery of the bedforms, and the steps necessary to obtain measurements of the bedform spatial patterns. Earth imagery from the WorldView-1 Satellite Sensor and Mars imagery from the High Resolution Imaging Science Experiment (HiRISE) camera aboard the Mars Reconnaissance Orbiter (MRO) have different spatial, spectral, and radiometric resolutions which present challenges in bedform digitization. Various image enhancement techniques were used in ENVI to identify bedform crestlines prior to digitization with a C based open-source program (Online Line Segment Detector, OLSD). Python scripts were written to obtain quantify crestline segments, crestline spacing, and sinuosity angle measurements based on OLSD digitization. Manual digitization of pre- and post-enhanced imagery was compared to OLSD and Python script automation for efficacy.

Rachel Nelke, Oregon State University
OSU Propulsion Lab
Effects of Combustion Products on Detonation Velocities

Pressure gain combustion has received an increased interest in recent years, due to the potential of higher thermodynamic efficiencies when used for propulsion or power extraction than conventional engines. Two common pressure gain combustion devices are pulse detonation engines (PDEs) and rotating, or continuous, detonation engines (RDEs). In pressure gain devices, mixing of fresh fuel-oxidizer mixtures with combustion products can occur upon injection into the combustion chamber. Mixing the flammable mixture with combustion products may decrease detonation velocities, as seen in trends from laminar flame speed calculations and from detonation wave speed results from Sandia National Laboratories. These changes in velocity characteristics are expected to occur due to both dilution and chemical effects. Hydrocarbon fuels diluted with CO_2 and N_2 will be used, expanding on the results reported for laminar flames and ignition delay. The knowledge obtained from this study could be utilized in the design of detonation engines, enabling a better understanding of critical geometry while providing insight into practical usage and potential of PDE's and RDE's. The detonation propagation velocity is expected to decrease as the concentration of inert diluent increases until the deflagration to detonation transition no longer occurs. Similarly to the laminar flame speed results, it is expected that diluting the mixture with combustion products will cause a greater reduction to the detonation velocity than the inert gases because of chemical kinetic reactions. Preliminary results have shown a trend in this direction, however not enough definitive quantitative data has been collected yet.

Tara Prevo, Portland Community College
NASA Marshall Space Flight Center
Concept Analysis & Design of a Magnetically Damped Check Valve

Check valves are a common component in propulsion systems, designed to allow fluid flow in only one direction. Due to their simple passive nature, however, these valves are difficult to control and are prone to chatter, where high frequency pressure drops cause internal 'hammering,' prematurely degrading the valve and surrounding seals. The goal is to develop a design for a magnetic damping system for passive valves, which will utilize forces produced by magnets within copper tubes according to Lenz's Law. By analyzing experimental data, parameters must be established for the design, including magnet strength, copper tube wall thickness, clearances, and damping rates necessary. Using additive manufacturing, the concept design shall be printed and tested, and its effectiveness in eliminating chatter shall be evaluated. Should the design prove to significantly dampen passive valve chatter, its implementation could be widespread both in jet propulsion sciences and external mechanical fields.

Kevin Quintero, Oregon State University
NASA Marshall Space Flight Center
Single Person Spacecraft Assessment

Spacesuits are dangerous and painful for astronauts to operate in, but are currently required to service the International Space Station and other satellites. Also, future deep space missions have an increased risk associated with them. The FlexCraft is a single-person spacecraft concept that aims to solve these problems. It is designed to be an enclosed system equipped with robotic arms, which will reduce the fatigue of the astronaut and better protect against the hazards of space. This project is assessing the current design of the FlexCraft Simulator (FCS) and how intuitive the FCS is to pilot. These tests will determine what changes need to be made to the FCS and set a precedent for future tests. Localization sensors are used to record position and rotation data, and surveys will be used to collect qualitative data. The results will suggest improvements for the software, electronics, and mechanical systems of the FCS. These results and improvements will help NASA in their assessment of the FlexCraft concept.

Sanjay Ramprasad, Portland State University
Oregon NASA Space Grant Undergraduate Research Fellowship
Reproduction Dynamics in Small Networks of Autocatalytic RNAs

RNA's competency as both a catalyst and an information store suggests that large networks of these macromolecules were the immediate precursors to biological systems capable of undergoing Darwinian evolution. With emerging experimental and theoretical support, it seems increasingly plausible that life on earth originated from a heterogeneous network of cooperating RNAs rather than a single self-replicating species.[1] Here we propose that simple graphs can be used to predict the outcome of reproductive competitions in small RNA networks of the Azoarcus group I intron. The Azoarcus isoleucyl-tRNA group I intron is catalytically active and can recombine exogenous RNA fragments to produce more copies of itself. This is accomplished via a three-nucleotide interaction between the ribozyme and two exo-RNA fragments, which are subsequently ligated through a concerted trans-esterification reaction. To provide an empirical demonstration of the graphical models, ribozymes and RNA fragments were prepared by in vitro run-off transcriptions from DNA plasmid templates. Two, single nucleotide substitutions are introduced to produce heterogeneous ribozymes. The heterogeneous ribozymes are then forced to compete for a shared resource during rapid bouts of reproduction. Populations of ribozymes are tracked using differential ^{32}P labeling. This allows for the quantification of the chemical equivalent of evolutionary success across generations of RNA self-assembly. This investigation is in early stages however preliminary results will be presented.

[1] Yeates, J.A.M., Lehman, N. (2016). RNA networks at the origin of life. *The Biochemist.* 38:8-12.

Nathan Schorn, Oregon State University
OSU American Institute of Aeronautics and Astronautics (AIAA) Team
Oregon State Rocketry - Experimental Sounding Rocket Association Intercollegiate Rocket Engineering Competition (ESRA-IREC)

The Oregon State Rocketry Club (OSR) participates in the Experimental Sounding Rocket Association Intercollegiate Rocket Engineering Competition (ESRA-IREC) through the American Institute of Aeronautics and Astronautics (AIAA). The challenge is to design and build a rocket that can reach 23,000 ft. altitude above ground level with a 10 lb. scientific payload. The team of 15 students was split up into five sub teams: Aerodynamics & Recovery, Avionics, Payload, Propulsion, and Structures & Integration. Aerodynamics and Recovery was responsible for the aerodynamic profile and the recovery system. Payload and Avionics were a dual team of six students responsible for the scientific payload and telemetry. Propulsion was tasked with designing a motor providing impulse to reach the target altitude. Finally, Structures and Integration was responsible for fabricating the rocket body and integrating the subsystems. At the competition, OSR won 1st place in the advance rocket category and received an honorable mention in the payload challenge. This success has spurred on more projects under OSR creating teams pursuing a 100,000 ft. elevation challenge and development of a hybrid rocket.

Kyler Stephens, George Fox University
NASA Armstrong Flight Research Center
Fiber Optic Box Improvement

The Fiber Optic Sensing System (FOSS) Lab has developed a portable system, referred to as the FOSS box that can have many applications in flight research. In order to make the system easier to implement and use, there are several improvements that are being pursued. The objective of one of these projects is to provide a way to set the operational settings on the FOSS box in a Windows® app (Microsoft Corp., Redmond, Washington). Using C# (Microsoft Corp., Redmond, Washington), a graphical interface where the user can input the box's settings, is ideal. The app will then write out a binary file that the FOSS system can interpret and use to determine the proper operational settings. The system also needs a circuit that will allow a switch to be added to the box to control when the box is on or off. The circuit will first be designed in Eagle PCB design software (Eagle Electronics, Inc., Schaumburg, Illinois). Once this step is completed, the board will be fabricated using a PCB printer in AFRC building 4840 that I have recently set up. A final improvement to the FOSS system, full-immersion liquid cooling, is being considered in order to better cool the box while it is operating. This summer, experiments will be conducted on how effective fluids such as 3M™ Fluorinert (3M Company, St. Paul, Minnesota) are at dissipating heat while not interfering with the operations of the fiber optic system.

Connor Thompson, Western Oregon University
NASA Marshall Space Flight Center
Evaluation of Life Support Candidate Technology for 100% Oxygen Recovery

The current Atmosphere Revitalization (AR) life support system is not ideal for long-duration missions as the resource loop is open. This system vents materials into space and therefore requires regular resupply. NASA is currently developing a Bosch-based reactor system to minimize the severity of this problem. This system is composed of two reactors in series. The first is a Reverse Water-Gas Shift reactor (RWGSr) and the second, a Carbon Formation Reactor (CFR). The combination of these reactors is the Series-Bosch (S-Bosch) system. A Bosch-based AR system has the potential to close the resource loop, therefore decreasing the need for resupply and the required mass of the spacecraft. A kinetic analysis was conducted on the steel bead catalyst currently under investigation for the CFR. The current Precision Combustion Inc. (PCI) RWGS reactor was modified and tested for performance using two modification configurations. There are two designs for a CFR being investigated at MSFC, a Batch CFR (BCFR) and a Continuous CFR (CCFR). Design modifications were made to the CCFR and were incorporated into the BCFR. The CCFR was assembled and a test stand built. These combined efforts have furthered the understanding and development of an effective and efficient Bosch-based AR system.

Matthew Twete, University of Oregon
OSGC Faculty Research Award with Greg Bothun/UO
Analysis of the Occurrence and Rates of Supernovae in Abell Clusters

The rate and occurrence of supernova is of prime interest in astronomy, particularly if their behavior is a function of large scale environment and/or the small scale environment of local detonation. A cluster of galaxies is an environment where most of the galaxies are embedded in a hot intracluster medium (ICM) gas that emits X-rays. In addition, galaxies in a cluster feel far more gravitational perturbations from nearby galaxies than say, galaxies like ours. In this study the rates and locations of supernova in various Abell Cluster Galaxies were determined and were analyzed with respect to the X-ray luminosity of the clusters and galaxies, their redshift and the fraction radius of the supernova from the cluster center. Data taken from various supernova searches and the Abell catalog and was analyzed computationally. It was found that in clusters with high X-ray luminosity, supernova occurrence was lower in the cluster core. Indeed, only one supernova was found within the ½ mass radius of galaxy cluster with an X-ray luminosity above 10^45 ergs/second. Simple statistics based on the number of galaxies in that regions suggests that we should have found 15-20 events, instead of 1. Of the supernovae that had fractional radii larger than 0.6, only one was found to have an X-ray luminosity less than 5*10^44 ergs/sec, the remaining six ranged from ≈7*10^44 to 1.6*10^45 ergs/second. This shows that processes that cause Abell clusters to have high X-ray luminosity either directly or indirectly inhibit the occurrence of supernova near the cores of the clusters.

Charity Woodrum, University of Oregon
NASA Marshall Space Flight Center
Searching For The Electromagnetic Counterpart To Gravitational Wave Events

About one hundred years after Einstein's general theory of relativity, the existence of gravitational waves was confirmed experimentally by the Laser Interferometer Gravitational-Wave Observatory (LIGO). The merger of compact binaries such as neutron star - black hole systems or neutron star - neutron star systems are expected to produce burst-like electromagnetic signals in addition to gravitational waves. The Fermi Gamma-ray Space Telescope's Gamma-ray Burst Monitor (GBM) is continuously surveying the sky looking for the electromagnetic signals produced in these types of events. In addition to the on-board trigger system that alerts the astronomical community when a gamma-ray burst event has been detected, the GBM team is also developing a search algorithm to comb the data for possible gamma-ray bursts that did not trigger the on-board system. I analyzed the resulting events from this untriggered search to optimize the search algorithm by categorizing successful search parameters and evaluating timing and spectral information to distinguish gamma-ray burst events from known Galactic transients.