National Aeronautics and Space Administration

Marshall Space Flight Center

University Intern Abstracts

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NASA/MSFC University Intern Poster Day
Abstracts

Stephaine M. Jackson

Program/Internship Name: MISE
Education Institution: Alabama A&M University
Major: Business Management
NASA MSFC Mentor: Scott Jackson
Org Code: CS10

Title of Poster: Space Act Agreements

Abstract: My primary assignments focused on understanding the complete process for the development and activation of Space Act Agreements and also to obtain an understanding of the system that is used to generate the agreements. This involves meeting all requirements which includes financial, procurement, and legal. A Space Act Agreement is defined as an established a set of legally enforceable promises between NASA and another party to the agreement, and require a commitment of NASA resources (including funding, services, equipment, expertise, information, or facilities) to accomplish the objectives of the agreement. Space Act Agreements are agreement made between Marshall Space Flight Center (MSFC) and a partner. A partner is anyone is trying to do business with center and is willing is to pay for the services.

The agreement begins when a draft of the agreement is produced in a system called Space Act Agreement Maker System (SAAMS). After which the draft is sent to the potential partner where if there are any changes or additions they wish to make is suggested. Once the suggestion is received they are reviewed by the Agreement Specialist and Legal. The Legal department is responsible for making sure that any agreement made is in the best interest of the center. Once the revisions are made the final agreement must be approved by Financial Office and the Procurement Office. The financial office is responsible for making sure that the money is agreed upon is received. The center does not start work, which is outline in the agreement, until all appropriate funds are received. The Procurement office is to make sure that there will not be a conflict of interest between the new agreement and a contract that is all ready aligned. Procurement arrange contracts with companies, and the difference is that through Procurement the center pays for services and through an agreement the partner pays MSFC for their services. Once all offices places their stamp of approval the agreement is ready to be signed by both parties and placed in the active status. Any agreement that is waiting for approval or revisions is considered in progress agreements.

Kenion Blakeman
Program/Internship Name: MSGR
Education Institution: Carthage College
Major: Chemistry
NASA MSFC Mentor: Mike Wright
Org Code: CS-20
Title of Poster: Using History to Advance Space Exploration

Abstract: The history archives at MSFC contain information on past NASA projects that serve as a resource in helping achieve success in future missions. The purpose of the internship was to make selected resources in the history department more efficient to utilize. For example a collection of approximately 400 oversized diagrams including schematics, engineering drawings, posters, photographs and charts was indexed. Another project included working with a collection of approximately 50 recently recovered Saturn launch vehicle films from the 1960s. Film work included preparing an abstract for each Saturn I and V Quarterly Report Film DVD that lacked a transcript and creating more accessible CDS of each film. Other projects included scanning the covers of more than 1,000 technical reports and documents, and locating historical documentation requested through the Freedom of Information Act. Each of these projects help provide information needed for future space exploration missions.

Tru'Kessa S. Scott
Program/Internship Name: MISE (Minorities in Science & Engineering)
Education Institution: Alabama Agricultural & Mechanical University
Major: Mathematics
NASA MSFC Mentor: Dr. Virginia Tickles
Org Code: CS50
Title of Poster: Programmatic Data of NASA's Historical Space Missions

Abstract: The primary objective was to research programmatic data pertaining to NASA's historical missions and some recent missions. The mission types varied from manned to unmanned, earth orbiting to planetary, launch vehicles, and engines. REDSTAR, which was created by Marshall's engineering cost office, was the main search engine; however, some reliable internet sources were used. The searched data included: ATP, PDR, CDR, first delivery of flight unit, and the launch date. This valuable data was implemented into Microsoft Excel to form scatter plots. Analysis was then conducted on the partitioned data. The data gathered is also used to go into NASA Air Force Cost Model (NAFCOM), an automated parametric cost-estimating tool that uses historical space data to predict the development and production costs of new space programs. Therefore, the entire NASA cost estimating community benefits from the development and improvement of NAFCOM.

Ben DiMiero
Program/Internship Name: Marshall Space Grant Research Internship (MSGR)
Education Institution: Norwich University
Major: Mechanical Engineering
NASA MSFC Mentor: Gail Gordon
Org Code: EM10
Title of Poster: Cryoflex Material Testing

Abstract: The purpose of the cyroflex material testing was to determine the structural integrity of a variety of different foam thermal protection systems (TPS) that will insulate the upper stage of Ares I Crew Launch Vehicle. The foam will surround the liquid hydrogen and oxygen tanks, and therefore requires a stress analysis while under cryogenic conditions. The test consists of applying a tensile load to a foam specimen mounted to a bracket, which is placed flush against a hydrogen pressure vessel. Once the specimen experiences a temperature of approximately -320oF due to only conduction, the specimen will be loaded incrementally. This will simulate filling and expending the contents of the liquid fuel tanks. An inspection of the foam between each tensile load would then be preformed in order to determine if the material failed. The mode of failure is considered a delimitation of the specimen by a length of 0.3 inches or visual cracking and tearing as well.

After waiting for safety authorization the initial testing was done the week of July 14th, 2008. Unfortunately, the specimen did not approach the required temperature of -320oF, rather the specimen would not get any colder than -140oF. The test apparatus will be redesigned in order to eliminate possible heat sinks, which take the form of both conductive and convection heat transfer processes. The foam mounting material will also be replaced with an aluminum structure that will have a significantly higher coefficient of thermal conductivity, allowing for more heat to be pulled away from the specimen. An exterior insulating box will also be designed over the test specimen, which will eliminate the heat transfer to the ambient air in hopes of chilling the specimen to the required temperature.

Lindsay Greene
Program/Internship Name: USRP
Education Institution: Florida Institute of Technology
Major: Aerospace Engineering
NASA MSFC Mentor: Tina Malone
Org Code: EM10
Title of Poster: Mechanical Testing for FM*300K Manufacturing Process Sensitivity

Abstract: Mechanical testing is necessary to evaluate the effects different manufacturing processes for the application of the FM*300K film adhesive on the bond strength. This adhesive is an option for bonding the composite sandwich of the aluminum facesheets and the glassphenolic honeycomb core in the common bulkhead of the upper stage of the Ares I launch vehicle. The different aspects of the manufacturing process are very sensitive and flatwise tensile testing is necessary to test the effects of possible anomalies, which can occur during the manufacturing process, on the strength of the bond. Load and displacement values were collected during testing and from these numbers stress, strain, and modulus of elasticity were calculated and used for comparison. The values obtained are only a portion of the information taken into consideration when the processes are fully analyzed. In addition to the numerical calculations, it is also important to study the fracture mechanics and observe where the fracture actually occurred, whether in the primer, the bonding adhesive, or within the honeycomb itself.

Alexander Hreiz
Program/Internship Name: NASA Academy
Education Institution: Georgia Tech
Major: Aerospace Engineering
NASA MSFC Mentor: Tina Malone
Org Code: EM10
Title of Poster: "High Pressure Cryogenic Material Property Testing of Titanium Ti-6Al-4V"

Abstract: Titanium, an extremely lightweight high-strength material, can lose its desirable material properties in two cases: at cryogenic temperatures and in a hydrogen environment. Hydrogen embrittlement occurs when molecular hydrogen diffuses into a metal and recombines to form atomic hydrogen in the interstitial spaces. These molecules increase the pressure in the spaces and can lead to crack formation. This is a problem for NASA, which is considering using a titanium alloy for the helium pressurant tanks located within the hydrogen tanks for the Ares I. My project involves the testing and evaluation of Ti-6Al-4V ELI, a titanium-aluminum-vanadium alloy with fewer interstitial spaces than normal. Samples are tested in hydrogen and helium at a variety of temperatures ranging from -423 °F to 200 °F to simulate the expected environments the tanks will encounter in flight.

Jennifer Mayhew
Program/Internship Name: USRP
Education Institution: Oral Roberts University
Major: Mechanical Engineering and Spanish
NASA MSFC Mentor: Myron Tapscott
Org Code: EM10
Title of Poster: PhotoStress: An Optical Way of Viewing Stress

Abstract: Recently, the equipment has been updated with new software and a video camera to replace the system, which only consisted of a still-picture camera. The newer system is desired to be able to view stress as load changes to verify the FEA results. In-depth research was conducted to better understand the principles on which PhotoStress is based. Then, the equipment was examined and set up with the software. Various testing and studies of the equipment and software were performed to determine the capabilities of the equipment and the best settings while experimenting.

After the study of the capabilities of the software and equipment was complete, tests with specimens were conducted to compare the values from the software to the predicted values. The validity of the software was determined, and a comparison of the advantages of the new equipment versus the old apparatus was propagated. Now, the technique and knowledge will be taught to the others in the lab so that it may be used in future projects with confidence.

Hector R. Morales
Program/Internship Name: NASA Academy
Education Institution: Rensselaer Polytechnic Institute
Major: Aeronautical Engineering and Mechanical Engineering
NASA MSFC Mentor: Tina Malone
Org Code: EM10

Title of Poster: The Effect of Using a Reference Sample in Direct Current Potential Drop (DCPD) Fatigue Crack Growth (FCG) Measurements

Abstract: Accurate results are needed when taking measurements of Fatigue Crack Growth (FCG) given that these are used in calculations that ultimately determine whether or not a given material complies with the in-service specifications. Direct Current Potential Drop (DCPD) is a method for measuring FCG that has proven to yield reliable data when used correctly. One factor that should be considered is the susceptibility to thermoelectric effects of this method, which create additional DC potentials within the specimen. Using a reference sample along with the active sample during testing can allow for data corrected for this discrepancy. In a room temperature setting, however, the thermal fluctuations should be small and therefore not have much impact on the data. In light of the aforementioned, the objective is to verify if the effect of adding the reference sample to the procedure in ambient conditions yields a worthwhile improvement in the accuracy of the data.

Latoya Troupe
Program/Internship Name: MISE
Education Institution: Oakwood University
Major: Chemistry
NASA MSFC Mentor: James Perkins
Org Code: EM10
Title of Poster: Ionic Lubricants or Electroless Plating Solutions?

Abstract: Ionic liquids are a new type of solvent capable of producing industrial and environmental benefits. They are salt-like materials that are liquid below 100 °C. Some applications include: electrochemical devices, aluminum production, catalysis, pulp and paper industry, nuclear industry, extraction and separation process, green energy, and engineering fluids. More recently some ionic fluids can be used in the automotive industry to improve fuel efficiency by reducing friction of moving parts. Indication is that these fluids do not behave like ionic liquids. Testing will be conducted to prove the function of the fluids. Initial testing led the samples toward electroless plating type solutions.

Ashley Walker & Zenia Garcia
Program/Internship Name: MISE/MSFC , SHPE/MSFC
Education Institution: Alabama A&M, Univ. of Texas El Paso
Major: Industrial Technology, Mechanical Engineering
NASA MSFC Mentor: Chip Moore
Org Code: EM10
Title of Poster: Where did all the power go?

Abstract:

Background
The starboard SARJ is currently out of nominal service. The problem was first noted last October, when excessive vibrations and increased motor current required to rotate the joint were observed. Astronauts on several EVA's have visually examined the damage and sent back pictures to Earth to show the nitrided 15-5 precipitation hardened stainless steel race ring was prematurely spalling. Meanwhile, engineers on the ground have worked overtime to identify the most likely root causes, which will help determine the proper way to fix the rotating joint. To help them, astronauts have taken samples of the spalling debris and removed one of the trundle bearing assemblies and returned them to Earth for extensive study.

Objective
The purpose of this investigation is to perform Tribological examinations of trundle Bearing Assemblies(TBA's) to support International Space Station (ISS) Solar Alpha Rotary Joint (SARJ) anomaly of pre-mature fatigue spalling on race ring the Tribological examinations will serve to support Flight quality of the STA TBA's, in order to serve as a temporary replacement of on orbit TBA's, as well as serve as a reference to determine possible causes of the extensive premature spalling on the damaged "outer 45" raceway surface of the ISS starboard SARJ race ring.

Jasmine Williams and Leah Randle
Programs/Internships Names: NASA MUST and NASA Academy
Education Institution: Fisk University
Majors: Physics/Computer Science and Physics
NASA MSFC Mentor: Rudy Gostowski, Ph.D
Org Code: EM10
Title of Poster: Measuring Compatibility of Materials in Mixed Oxides of Nitrogen

Abstract: When designing an aerospace engine, the construction materials as well the propellants must be taken into account. The two must be compatible with one another or else the system will not operate properly. Minor changes in the composition of the materials or in the propellants used can result in unexpected and significant reactivity between the two. Differential pressure and isothermal calorimetry are two different compatibility tests utilized.

The older method of the two that is being compared is differential pressure, the heritage method. There is a control material and a sample material. Each is immersed in a propellant, and placed in two separate cells surrounded by a water bath. The two cells are held at constant temperature. Once heated the pressure is measured and compared. The pressure is indicative of the rate of the interfacial reaction between the propellant and material. This process is also known as Test 15 as described in NASA Standard 6001.

Isothermal microcalorimetry is proposed as an alternative method to determine compatibility. In this case, the rate of reaction is reflected in the rate of heat released. If the dominant chemical reaction in known and the corresponding activation energy then a formal rate constant can be calculated.

Nitrogen tetraoxide (NTO) is mixed with nitric oxide to form mixed oxides of nitrogen (MON) a propellant used on the Space Shuttle and is a prospect for use on the Ares 1 lift vehicle. Fuming nitric acid is similar to NTO and is used to compare both methods.

Name(s): Ajay R. Madhav
Program/Internship Name: ESMD
Education Institution: Auburn University
Major: Aerospace Engineering
NASA MSFC Mentor: Frank L. Hepburn
Org Code: EM20

Title of Poster: Determining Variance of Dielectric Constants with Temperature at Millimeter Wave Frequencies

Abstract: Microwave or millimeter waves can be used to determine the dielectric constant of materials. Current laboratories, including the Microwave Nondestructive Evaluation (NDE) Laboratory at MSFC, are able find dielectric constants at ambient temperatures. However, dielectric constants can change due to large temperature variations. Thus, when dealing with an extreme environment, such as space, there is a need to develop a lab setup to find the dielectric constant of a particular material in a broad range of temperatures. The work done this summer at the Microwave NDE Lab has started the implementation of such a setup. An insulated, aluminum chamber has been designed to contain a sample material on an optical bench setup. Heating and cooling systems integrated into the chamber will provide a temperature range of -100 degrees C to 200 degrees C within the chamber. Measuring the dielectric constant at a broad range of temperatures will prove beneficial for the reliability and efficacy of Microwave and Millimeter Wave NDE applications. An example of the importance of a precise dielectric measurement will also be discussed in the context of Launch Pad 39-A Flame Trench investigation that the Microwave NDE lab aided.

Jimmy Pope
Program/Internship Name: USRP
Education Institution: Virginia Tech
Major: Mechanical Engineering
NASA MSFC Mentor: Dr. Alan T. Nettles
Org Code: EM20
Title of Poster: Damage Tolerance Comparison of IM7/8552 and T800/AR250 Composite Laminates

Abstract: The purpose of this study is to determine the feasibility of using fiber/resin T800/AR250 for use in a liquid oxygen (LOX) composite tank because this material has been demonstrated to be LOX compatible. A composite cryogenic tank would greatly reduce weight over a conventional metallic tank; however the difficulty comes in quantifying the damage tolerance properties and characteristics of composite materials. The first step in doing so is to determine whether T800/AR250 has suitable compression-after-impact (CAI) properties compared to the more traditional, but LOX incompatible IM7/8552. This was done by performing instrumented drop weight impact testing on 32-ply quasi-isotropic specimens of T800/AR250, as well as IM7/8552. After being damaged, CAI testing using a hydraulic load frame was performed to determine the maximum load these panels could withstand. From these results it has been determined that T800/AR250 is more damage resistant and equivalent in damage tolerance to IM7/8552.

Adrienne Accardi

Program/Internship Name: NASA Academy

Education Institution: University of South Florida

Major: Mechanical Engineering

NASA MSFC Mentor: Timothy Vaughn

Org Code: EM30

Title of Poster: Ares I Upper Stage Development Archive

Abstract: The Ares I rocket is the new launch vehicle being developed by NASA for the purpose of human space flight. It is part of the constellation project and is designed to take astronauts back to the moon and maybe Mars. The upper stage of the Ares I refers to the liquid hydrogen and liquid oxygen fuel tanks as well as the J2-X engine. The components of the upper stage include but are not limited to gore panels, common bulkhead domes, barrel panels, ring forgings and manhole rings. Development issues often arise when designing and manufacturing components for a new launch vehicle. A historical development archive is being created so that engineers may easily identify past problems and solutions to these problems as well as the material properties of the component and testing regimes applied to the component. The archive also identifies a timeline for each component starting from initial development, running through the materials testing process and ending when final components are delivered. The archive will be available on the MAPTIS network.

Omar Fabian

Program/Internship Name: SHPE

Education Institution: Massachusetts Institute of Technology

Major: Materials Science and Engineering

NASA MSFC Mentor: Peter Curreri

Org Code: EM30

Title of Poster: Techniques for Oxygen Production from Lunar Materials

Abstract: With the increased consumption of Earth's natural resources and the escalating costs of space transport, it is becoming necessary to develop methods to utilize extraterrestrial resources for further space exploration and, ultimately, large-scale space and lunar habitation.

A first and important step toward this end is to gain the ability to extract an appreciable amount of oxygen from said resources, as it is a primary component of rocket fuel and, not to mention, necessary to sustain life as we know it. While many of the methods employed thus far, including high temperature reduction processes and molten material processing, have been successful in extracting certain amounts of oxygen from ersatz lunar soil, there should exist a more sustainable and more efficient method. The high temperatures involved in presently developed reduction methods are followed by a concomitantly high energy cost (often exceeding 100 kW), and molten material processes often call for the solubilization of lunar soil with strong acids (H2SO4) making chemical safety, storage, and reactant regeneration recurring problems of method.

The most promising method and the one herein explored is that using conventional electrowinning methods in combination with electrolytic ionic liquids which are stable under ambient conditions and may be effectively regenerated.

Jack McCready
Program/Internship Name: Marshall Space Grant Research
Education Institution: University of Tulsa
Major: Mechanical Engineering
NASA MSFC Mentor: Dr. Art Nunes
Org Code: EM30
Title of Poster: Design and Calibration of Load Table

Abstract: An instrumented table was designed and constructed for the purpose of quantifying tool forces and moments generated by friction stir welding and other processes. The table was outfitted with clamps to hold the work piece during testing. Twelve strain gages were placed on the legs of the table to measure forces and moments acting on the table. Gage location was optimized using neutral axis theory and beam theory. For accuracy, there was some redundancy between gages. The table was calibrated by applying known forces and moments and observing the response in strain gage outputs. The applied forces were quantified using a calibrated load cell, and the applied torques were quantified using a digital torque wrench. Since friction stir welding generates a significant amount of heat, the table was outfitted with eight thermocouples and the relationships between temperature and strains were found. This information will be used to compensate test results for temperature. Outputs were monitored and recorded using LabVIEW.

Haley Rubisoff
Program/Internship Name: MSGC
Education Institution: Mississippi State University
Major: Mechanical Engineering
NASA MSFC Mentor: Carolyn Russell
Org Code: EM30
Title of Poster: Variation of Metal Flow Paths in Conventional Versus Self-Reacting Friction Stir Welding

Abstract: Tracer studies were conducted to compare 2 friction stir weld (FSW) processes using a threaded pin. Conventional (C) FSWing is used primarily for longitudinal flat welds and uses a threaded pin and a backing anvil. For circumferential welding, a self-reacting (SR) FSW is made by pinching the metal between two shoulders. In this study, copper was deposited on the crown, root, or faying surfaces of AA2219 panels before welding, and tungsten wire was placed longitudinally along the faying surface to trace the material flow at various locations in the weld. The test matrix compared tool rotational speed, travel speed, load, and pin thread pitch to better understand how the weld parameters affect the material flow. Plan, longitudinal, and transverse section radiographs were examined to determine flow paths using the copper and tungsten as markers. The results were then used to model how the metal flow varied between the 2 FSW processes as a function of the process parameters.

Jennifer Walley
Program/Internship Name: USRA
Education Institution: University of California, Davis
Major: M.S. Materials Science and Engineering
NASA MSFC Mentor: Steve Hudson
Org Code: EM30
Title of Poster: Ares I First Stage, D6ac steel, heat treatment characterization

Abstract: Development of Ares First Stage D6ac steel components has resulted in several processing issues. In order to decrease the propensity for stress corrosion cracking, an increase in fracture toughness, from 90 ksi√(in) to 100-120 ksi√(in), is desired. The development of different a heat treatment is required since material properties are a function of processing parameters. This body of work hopes to examine different aspects of the processing steps that require development to accomplish the material properties needed for the RSRM program.

Mark Hofacker
Program/Internship Name: NASA Academy
Education Institution: Vanderbilt University
Major: Mechanical Engineering
NASA MSFC Mentor: Mike Kovach
Org Code: EM40
Title of Poster: Common Bulkhead Damage Assessment

Abstract: The common bulkhead on the upcoming Ares I is a complex and expensive structure to manufacture. Imperfections during construction are inevitable and it is therefore necessary to know which flaws are innocuous and which are potentially catastrophic. By constructing and testing over 80 sandwich composite specimens a correlation has been drawn between observable exterior damage, hidden interior damage, and the degree to which the structure's integrity has been compromised. This work could potentially save a future space craft from being scrapped due to misinterpreting superficial damage.

Victoria Poole
Program/Internship Name: MISE
Education Institution: Oakwood University
Major: Chemistry
NASA MSFC Mentor: Curtis Manning
Org Code: EM40

Title of Poster: Optimizing the Selective Laser Sintering Performance

Abstract: Rapid Prototyping (RP) proves to be one of the more innovative advanced technology developments. Its basic concept derives from the design of a part from CAD software to direct production using a layer-on-layer deposition process. A design engineer can communicate design concepts to a customer in a timely manner without the extra costs relating to production.

Rapid Prototyping has a bright future with the Constellation program. NASA is currently researching In-Situ Fabrication and Repair (ISFR) techniques that would exponentially enhance our ability to have long term exploration bases on other planets. The utilization of materials already on these planets to create needed spare parts, reduce launch mass & cost, and enhance mission safety would have a profound effect on the advancement of Space travel.

Selective Laser Sintering (SLS) is only one of the several RP methods at the Marshall Space Flight Center. With many orders coming in for this process, it is imperative to monitor and determine the efficiency of the machine. As parts are being built, it is important to consider material ratios, part dimensions and scale, and any problems relating to warping, curling, and delaminating. This project examines the cause and effects of such anomalies and provides implications to improve the quality of the SLS manufactured parts.

Dwight Smith, Royce Collins
Program/Internship Name: MUREP-AIHEC
Education Institution: Navajo Technical College
Major: Auto CAD
NASA MSFC Mentor: Steven Phillips
Org Code: EM40

Title of Poster: Points to Products: Implementing Laser Technology Within Digital Manufacturing

Abstract: Laser scanning combined with digital manufacturing, create a force that is not only productive but extremely accurate. Having accuracy that's within a few inches is important with the research that we are conducting. Working from blueprints is not only unreliable but also outdated. All throughout the different rocket designs, from the Shuttle to the Saturn V, the modifications to original structures, buildings, and components at MSFC have made blueprints unreliable. The ability to take laser scan data, convert it to a CAD compatible file, and then create accurate 3D models helps with the interpretation and understanding of manufacturing processes and modifications. For example, visualizing and verifying the dimensions of building 4707 and redesigning the structural components of 4670 (west test stand) can be done ahead of time to detect unforeseen problems. Having the ability to first visualize the problem and then design around it without compromising any equipment is vital to the overall success of any project.

Willie Crutcher II

Program/Internship Name: Minorities in Science and Engineering (MISE)

Education Institution: Alabama A&M University

Major: Chemistry and Food Science and Technology

NASA MSFC Mentor: Dr. Jan Rogers

Org Code: EM50

Title of Poster: Emissivity and Creep Analysis

Abstract: Aerospace is one of the most unique and exciting modern industries. From its meager beginnings from hot air balloons to the ground breaking work of the Wright brothers, to the crew of the Apollo 11 landing on the moon, this industry continues to bring forth new innovation that not only benefits the development of aerospace technologies but other national and international industries. However, it is vital to note that the success of aerospace endeavors depends on materials properties. The materials used to manufacture aircraft and spacecraft undergo a considerable amount of stress and strain depending on their application. The ability of certain materials to deal with the demanding environments they are exposed to is of great importance to a materials scientist which utilizes various methods to analyze certain traits of a material. This summers' research focused on observations and analysis of emissivity and creep characteristics of materials.

Molly Denman, Jauquin Holmes, and Hannah Sheldon
Program/Internship Name: MSGR, MSGR, ESMD
Education Institution: The University of Alabama, Missouri University of Science and Technology, University of Pennsylvania
Major: Mechanical Engineering, Aerospace Engineering, Physics
NASA MSFC Mentor: Andy Finchum
Org Code: EM50
Title of Poster: Impact Testing for Environmental Effects on Space Craft

Abstract: The Impact Testing Team's overarching goal is to simulate the interaction between NASA spacecraft and their environment. Materials being investigated for spaceflight and ground use are tested for damage caused by impacts with micrometeoroids, orbital and launch debris. For micrometeoroid testing, particles are accelerated with hypervelocity guns into the test material. In order to produce the most efficient results, velocity must be consistent. The main gun we experimented on for velocity consistency was the Exploding Wire Gun (EWG). The EWG uses capacitors as its power source. A 6-22 kV is instantaneously forced through a small wire in the barrel block, causing the wire to explode. The plasma of the exploding wire accelerates the projectile to the target. Variables tested include burst disc material and thickness, and thickness of spacer. The rain gun was used for weather encounter testing. In this case the rain gun accelerates a sample of external tank foam toward a drop of water to simulate damage from launch in rainy conditions. We were able make substantial progress towards velocity consistency in the EWG, but future testing is also necessary.

Zachary Glueckert

Program/Internship Name: USRP

Education Institution: Colorado State University

Major: Mechanical Engineering

NASA MSFC Mentor: Todd Schneider

Org Code: EM50

Title of Poster: Kapton XC High Flux Electron Exposure Testing

Abstract: Kapton XC is being considered as a conductive mitigation shield for some of the James Webb Space Telescope electronics. While Kapton is primarily known as a polymeric insulator, Kapton XC is doped with a conductive carbon material allowing it to dissipate charge. Previous testing conducted for the Wilkinson Microwave Anisotropy Probe satellite at high energy and flux rates, indicated possible internal arcing or "crackling" of Kapton XC. The goal of this investigation was to expose Kapton XC to energy levels ranging from 4 to 15 keV and flux rates of 2 to 10 nA/cm^2. The arc rate and magnitude were then monitored with a digital oscilloscope. Several different surface resistivities of Kapton XC (ranging from 230 Ohm/sq to 10E7 Ohm/sq) were compared and studied in order to determine at what energy and flux rates significant arcing would occur. For Kapton XC with high resistivities, an increase in arc rate was found to directly depend on the electron beam energy level. Arc magnitudes ranged from 4 to 40 mA and the repetition rate was found to range from 0 arcs per fifteen minutes to 76 arcs per fifteen minutes.

Kia C. Askew
Program/Internship Name: MISE
Education Institution: Alabama A&M University
Major: Mathematics/Computer Science
NASA MSFC Mentor: Elaine F. Duncan
Org Code: EO40
Title of Poster: Systems Engineering

Abstract: The purpose of this poster is to provide general information on systems engineering. It will introduce systems engineering objectives, demonstrate the steps of the life cycle of a project, give an in depth look at the SE engine, discuss operability, and explain the importance of cost-effectiveness and life cycle cost.

Tyler Kirby
Program/Internship Name: ESMD
Education Institution: Alabama A&M University
Major: Mechanical Engineering - Propulsion
NASA MSFC Mentor: Richard T. Stroud
Org Code: ER01
Title of Poster: It's a CAD World

Abstract: NASA is currently in a conversion state pertaining to the process in which to design and construct CAD (computer aided design) models. The objective for the following investigation was to employ and compare three Top-Down CAD processes on points of efficiency and ease of use. The processes include NASA's current and future protocols as well as one used by a major industry leader that will rename nameless for proprietary purposes. To limit the variables that exist between processes, a simple, two stage sounding rocket model was constructed for each using the same CAD package - Pro Engineer Wildfire 3.0 by Parametric Technology Corporation. From these evaluations, a recommendation was made as to which the author felt was the process that NASA should go forward with in their upcoming endeavors. Note: Due to time and proprietary issues, these processes will only be evaluated on an extreme top-level scope.

Brian Donius
Program/Internship Name: ESMD
Education Institution: Missouri University of Science and Technology
Major: Aerospace Engineering
NASA MSFC Mentor: Joe Leahy
Org Code: ER21

Title of Poster: Support of Altair Ascent Engine Trade Studies Through First Order Simulation

Abstract: As President Bush's vision for space exploration has progressed, NASA began the ALTAIR program to develop the technologies needed to land and leave the Moon and Mars. NASA MSFC is currently working the descent and ascent Lunar Lander engine development. The tasks during the summer term were to support trade studies of the Ascent engine development. The main objective was to expand the capabilities of current simulation software in the areas of performance and mass estimation when using hypergolic and soft cryogenic fuels.

Joseph Balla
Program/Internship Name: USRP
Education Institution: The Ohio State University
Major: Aerospace Engineering
NASA MSFC Mentor: Dr. Kurt Polzin
Org Code: ER24
Title of Poster: Measurement of a Micrometeoroid Using A High Speed Streak Camera

Abstract: Present work at MSFC's Propulsion Research and Development Lab is focused on building a plasma gun to accelerate particles to high speeds. These high-speed particles impact target material, simulating the impact of micrometeoroids. Past research has shown that micrometeoroids in the solar system have a large distribution of velocities, with the most probable velocity of 20 kilometers per second. A high speed streak camera is used to ensure that the simulated particles in the experiment are moving with velocities close to those of micrometeoroids found in space. The velocity is measured using a time-of-flight method, where light emitted from the plasma as it accelerates the particle serves as the start time, and light emitted from the particle's impact on the test target provides the end time of the interval. The setup and use of the steak camera diagnostic will help in correlating damage done to various target materials with micrometeoroid impact velocity.

Adam Kimberlin
Program/Internship Name: MSGR
Education Institution: Tennesee Tech
Major: Mechanical Engineering
NASA MSFC Mentor: Kurt Polzin
Org Code: ER24
Title of Poster: Software Development for Plasma Propulsion Systems

Abstract: Work in the Propulsion Research and Development Lab has focused on preparing the Marshall Space Flight Center electric propulsion thrust stand for a plasma thruster test. The plasma thruster to be tested is a Princeton cylindrical Hall thruster. The work has primarily involved the implementation and refinement of data acquisition methods and tools used to quantify the performance of low thrust thrusters. Thus far, advances have been made to enhance the user's ability to correct for variations in the ambient environment. This has involved making modifications to the software used to control the hardware and perform desired measurements while under test. The end goal is to further improve the implementation of these experimental procedures to the point where the processes of performing a test and obtaining accurate data are integrated into a single, easy to use interface.

Dionna O'Daniel

Program/Internship Name: ESMD

Education Institution: University of Evansville

Major: Mechanical Engineering

NASA MSFC Mentor: Richard Eskridge

Org Code: ER24

Title of Poster: Lunar Micrometeorite Impacts on Shielded Cryogenic Multi-layer Tank Insulation Using a Micrometeorite Gun

Abstract: For long duration missions in lunar environment, cryogenic ascent stage fuel and oxidizer tanks are exposed to high- speed micrometeorites. Cryogenic fuel tanks are covered with multi-layer insulation (MLI), consisting of alternating layers of perforated double-Aluminized Mylar and Dacron, and spray on foam insulation (SOFI). The MLI is tested for survivability using simulated micrometeorites. Glass beads are accelerated to a velocity of approximately 14 to 25 kilometers per second, simulating micrometeorite impacts on the MLI test samples. Multilayer insulation samples are exposed to these impacts to assess the physical damage and estimate the degradation of thermal performance. Additional tests will be performed at the end of the program to determine the performance of a shielding layer for the insulation.

Jarred Reneau
Program/Internship Name: MSGR
Education Institution: Mississippi State University
Major: Aerospace Engineering
NASA MSFC Mentor: Dr. Kurt Polzin
Org Code: ER24\Propulsion Research & Technology Applications Branch
Title of Poster: Chamber Wall Effects on Pulsed Inductive Thruster Performance Measurements

Abstract: Pulsed inductive thrusters are electromagnetic devices that use interactions between a plasma current and an induced magnetic field to accelerate the plasma and produce thrust. All plasma currents and fields are induced, making this variant of electric thruster electrodeless. Two concepts, the Pulsed Inductive Thruster (PIT) and Faraday Accelerator with RF-Assisted Discharge (FARAD) operate on this principle. During experimentation, a PIT MkV was positioned in a vacuum chamber where its thrust and specific impulse (Isp) were quantitatively measured. It is hypothesized that the close proximity of the vacuum chamber walls to the thruster has an influence on the measured performance. A 2-D axisymmetric, magnetic field solver (QuickField) is used to mathematically model the actual experiment and to determine if the vacuum chamber wall had any noticeable effects on the magnetic field generated by the PIT MkV. MATLAB technical computing software is used to solve an acceleration model consisting of a set of equations, yielding performance estimates based on the QuickField data. These data are analyzed, plotted, and graphed to learn the effect of the metallic chamber on thruster performance.

Tristan Wolfe and Chase Dervan
Program/Internship Name: ESMD/USRP
Education Institution: West Virginia University/Georgia Institute of Technology
Major: Mechanical Engineering & Aerospace Engineering / Mechanical Engineering
NASA MSFC Mentor: J. Boise Pearson
Org Code: ER24
Title of Poster: Design of a Cold Trap for Use in Pumped-NaK Flow Loops

Abstract: The design and analysis of a proposed cold trap for use in the purification of circulated eutectic sodium potassium (NaK-78) loops is presented. The cold trap is designed to be incorporated into the Fission Surface Power Primary Test Circuit (FSP-PTC) and a Feasibility Test Loop (FTL) which both incorporates pumped-NaK loops to simulate in-space nuclear reactor based technology using non-nuclear test methodology as stated by the Early Flight Fission – Test Facility (EFF-TF) group tasked by NASA MSFC's Nuclear Systems Office. The FSP-PTC provides a test circuit for the development of fission surface power technology. The FTL works as a small-scale test circuit to enable rapid testing of techniques and hardware in development stages. Both systems operate at temperatures that would be similar to those found in a reactor. By dropping the operating temperature of a specified percentage of NaK flow through a bypass containing a forced-convection cold trap, the NaK purity level can be increased by precipitating oxides from the NaK and capturing them within the cold trap without circulating these oxides back through the system.

Andrew Damon

Program/Internship Name: USRP

Education Institution: Purdue University

Major: Aeronautical/Astronautical Engineering

NASA MSFC Mentor: David Reynolds

Org Code: ER32

Title of Poster: J-2X Gas Generator

Abstract: The J-2X engine will be used to power the upper stages of NASA's Ares I and Ares V vehicles, as well as the Earth Departure Stage (EDS) in future lunar missions. A gas generator cycle is utilized in the J-2X, in which fuel and oxidizer (LH_2 and LOX) are combusted in the gas generator and then used to turn the engine's turbopumps, which in turn deliver high pressure propellants to the main injector. The Workhorse Gas Generator (WHGG) was tested at Marshall Space Flight Center's Test Stand 116 to characterize its performance, durability, and combustion environment in order to determine the proper flight configuration for the gas generator. One important requirement of the WHGG is that it deliver combustion gases uniform to ±50 °F at the turbopump inlet. Temperature uniformity is directly related to the degree of mixing of fuel and oxidizer. In order to evaluate the temperature spread of the hot gas, data from several thermocouple rakes was analyzed, and thermal profiles were generated using interpolative methods. In the majority of WHGG tests, temperatures at the simulated turbopump entrance were within requirements.

Evan Sproul

Program/Internship Name: ESMD

Education Institution: New Mexico Tech

Major: Mechanical Engineering

NASA MSFC Mentor: Kevin Ward, Kevin Pedersen

Org Code: ER33

Title of Poster: Design and Testing of a Capacitance Probe Calibration Apparatus.

Abstract: Capacitance probes measure the dielectric permittivity of a surrounding medium. By measuring changes in the permittivity, these probes can be used to calculate the amount of fluid present around the probe. NASA will utilize capacitance probes in the upcoming system development test article (SDTA) in support of the Ares launch vehicles. The probes will be used to measure liquid levels within a simulated reaction control propellant delivery system. Due to necessary high pressure ratings and a good performance record, the test conductors of the ER33 Component Development Area (CDA) have chosen to use American Level Instruments' RF capacitance probes. To ensure that the accuracies of these probes meet SDTA requirements, a calibration and testing apparatus was designed, built and tested within the CDA. The apparatus was used to test an American Level Instruments' insulated reference wire probe. The apparatus proved capable of performing calibration and testing duties. In addition, the apparatus revealed a possible malfunction in the reference wire probe that merits further investigation. By using this apparatus for further calibration and testing the CDA can identify capacitance probe problems early on in testing and avoid future instrumentation problems.

Leethaniel Brumfield, III
Program/Internship Name: NASA-MUS
Education Institution: Langston University
Major: Chemistry & Biology
NASA MSFC Mentor: Stanley Tieman
Org Code: ER50
Title of Poster: The Five-Finger Propulsion System Experience

Abstract: In an effort to highlight my complete internship experience, this poster displays a RSRM nozzle and ballistics overview, a brief description of the ALICE (Aluminum-ICE) rocket development and advanced propellant technology, a summary of MSFC's nozzle reference databook, and it lists a few engineering career paths available with NASA. Perhaps most compelling about the RSRM nozzle, I learned that it converts combustion gas thermal energy to kinetic energy via the expansion process. Prior to my internship, I knew that ballistics was the science of mechanics that deals with the motion, behavior, and effects of properties like bullets, gravity bombs, and rockets. However, I learned that ballistics involves designing and accelerating projectiles to achieve a desired performance. In regards to rocket development and advanced propellant technology, a new discovery called ALICE is being formulated as Al/H_20, $Al/H_20/H_20_2$, or another AB (ammonia borane-based) propellant combination. In addition, a tertiary mixing procedure is currently being investigated that attempts to: (i) dissolve AB in methanol, (ii) add HTPB to the mixture, (iii) run vacuum on mixture to evaporate the methanol, and/or (iv) add AP & curatives to the mixture to create a propellant grain. I had the pleasure of assisting in the update of the MSFC nozzle engineering databook. The most recent addition that I contributed to the databook was the RSRM-102 (STS-124) that launched on 5/31/08. Its improvements included: (i) a wider entrance & exit slots to prevent edge damage, (ii) a 2^{nd} thermocouple for monitoring internal temperature, and (iii) a variable thermal control system versus original on/off heat input. Perhaps most beneficial, this internship experience gave me the chance to explore other possible careers possibilities in engineering with NASA that I had not thought of prior to this summer.

Holley Dickmeyer
Program/Internship Name: MSGR
Education Institution: Purdue University
Major: Materials Science and Engineering
NASA MSFC Mentor: Noah Rhys
Org Code: ER52
Title of Poster: Jettison Motor: Nozzle Housing Materials and Thermal Analysis

Abstract: NASA's Ares I Crew Launch Vehicle (CLV) will carry man to the International Space station, back to the moon and beyond. An important component of the Ares I vehicle is the Launch Abort System (LAS). The Launch Abort System will safely carry the crew away from the rocket in the case of a failure during a launch or the ascent to orbit. It is made up of three motors, the Abort Motor, the Jettison Motor and the Attitude Control Motor. The Jettison Motor is currently in the testing phase, and while the test objectives have been met, a few materials issues have occurred. In the gap (used to pressurize the o-ring) between the nozzle entrance and nozzle housing, the insulating EPDM and stainless steel are eroding due to high velocity and high temperature gas flows. All pre-test analyses seem to underestimate the flows within the gap and no instrumentation can be placed in the gap during testing. Thus, an attempt was made to reverse engineer what happened within the gap. Post-test images and known material properties were used to predict the temperatures and flows experienced by the materials in the gap during the test fire. As high temperature properties were often unknown, trends at lower temperatures were used to estimate the material properties at high temperatures. As a result of research and estimation, the best estimate shows that the temperatures in the gap are most likely closer to 2500 $^{\circ}$F (the melting temperature of steel) and instead of becoming stagnant, the gas is flowing circum,ferentially within the gap.

Geoff Glidden

Program/Internship Name: Marshall Space Grant Research

Education Institution: University of Missouri

Major: Mechanical and Aerospace Engineering

NASA MSFC Mentor: Philip Franklin

Org Code: ER52

Title of Poster: Ullage Settling Motor Subsystem

Abstract: The Ullage Settling Motor (USM) subsystem serves two important tasks for the Ares I launch vehicle. Primarily, it must ensure that the ullage spaces in the liquid propellant for the Upper Stage (US) main engine are settled and do not move away from the forward position at the time of J-2X ignition. In addition, it must supply the necessary positive thrust for the US to allow for separation from the Interstage and the First Stage (FS) following the FS main booster burnout. The USM design verification is to be demonstrated through static testing of a full-scale grain in a Heavy Weight Motor (HWM) case. A specific aspect that must be addressed in the design is the thermal insulation for the interior of the case. This thermal insulation must protect the external case from extreme heat while also staying within strict limits to satisfy all performance requirements placed on the USM. As a result, research and analyses were done both to verify the current insulation thickness and to explore a better method to apply the insulation, known as vulcanization.

John P. Guidry II
Program/Internship Name:
Undergraduate Student Research Project
Education Institution: Middle Tennessee state University
Major: Electro-Mechanical Engineering Technology
NASA MSFC Mentor: Dave Whitten
Org Code: ES21
Title of Poster: Modification and Redevelopment of the Ares I Instrumentation Unit Camera System

Abstract: The Ares I crew launch vehicle is currently under development to replace the Space Shuttle Discovery after its 2010 retirement. The Ares I rocket will carry its crew to low Earth orbit. The rocket's Instrumentation Unit is located on the Upper Stage just below the Orion Crew Exploration Vehicle and contains most of the Ares I avionics, navigation systems, upper stage camera systems, and many other electronic vehicle components. The purpose of the project was to modify the upper stage camera system in order to adapt to environmental conditions and system requirements which include low temperature lens frosting, aerodynamic and gravitational loading, weight restrictions, and proper viewing perspectives. To combat lens fogging/frosting, the camera assembly was moved up approximately 5 inches into a warmer region. The camera fairing assembly was shortened in order to reduce the weight and remove unnecessary mass. In order to achieve the desired camera perspective an angled adapter was created for the camera to be mounted on. This created both distance from the Instrumentation Unit surface and an inward pointing field of view. The angled adapter also allowed for more system versatility if the camera heights or angles require later adjustment. Mechanical analysis was performed to view the effects of loading on the various components. These modifications successfully created an unobstructed camera view of the intended Ares I upper stage portion.

Judson Houston

Program/Internship Name: ACCESS

Education Institution: Texas A&M University

Major: Mechanical Engineering

NASA MSFC Mentor: Lawanna Harris

Org Code: ES21

Title of Poster: Solid Modeling for Aries 1 Cameras

Abstract: The Ares I rocket is currently being designed by NASA and its contractors to carry the next generation manned spacecraft into orbit. NASA's Marshal Space Flight Center is the location for most of the design work being done for the Aries project. ES21 Structural and Mechanical Design Branch is the leading the design of the ARES-1 Upper Stage Aft Skirt and the Instrument Unit. Lawanna Harris, Judson Houston's mentor, the Computer-Aided Design (CAD) Lead for the Ares-I Upper Stage Aft Skirt. The Aft Skirt measures 55-inches in length that surrounds the Liquid Oxygen (LOX) tank aft dome, leaving a working volume of approximately 50 cubic-feet to mount the cameras, avionics, and provide support for various fluid lines. The Aft Skirt also accommodates a thermal curtain that spans from the aft ring flange of the Aft Skirt to the Thrust cone just above the engine gimbal plane. The Aft Skirt will have three (3) cameras strategically placed to view engine operation, engine dynamics, and to ensure the separation event does no harm to the engine bell.

The task was to find the best viewing location for the cameras and design a bracket to mount the cameras; while minimizing the opening that would be needed in the thermal curtain. The limited space available in the Aft Skirt, its numerous avionics boxes and the requirement to limit the size of the opening in the thermal curtain, required devising a mounting scheme that utilized the volume below the avionics boxes. Therefore, the bracket design interfaces with the mounting plate used to the mount the avionics. As a result the bracket can be mounted virtually any where there is an avionics box. During the design process, adjustability feature was added to the design. The bracket design features a toothed-surface to allow angular adjustment of the camera up to 120 degrees with a locking feature, so the camera can be adjusted to the proper viewing angles in the vehicle.

A thermal insulated box was designed for the camera designated to view engine operations. The location of this camera has not been fully defined. There are two locations being considered, the Thrust cone and on the Aft Skirt outside of the thermal curtain. The thermal insulated box is necessary to protect the camera from the high temperature (~1300 ˚F) exhaust of the engine. The camera's operational temperature is (~120 ˚F). The box can be mounted on the Thrust Cone with a standoff or mounted to the Aft Skirt using an elongated version of the previously mentioned bracket. The bracket design is a mechanical success, and will most likely only be slightly modified once evaluated by stress analysis, other engineering disciplines, and the designers of interfacing components, namely the thermal curtain designers.

Lizmar Principe

Program/Internship Name: NASA MUST Scholarship

Education Institution: University of Puerto Rico, Mayaguez Campus

Major: Mechanical Engineering

NASA MSFC Mentor: Paul Tatum

Org Code: ES21

Title of Poster: Ares 1 Protrusions Design for the Pathfinder Testing Article (PTA)

Abstract: Ares I will carry the Orion spacecraft and its crew on missions to the International Space Station and then later on to the moon and beyond. To be able to successfully accomplish these goals, an Upper Stage pathfinder is going to be developed. This Pathfinder Testing Article (PTA) design will have the effect of avoiding cost, minimize risks and enhance the schedule by pathfinding Ground Support Equipment (GSE), facilities and ground operations. The pathfinding events are based on the need to verify GSE form, fit, function and fit check services of the ground facilities designed to accommodate the US development, test and flight readiness before use of those facilities for flight hardware operations. The protrusion design project focuses on producing Pro Engineer models and drawings for protrusions that extend more than two inches from the outer mold line of the PTA. This project allows me to participate in the fundamental design process by meeting with other designers to understand a need, produce models and drawings using the preferred CAD package and understanding the manufacturing process. By the end of the term, I will have produced a complete design that will be used on hardware that will directly support the Ares I project. The various protuberances for the PTA, such as the system tunnel, roll control system and camera fairings where modeled using sheet metal design. One of the main reasons that sheet metal was used was for feasibility, providing minimal cost investment.

Tatiana Aguilera
Program/Internship Name: NASA Academy
Education Institution: Carnegie Mellon University
Major: Chemical Engineering, Engineering and Public Policy
NASA MSFC Mentor: Jay L. Perry
Org Code: ES22
Title of Poster: Studies of Challenges in Air Quality of Cabin Atmosphere

Abstract: Optimizing the air quality of the cabin atmosphere is important for long duration space habitation. The overall objective was to analyze three different issues concerning air quality in the International Space Station and future lunar surface vehicles and habitats, especially the Altair Lunar Lander and Lunar Outpost. One investigated component was the bacteria filter element units (BFE) that filters dust and other particulate matter in the ISS. A pressure drop assessment on filters returned from flight was conducted. An experimental evaluation was done in the lab using an existing testing flow setup. The estimated service life for each filter was calculated based on the test results. The second component that was focused on was the acid removal from the process air stream through the use of the trace contaminant control subassembly. This activity involved laboratory apparatus design and operation in order to study the cause of an abnormal increase in pressure drop for a packed bed of lithium hydroxide, which removes acid. It was important to conduct this test in order to replicate the problem on the ground and confirm the current hypothesis for the issue. Lastly, in order to contribute to future developments of the cabin atmosphere for potential lunar surface exploration various filtration techniques for lunar dust were investigated. These techniques are primarily applications that have been researched, developed, or are currently in use in academia or in industry. In conclusion, these three project components will be helpful in attempting to improve upon air quality in varying cabin atmospheres from future flight hardware and life support systems.

Lauren Gardner

Program/Internship Name: MSGR

Education Institution: Alabama A&M University

Major: Mechanical Engineering

NASA MSFC Mentor: Mike Tinker/Nadra Hatchett

Org Code: ES22/ES23

Title of Poster: Ares I Instrument Unit Fastener Analysis and Upper Stage Common Bulk Head Preparation, Installation, and Assembly

Abstract: The National Aeronautics and Space Administration's (NASA) Constellation program is developing a new launch vehicle, Ares I, to send astronauts to the Moon, Mars, and beyond. Ares I is currently being refined to meet safety, operability, reliability, and affordability goals. The quest to complete the Ares I is a nation wide effort that requires the utilization of all aspects of NASA as a whole. Analysis, manufacturing, and fabrication play an extremely important role in the completion of Ares I. Thorough preparation and evaluation are implemented in order to ensure a successful outcome. Branch ES22 of the Marshall Space Flight Center (MSFC) is the mechanical and thermal analysis headquarters for the Instrument Unit (IU) of the Ares I. The IU consists of several components that have to be mechanically and thermally analyzed. The fasteners of the IU are a small but significant component. The fasteners must sustain all loading conditions of the Ares I. Currently, three fastener analysis tools are being used. Using one standard analysis tool would improve consistency and efficiency of fastener analyses. ES23 is the Mechanical Fabrication Branch and headquarters for manufacturing and fabrication. It supports the Upper Stage of Ares I. The common bulk head, located in the Upper Stage of Ares I, is an oblate spheroid that attaches the liquid hydrogen and liquid oxygen tank barrels. The common bulk head consists of two domes joined by honeycomb. An efficient and effective method of machining the honeycomb is needed in order for the domes to properly connect. Expediting this process requires the Hi-bay of building 4705 to be cleared in order to accommodate the necessary machining center. A diligent, efficient, and effective collaborative effort is necessary for the successful completion of Ares I.

Kristen Gooshaw

Program/Internship Name: NASA Academy, ESMD
Education Institution: University of Washington
Major: Chemical Engineering, Computer Science and Engineering, and Paper Science and Engineering
NASA MSFC Mentor: James Knox
Org Code: ES22

Title of Poster: Analytical and Experimental Studies for the Development of Future Life Support Needs

Abstract: The retirement of the Space Transportation System (STS) presents several new challenges that the International Space Station (ISS) will experience. Pure oxygen (~100%) is needed for breathing during Extra-Vehicular Activities (EVA) as well as during the pre-breathing process and purging of the suit's life support systems. Previously, the pure oxygen was collected from the propulsion system on board of the Space Shuttle. One potential solution to this challenge is to use a Pressure Swing Adsorption (PSA) based oxygen concentrator on the atmosphere on board of the ISS. A test stand and experimental procedure has been created to evaluate the success of the proposed solution. A blended gas with the same makeup as ISS air will be processed by the PSA oxygen concentrator and analyzed by a Micro Gas Chromatography to determine the percentage of nitrogen, argon, and oxygen. A few of the problems presented are the chemical similarities of oxygen and argon, and the unknown effects of a higher concentration of argon on human physiology.

Optimization of oxygen is not only valuable for the ISS; it will help also future missions. Based on United States Space Exploration Policy, future visits to the moon will be accomplished using, among other elements, the Crew Exploration Vehicle (CEV), Orion, and the Lunar Lander (LL), Altair. During the Trans-Lunar phase, Altair will be docked with Orion for approximately four days. While they are connected, the crew from Orion will use the space in Altair for several different activities. Both Orion and Altair have their own individual PSA system to remove carbon dioxide and water vapor from the cabins. To save power, the PSA system of Altair will be turned off while in the Trans-Lunar phase. EcoSimPro will be used to simulate the amount of time the crew can spend in Altair before the levels of water vapor or carbon dioxide become too high.

Adam Hoefer

Program/Internship Name: ESMD

Education Institution: Missouri University of Science and Technology

Major: Aerospace Engineering

NASA MSFC Mentor: Mike Tinker / Andrew Schnell

Org Code: ES22

Title of Poster: Optimization of a Lunar Habitat and Stress Analysis of a Solar Concentrator

Abstract: In order to safely inhabit the moon, a habitat must be constructed that is not only safe, but efficient to transport to the moon. Minimizing the mass needed to transport to the moon is a key element in the design process. Several different layers of material will be used to protect the astronauts from the various elements on the moon such as the temperature difference, radiation, and micro-meteoroid/orbital debris. These criteria, along with minimizing up-mass, are included in the optimization process, for which XTOOLS is used as the optimization software package.
Another object being analyzed is a solar concentrator. The solar concentrator has a mirror that reflects light from a large area and concentrates it into a much smaller area, which provides enough energy to extract metal molecules from the lunar regolith. The mirror can be adjusted by its supporting hexapod with adjustable legs in order to achieve the correct angle so the light is concentrated in the correct spot. However, the solar concentrator must first be analyzed to ensure that the hexapod can withstand the weight and forces associated with the mirror.

John L. Polansky
Program/Internship Name: NASA Academy
Education Institution: University of North Dakota
Major: Mechanical Engineering
NASA MSFC Mentor: David Howard
Org Code: ES22
Title of Poster: Test Facility Development for Microlith Sorbent Based Atmosphere Revitalization

Abstract: Vital to the successful establishment of a Lunar Outpost is the development of Atmosphere Revitalization (AR) technologies that are robust, energy efficient, compact and light weight. In order to meet these habitation goals, Precision Combustion, Inc. (PCI) has developed, built and delivered three microlith sorbent modules to the Marshall Space Flight Center for testing in the Environmental Control Life Support Systems (ECLSS) lab.

\One module each has the intention of removing humidity, trace contaminants and carbon dioxide from process air. It is critical that that the ECLSS division fully evaluate each module's capability and performance both individually and in a series configuration.

Therefore, a test facility must be provided that meets the microlith sorbent evaluation criteria. This requirement includes conditioning process air to control inlet humidity, temperature, carbon dioxide and trace contaminant levels, providing electronic control of valves and flow controllers, and also providing data output corresponding to all outlet conditions. Additionally, the facility must be able to test the modules individually or in series.

Ben Briscoe

Program/Internship Name: USRP

Education Institution: Cumberland University

Major: Mathematics/English

NASA MSFC Mentor: Jeremy Myers

Org Code: ES31

Title of Poster: High Speed Parachute Camera (HSPC)

Abstract: The HSPC will utilize Commercial Off The Shelf (COTS) ruggedized hardware to provide an onboard view of parachute deployment for Ares program test flights. Specifically, this summer's work has been geared towards readying the system for flight aboard the Ares I-X. The period of interest is the main parachute deployment. This takes place immediately following Forward Skirt Extension Separation during the First Stage Recovery Sequence.

The poster will provide a brief mission overview including objectives as described above. Also, the poster will describe the function and relationship of flight components.

Josh Hathaway
Program/Internship Name: MSGR
Education Institution: Oklahoma State University
Major: Mechanical and Aerospace Engineering
NASA MSFC Mentor: Dean Alhorn
Org Code: ES32
Title of Poster: International Lunar Network

Abstract: The Moon today presents a record of geologic processes of early planetary evolution. The goal of the International Lunar Network (ILN) is to understand the interior structure and composition of the Moon. In order to do this, NASA has tasked the ILN engineers with properly landing and deploying the science instrumentation. This project is currently in the conceptual, pre-phase A design phase. Therefore, the overall design is constantly subject to change. The payload will consist of instruments that will be used to measure lunar seismometry, heat flow, EM sounding, and laser retroreflection. The hard-landing spacecraft concept is going to release a Penetrator prior to landing to pierce the lunar surface, going approximately 3 meters deep (at 400m/s), in order to deploy the heat flow measurement transducers. The spacecraft itself will experience a landing impact of about 40 times that of Earth's gravity. Selecting electronic components for this impact along with the other space rated requirements can be challenging. The goal of this summer internship experience was to develop advanced concept solutions to the many avionics problems the ILN will be faced with. Among these problems have been: designing the overall system architecture, determining which components need to be developed and tested, and researching off the shelf components to integrate into the system.

Pamela Y. Valdez
Program/Internship Name: SHPE/Society of Hispanic Professional Engineers
Education Institution: University of Texas at El Paso (UTEP)
Major: Electrical and Computer Engineering
NASA MSFC Mentor: David E. Howard & Dennis A. Smith
Org Code: ES32
Title of Poster: Thermostat Design for Multiple Purposes

Abstract: The design process for control and signal conditioning electronics requires several steps. Steps include: design, bread boarding, & analysis, PWB design & layout, populating of the PWB, testing, and incorporating into the flight system. The intent of this project is to go through these steps with a thermostat design. To develop the Thermostat for Multiple Purposes it was first designed on a schematic. The second step included the design of the Printed wiring board PWB, followed by the population of the PWB. The final step was to test the design and make any necessary changes as needed. Thermostats are used to control temperature in many applications such as the temperature of the shell for the Multi-Purpose Logistics Module (MPLM) and the lasers for the Next Generation Advanced Video Guidance System (NGAVGS).

Elizabeth S. Sooby

Program/Internship Name: USRP

Education Institution: Millsaps College

Major: Physics

NASA MSFC Mentor: Mark Krome

Org Code: ES42

Title of Poster: Electromagnetic Interference Shielding Analysis

Abstract: A significant problem in cabling is poor shield termination, which negates shielding effectiveness. A means to avoid EMI (electromagnetic interference) test failures is to inform manufactures and customers of the importance of shielding effectiveness and proper shield termination technique. The tests and analysis performed explore the effects of noise inductively (magnetic field) coupled onto coaxial cables due to various shield termination techniques. Through the two tests and analysis performed, the study proves that the effectiveness and quality of shielding terminations is independent of the shielding material's DC resistance. The conclusion can be drawn that historically accepted termination techniques, such as pig tails, are relatively ineffective as the frequency of the noise increases and likely contributors to EMI test failures

Yemina Leszczuk
Program/Internship Name: MSGR
Education Institution: University of Michigan
Major: Material Science and Engineering
NASA MSFC Mentor: Dr. Terry Rolin
Org Code: ES43 EEE Parts Engineering and Analysis Team
Title of Poster: X-Ray Flourescence Spectroscopy Study of Coating Thickness and Base Metal Composition

Abstract: For electrical, electronic, and electromechanical (EEE) parts to be approved for space use, they must be able to meet safety standards set by NASA. A fast, reliable and precise method is needed to make sure these standards are met. Many EEE parts are coated in gold and nickel, and the thickness coating is crucial to a parts performance. A non-destructive method that is efficient in measuring coating thickness is X-ray Fluorescence Spectroscopy. The X-ray Fluorescence Spectrometer (XRF) is a machine designed to measure layer thickness and composition of single or multi-layered samples. By understanding the limitations in the collection of the data by this method, accurate composition and thickness measurements can be obtained for samples with gold and nickel coatings. To understand the limitations of data found, measurements were taken with the XRF in varying ways and compared to true values of Standard Reference Materials (SRM) that were NIST traceable. For every sample, six different parameters were varied to try to reduce measurement error: coating/substrate combination, number of layers, counting interval, collimator size, coating thickness, and test area location. Each measurement was taken in accordance with standards set by ASTM International Standard B 568.

Jonathan Minder
Program/Internship Name: MSGR
Education Institution: Washington University in St. Louis
Major: Mechanical Engineering/Applied Mathematics
NASA MSFC Mentor: Jeff Brown
Org Code: ES43

Title of Poster: Dielectric Withstanding Voltage (DWV)
IPC-2221A Standards Testing

Abstract: Testing is being conducted on circuit boards to determine the dielectric breakdown on traces at different distances and under different environments using a coating of solithane. Worst case scenarios and real data sets are needed to challenge and explain the current accepted values of voltage failure versus distance.

Nathan Brooks, Josh Calnan, Ches Hall, and Crystal Slavens
Program/Internship Name: Robotics Academy
Education Institution: University of Tulsa (Brooks), University of Kentucky (Calnan), Georgia Tech (Hall), University of South Carolina (Slavens)
Major: Electrical Engineering and Computer Science (Brooks)
Civil Engineering (Calnan)
Mechanical Engineering (Hall)
Mechanical Engineering (Slavens)
NASA MSFC Mentor: Linda Brewster
Org Code: ES62
Title of Poster: Autonomous Rendezvous and Docking of Satellites

Abstract: The Automatic Rendezvous and Docking (ARD) team will be performing research on a project supervised by the Automated Rendezvous and Capture group at the Marshall Space Flight Center. Specifically, the group will be working on modifying the existing architecture for the Large Mobility Platform (LMP), Small Mobility Platform (SMP) and Newmark test beds for iterations of the Advanced Video Guidance System (AVGS).

The mobility platforms operate on an 84' by 44' epoxy "Flat Floor" housed in the Flight Robotics Lab (FRL) at MSFC. Using compressed air, the mobility platforms float on a small cushion of air and each use a series of thrusters to translate and rotate. The LMP is equipped with gyros, accelerometers, laser rangefinders and a corner cube retroreflector array to obtain its position, acceleration and velocity. The SMP has an AVGS which is used to autonomously approach and dock with the LMP using trailer hitch balls mounted on the LMP and cones mounted on the SMP.

The ARD team will also perform hardware and software upgrades on the Newmark test system, which will be used in conjunction with the Next Generation Advanced Video Guidance System (NGAVGS). The NGAVGS will be mounted on a two degree of freedom gimbal and receives measurements from a corner cube retroreflector array mounted on a four degree of freedom target platform.

Adria Brooks
Program/Internship Name: MUST
Education Institution: University of Arizona
Major: Engineering Physics
NASA MSFC Mentor: Todd Macleod
Org Code: ES63
Title of Poster: Irregularities in Electrical Polarization Decay Within Ferroelectric Transistors

Abstract: Ferroelectric materials have the unique ability to hold an electric polarization longer than any other metal. This ability is temporary and it is presently expected that the polarized charge held within ferroelectrics decays at a predictable rate. Tests being run on ferroelectric transistors are not showing predictable polarization decay, however. Irregularities are consistently produced in both the decay of electrical polarization and the re-polarization of the transistors. These irregularities could be produced from structural or thermal strain on the material, from the existence of oxygen vacancies, or from the immobility of charge caused by pinned modes and defect dipoles. The physical presence of these possible defects is considered and their respective effects on the ferroelectric transistors are explored.

The ability of ferroelectrics to hold charge could become useful in increasing the capabilities and speed of computer memory when used in electrical circuits, but not until the polarization can be stabilized.

Nicoya Nobles and Marcus LaRose
Program/Internship Name: MISE , SHPE
Education Institution: Alabama A&M, The University of Texas at San Antonio
Major: Electrical Engineering
NASA MSFC Mentor: Mark James & David Simmons
Org Code: ES63
Title of Poster: Implementation of a Noise Diode and on AMPR Advanced Microwave Precipitation Radiometer

Abstract: This summer we have been assigned to a team of scientists at the National Space Science and Technology Center along with engineers from NASA's Marshal Space Flight Center to work on an Advanced Microwave Precipitation Radiometer or AMPR for short. AMPR is a total power passive microwave that produces calibrated brightness temperatures at 10.7GHz, 19.35GHz, 37.1 GHz and 85.5 GHz. These are frequencies that are sensitive to the emission and scattering of precipitation size, ice, liquid water, and water vapor.

Each intern was assigned a specific task. Marcus was assigned the task to add a third calibration source to AMPR focusing on the 10 GHz channel. AMPR uses two calibration loads to provide the linear calibration of the instrument and my task is to add a noise diode that will provide an additional calibration point, which will improve the accuracy of the data. Nicoya was assigned the task to provide the ability to adjust the level of output signals from the RF receivers to compensate for any thermal drift that will occur due to the high altitude/cold temperature environment that the AMPR instrument will encounter during science missions. This will ensure that the levels going into the Analog to Digital (A/D) converter remain inside the voltage range that the A/D converter can measure.

Alex Thompson

Program/Internship Name: MSGR

Education Institution: University of Alabama

Major: Chemical Engineering

NASA MSFC Mentor: Philip Swofford

Org Code: ET10

Title of Poster: Helium to Hydrogen Trickle Purge Changeover

Abstract: Trickle purges, also called blanket purges, use low velocity gas to maintain a slight positive pressure on piping systems, keeping them dry and free of contaminants. Contaminants in piping systems can damage system components or cause accidents such as fires. The purpose of this project is to supplement trickle purge systems that use helium gas in the West Test Area with new systems that use hydrogen gas instead. By using hydrogen gas instead of the more expensive helium gas, we can improve cost efficiency while also conserving a rapidly depleting helium supply. After gaining a working knowledge of the testing areas and obtaining accurate flow calculations through each system component, we determined the most efficient component types and sizes, operating conditions, and piping layout. We are currently in the design stage of this process, and the new purges will not be installed until after this summer. Once completed this project will provide the West Test Area an equally functional, but more economical and environmentally friendly trickle purge system.

Zack Coppens

Program/Internship Name: MSGR

Education Institution: University of Alabama

Major: Mechanical Engineering

NASA MSFC Mentor: Patrick V. Hull Ph.D

Org Code: EV32

Title of Poster: Ares I Upper Stage Tanking Table

Abstract: The Ares I rocket will deliver 294,000lbs of thrust during the upper stage burn. It carries 14,633 cubic feet of fuel and oxidizer and burns it at an extremely rapid rate. Propellant level analysis is essential for tanking the rocket, dynamic control during flight, thermal analysis, and structural design.

This upper stage configuration of the Ares I rocket houses two propellant tanks separated by an internal partition within the tank assembly that physically divides the fuel from the oxidizer (a common bulkhead). A tanking table was developed to determine the propellant volume at every inch for both the liquid hydrogen and the liquid oxygen tanks. This analysis includes tank internal structures and was evaluated under three conditions: ambient temperature, cryogenic temperature and pressurized cryogenic temperature.

Derrick Tobias Babb
Program/Internship Name: ACCESS
Education Institution: University of Florida
Major: Industrial and Systems Engineering
NASA MSFC Mentor: Dr. Benjamin Penn, Dr. Curtis Banks
Org Code: EV43

Title of Poster: Composite-Overwrapped Pressure Vessels: Towards High Resolution In Situ Structural Health Monitoring Using Optical Fiber Bragg Grating Sensors

Abstract: In this project, a framework for mathematical analysis and model visualization was developed to assess the real-time structural health monitoring of a Composite-Overwrapped Pressure Vessel (COPV) based on data acquired from multiple embedded Fiber Bragg Grating (FBG) sensors during pressurization from ambient to burst. A nonlinear programming approach was used to model the deformation of a COPV.

Grace A. Belancik
Program/Internship Name: USRP
Education Institution: Georgia Institute of Technology
Major: Chemical Engineering
NASA MSFC Mentor: David D. Smith
Org Code: EV43
Title of Poster: Zinc-Coated FBG Cryogenic Temperature Sensors

Abstract: Silica Fiber Bragg Gratings (FBG) are insensitive to cryogenic temperatures unless they are coated with a material having a high coefficient of thermal expansion (CTE), such as Zinc or Indium. High CTE coatings were applied using room-temperature electroless deposition of silver followed by electroplating, thereby avoiding the thermal stresses which can degrade FBG performance. This process yielded a cryogenic FBG temperature sensor that is about three times more sensitive than a bare FBG sensor at room temperature, and is expected to function down to liquid helium temperatures and be three orders of magnitude more sensitive than uncoated FBGs at cryogenic temperatures.

Albanie T. Bolton

Program/Internship Name: Marshall Space Grant and Research (MSGR)

Education Institution: Alcorn State University

Major: Computer Science and Applied Mathematics

NASA MSFC Mentor: Jonathan Patterson

Org Code: EV43

Title of Poster: Implementing Reliable Execution of Abort Failure Detection Algorithms for Ares I Launch Vehicle Using Autonomous Software

Abstract: The Ares I launch vehicle will require capabilities to detect failure conditions which necessitate the crew of the Orion to initiate an abort. Designs for the Ares I launch vehicle system must consider the possibility that failures will arise which require the crew to abort, and provide the means by which the crew can safely escape from the Ares I vehicle in such an event. In this project, we described, analyzed, and documented simulation software which simulates conditions which require an abort. The simulation software is used to develop algorithms necessary to detect specific abort conditions defined in the Ares I Abort Conditions Report (ACR). NASA's ultimate purpose/goal is to create an abort failure detection, notification and response system that will alert the crew of the need to abort; and, where possible, to take action to minimize damage and prevent catastrophic failures.

In order to test these abort condition detection algorithms, there is special software that is used to simulate various vehicle and environmental conditions. The conditions could possibly range from ruptures or breakage of structural parts to minor anomalies. By creating a system of this caliber, we will ensure that the software can detect abort conditions while crew members are aboard to facilitate their safe escape from a failing vehicle. Additionally, it will ensure that the software will not make a false recommendation to abort when conditions do not necessitate such a response. Thus, it will create a heightened sense of confidence and security in the Ares I launch vehicle.

Neyvin De Leon
Program/Internship Name: SHPE
Education Institution: Cornell University
Major: Mechanical Engineering
NASA MSFC Mentor: Curtis Banks
Org Code: EV43
Title of Poster: A Novel Fiber Optic Fabry-Perot Pressure and Temperature Sensor

Abstract: A novel approach is presented for fabrication of a Fabry-Perot sensor for measuring pressure and temperature. The sensor was fabricated by etching a cavity from a single mode fiber and fusing it to an un-etched fiber. Preliminary data from the fabricated sensor showed feasibility of a low cost micro-sensor compared to a MEMs technique.

Naheerah King
USRP Program/Internship Name: USRP
(Undergraduate Student Research Program)
Education Institution: Alcorn State University
Major: Computer Science
John T. Wiley
Org Code: EV43
Title of Poster: Space Sensors and Measurement Techniques –
The Art of Web Design and Programming

Abstract: I have had two distinct tasks during my summer internship. The first involved designing and debugging a website. Web design is a process of conceptualization, planning, modeling, and execution of electronic media content delivery through the internet in the form of technologies (such as markup language) appropriate for interpretation and display by a web browser or other web-based graphical user interfaces. The main purpose of web design is to create a website that is functionally easy for website users to provide the necessary and requested information for customers. The website will accommodate the needs of the owner in bringing data from outside entities that can be used for a wide variety of applications. Such elements as text, forms, and bitmapped images (GTF's, JPEG's, and PNG's) can be placed on the page using HTML, XHTML, or XML tags. I created a web page entitled Space Sensors and Measurement Techniques (The art of making accurate and reliable measurements) with different links and forms. My second task was the processing of optical sensor data using MATLAB. I learned various applications using MATLAB fundamentals and programming techniques. The purpose of this exercise was to process data from optical detectors into engineering units. MATLAB language is a user friendly, intuitive syntax, favoring simplicity. It is a high-level language, making it possible to carry out computations in a line or two that would require hundreds of lines of code in languages such as FORTRAN or C. MATLAB allowed me to interactively read data, plot data, and use expressions to compute new variables. In MATLAB I performed array multiplications and powers by over-riding the default matrix operations. Systems of linear equations in MATLAB can be expressed by creating variables for the coefficient matrix and the vector of constants on the right hand side of the equation. In Matlab I learned to edit and view multiple plots, graphs, and 3D matrix data using plot tools. The basic plotting commands are surf, imagesc, and contour. Throughout the time here I have developed skills in MATLAB and web design.

Michael LaBarbera
Program/Internship Name: Visiting Student Researcher
Education Institution: University of Cincinnati
Major: Electrical Engineering
NASA MSFC Mentor: Clint Patrick
Org Code: EV43
Title of Poster: Fault Mitigation in Communication Lines using Reconfigurable Computing

Abstract: In the harsh environment of space, high energy particles are just one example of the kind of events that can cause errors in electronics and even damage equipment. Using Field Programmable Gate Arrays, we can create a system that can detect when damage has occurred in a communication line and solve the problem without needing any additional hardware or human interaction. Today, these damaged systems need to be thoroughly examined to find where the fault is and the system must be replaced. This cutting edge system can be applied to current and upcoming systems to automatically detect and bypass the fault, thus increasing the efficiency and lifetime of hardware at little additional cost.

Nehemiah James Mabry
Program/Internship Name: Minorities in Science and Engineering (MISE)
Education Institution: University of Alabama in Huntsville/Oakwood University
Major: Applied Mathematics/Civil Engineering (Structural)
NASA MSFC Mentor: Clint Patrick and Dr. Robert Ray
Org Code: EV43
Title of Poster: Reconfigurable Computing:
Fast Fourier Transforms in Image Processing

Abstract: In preparation for future long-term space flight missions, NASA has initiated the Radiation-Hardened Electronics for Space Environments (RHESE) project. Considering the harsh conditions of these off-world missions, an obvious concerned is the capability of these electronic devices to provide necessary resources without the drawbacks of launching large components. Therefore a Reconfigurable Computing (RC) subtask has been setup. It is to examine technologies with universal compatibility and flexibility that have complete modularity for a myriad of purposes. An elemental computing array chip (ECA-64) is being developed with these capabilities; one of which lends itself to computation of Fast Fourier transforms (FFT) algorithms for the purpose of Image processing. It has been my work this summer to assist Dr. Bob Ray in implementing these computations into ECA-64 chip.

Gabriel Montemayor
Program/Internship Name: SHPE
Education Institution: Massachusetts Institute of Technology
Major: Computer Science and Engineering
NASA MSFC Mentor: Jon Patterson
Org Code: EV43
Title of Poster: Ares 1 Abort Conditions Database

Abstract: The Fault Detection Diagnostics and Response (FDDR) group analyzes Failure Mode Effect Analysis (FMEA) and the Hazards list to produce a list of monitored and non-monitored abort conditions which are events that requires the crew to get off the vehicle. Abort Conditions are mapped to FMEAs and Hazards. An assessment of an abort condition is made after considering the specifications of each associated FMEA and/or Hazard. My project involved creating an MS Access database to help structure this information and improve data retrieval. The data is currently located on spreadsheets. Moving it to a database will allow custom form views with only relevant data for each group currently accessing the spreadsheets. Through the database mapping, users may quickly access data tied together through relationships instead of manually searching for related components.

Bryan Reese
Program/Internship Name: MSGR
Education Institution: Mississippi State University
Major: Electrical Engineering
NASA MSFC Mentor: Curtis Banks
Org Code: EV43
Title of Poster: Structural Health Monitoring by Acousto-Optics with Chirped Fiber Bragg Gratings

Abstract: This experiment focuses on a structural health monitoring technique based on acoustic emission detection by fiber Bragg gratings (FBGs). A chirped fiber Bragg grating allows a linear response over a wide wavelength. When used in conjunction with FBGs, an acoustic response can be detected. The advantage of this technique over traditional acoustic emission is light weight, magnitude of damage, damage location, and strain. This paper presents the theoretical approach and measurement process of the system. Preliminary experiments have been performed to test this process, and the results are presented

Ethan Rhodes
Program/Internship Name: MSGR
Education Institution: George Fox University
Major: Electrical Engineering
NASA MSFC Mentor: Jonathan Patterson
Org Code: EV43
Title of Poster: Object Detection and Avoidance with the Swiss Ranger 3000

Abstract: Object Detection and Avoidance (ODA) is a critical area of development for NASA. New ODA technology is needed for both Lunar and Mars vehicles. The research described here is composed of both data acquisition using the SR-3000 camera and data analysis and ODA algorithm development using the MATLAB computing language. Through this summer's research, significant advancements have been made in data analysis and 3D representation which will aid more complete ODA algorithm development in the future.

Avery Simon

Program/Internship Name: ESMD

Education Institution: West Virginia University

Major: Electrical Engineering, and Computer Engineering

NASA MSFC Mentor: Andrew Keys/Clint Patrick

Org Code: EV43

Title of Poster: Reconfigurable Computing

Abstract: Reconfigurable Computing is a sub-task of Radiation-Hardened Electronics for Space Environments (RHESE). The goal of reconfigurable computing is to develop computing elements that can automatically and eventually autonomously rearrange their internal configuration/ programming to perform functions other than what they were originally intended. In addition, these elements should be able to deal with their own physical damage and be able to work around it. The goal for the RC group this summer has been to develop a demo of a basic implementation of reconfigurable computing in the form of a small robot. My task was to take an existing simple motor control program and make the control more efficient and more precise, as well as, give the motor a simple intelligence that allows it to deal with unknown circumstances and learn from past events.

Noemi Torres
Program/Internship Name: SHPE
Education Institution: UAHuntsville
Major: Computer Science
NASA MSFC Mentor: Dr. Craig Moore
Org Code: EV43
Title of Poster: Interfacing the SICK-LIDAR

Abstract: This summer I was responsible for the interfacing of the SICK-LMS 200. This measurement sensor is currently being used on various robotics such as the R-Gator which is an autonomous robotic vehicle developed by John Deere that enforces successful navigation, obstacle avoidance, and road following. The SICK-LMS 200 has been considered being used on the test stand for the Ares I and possibly for autonomous vehicles in space.

The goal for the research project was to provide a friendlier graphical user interface. This interface would help users detect any possible objects that could come into contact with the sensor. The program generated would also be able to store real time data acquired by the sensor for future modifications.

Emily Bowsher

Program/Internship Name: NASA Academy

Education Institution: Georgia State University

Major: Physics and Astronomy

NASA MSFC Mentor: Bill Cooke

Org Code: EV44

Title of Poster: Meteor Detections and Lunar Impact Monitoring

Abstract: In order to safely travel and spend extended periods of time in space, one must understand the meteoroid environment both in and beyond Earth's orbit. A thorough knowledge of this environment is required for the design of spacecraft, habitats, and EVA suits, all of which must be able to withstand everyday meteoroid impacts and the ejecta produced during the creation of an impact crater. One of the most important aspects is meteoroid speed. The Meteoroid Environment Office (MEO) observes meteors in Earth's atmosphere and meteoroids impacting the Moon in an effort to better understand the velocity distribution of medium-large meteoroids (~500g or 1 lb). MEO is in the process of setting up two networked Sentinel all-sky cameras for meteor detection. The data from these two cameras will allow the determination of the speed of the meteor entering Earth's atmosphere. The size of the meteors detected by the camera is comparable to the size of the impactors detected on the moon, so speeds determined with the all-sky cameras should correlate to the speed of the lunar impactors.

For two and a half years, MEO has observed the non-illuminated portion of the moon in crescent phase, detecting the flashes of light generated by meteoroid impacts. The fraction of the incoming meteoroid's kinetic energy that is converted into this light is called the luminous efficiency of the meteoroid. In order to better determine the luminous efficiency of the observed lunar impacts, hypervelocity impact experiments were conducted at the NASA Ames Vertical Gun Range (AVGR). Careful testing of the filters and cameras used to record these experiments is required in order to accurately interpret the data and therefore accurately extrapolate the speed and other impact parameters of the observed meteoroid hitting the moon.

Catherine C. Keys
Program/Internship Name: USRP
Education Institution: University of Michigan
Major: Atmospheric, Oceanic, and Space Science Engineering
NASA MSFC Mentor: Hilary Justh
Org Code: EV44
Title of Poster: Mars GRAM: Landing site selection.

Abstract: A major factor in any outdoor activity is the weather. From a picnic to the launch of the space shuttle weather plays an important role. Global Reference Atmosphere Models (GRAMs) are programs designed to model the atmospheres of celestial bodies for a variety of engineering applications. Currently EV44 provides users with GRAMs for Earth, Titan, Neptune, Venus, and Mars. GRAMs provide a broad view of the atmospheres they model, giving both large-scale patterns of atmospheric variation and small-scale, turbulence-like perturbations about the mean . These simulations are useful to many groups wishing to deal with an atmosphere on a regular basis. Mars GRAM models the atmosphere of Mars and has been validated by Mars Pathfinder and Mars Global Surveyor observations, and by comparison with two different Mars mesoscale atmospheric models. Because of the proven quality of Mars GRAM, NASA intends to use it to help select viable landing sites for future Mars missions including Mars Science Laboratory (MSL).

Anthony Usher

Program/Internship Name: Minorities in Science and Engineering (MISE) Program

Education Institution: Oakwood College/University of Alabama in Huntsville

Major: Applied Mathematics/Electrical Engineering

NASA MSFC Mentor: Dr. Jonathan Campbell

Org Code: EV44

Title of Poster: Earth Defense: Protecting the Earth from Potentially Hazardous Objects (PHOs) such as Asteroids, Meteoroids, and Comets

Abstract: About 65 million years ago, a small asteroid is believed to have struck the Earth in the Yucatan Peninsula area. The result of this impact is believed to have resulted in the mass extinction of dinosaurs. A more recent impact occurred in Tunguska, Siberia on June 30, 1908. The result of this impact was the devastation of about 500,00 acres of trees. Protecting the Earth from impacts with Potentially Hazardous Objects (PHOs) has become an important priority for the NASA administration. According to NASA "as of July 14, 2008," 5533 Near-Earth objects (NEOs) have been discovered. 746 of these NEOs are asteroids with a diameter of approximately 1 km or larger. Also, 950 of these NEOs have been classified as Potentially Hazardous Asteroids (PHAs). A 2-km object is known to be capable of causing catastrophic damage. Asteroids and comets are two of the main types of Near Earth Objects (NEOs) encountered. Asteroids are relatively rocky or metallic objects without atmospheres. Comets are bodies of ice, rock, and organic compounds that can be several miles in diameter. There are still many other Near Earth Objects (NEOs) that have not been even detected yet and their orbits are also unknown. With that said, finding ways to protect the Earth from potential impacts with these kinds of dangerous phenomena is very important and presents a difficult challenge. Unlike other natural disasters, such as earthquakes, tsunamis, hurricanes, and tornadoes, which cannot be prevented, the threat posed by Near Earth Objects (NEOs) can be lessened provided an adequate amount of warning time. In order to effectively meet this challenge head on, several detection techniques for tracking these Potentially Hazardous Objects (PHOs) are currently being implemented as well as future techniques being developed.

Elias Jaffa

Program/Internship Name: USRP

Education Institution: Brown University

Major: Cognitive Neuroscience

NASA MSFC Mentor: James Andrews & Diane Cain

Org Code: HS10

Title of Poster: Leadership at NASA: Present and Future

Abstract: Over the next several years, NASA will undergo several organizational changes. As the Shuttle is phased out and the Constellation Project begins to take shape, the organization will be switching an enormous workforce from an operational to a design mindset. Several years further on, it will be adjust to the management of a permanent contingent of humans on the moon, and even later on, potentially one on Mars. The extreme isolation involved, the technical hurdles that must be overcome, and the ever-changing workforce are all challenges that the NASA leadership will have to face. Among the areas that will need to evolve if they are to succeed are:

- Communication structure (both between ground control and astronauts and between the centers and organizations within NASA)
- Leadership styles of managers (at all levels)
- Focus put on physical vs. psychological challenges of surviving in space

Paul McNeil
Program/Internship Name: MISE
Education Institution: Oakwood University
Major: Computer Science
NASA MSFC Mentor: Yvonne Quinn-Cantrell
Org Code: IS40
Title of Poster: Lockheed Martin Property Management

Abstract: Lockheed Martin Information Technology works diligently in order to meet the goals MSFC has set for it in their contract. Its progress is charted by system called Metrics. Lockheed's goal to receive, deliver, and setup systems within ten days of MSFC approving the order, affects the warehouse more than any of the other requirements. To meet this standard, the warehouse receives, stores, and delivers hundreds of assets each month for MSFC. Further, it prepares older systems for donations to schools and many nonprofit organizations. This summer I was trained to perform in each of the above mentioned responsibilities of the warehouse.

Allen Boswell

Program/Internship Name: USRP

Education Institution: University of North Alabama

Major: Computer Information Systems

NASA MSFC Mentor: Linda Dinges

Org Code: QD10

Title of Poster:Systems, Applications and Products in Data Processing

Abstract: The Safety and Mission Assurance office is located on the second floor of building 4203. According to the Safety and Mission Assurance (S&MA) mission they plan, establish, implement, and direct all safety and mission assurance programs for Marshall Space Flight Center (MSFC). One of the main tools in the S&MA department is the Business Warehouse (BW) web application. This application allows the S&MA to obtain information from the SAP database by running BW queries such as official labor, accounts payable, accounts relievable, budget execution, cost management, purchasing, general ledger, travel, and standard management.

Christina L. Amos
Program/Internship Name: MSGR
Education Institution: Auburn University
Major: Industrial & Systems Engineering
NASA MSFC Mentor: Dennis Davis
Org Code: QD12
Title of Poster: Fixed Ladder Safety at MSFC

Abstract: At the end of last year, there was a mishap at MAF where a worker fell from a 14-foot industrial ladder and suffered severe injuries. A contributing factor to the fall was that the ladder was not installed per design and therefore not compliant with OSHA standards. A sample size of 40 ladders at MSFC was chosen to be observed in order to determine if MSFC had similar problems with OSHA compliance. After examining the ladders for over 30 attributes, several problematic trends were discovered. There were three common non-compliances. These include: the top rung was too high/low, the rungs were not non-slip, and the cage was not flared. Other findings include: absence of a required landing, absence of a required cage, the bottom rung was too high, the handlebars were not extended, and various housekeeping issues. 92% of ladders had at least one attribute that was not OSHA-compliant. Because the results of this sample are so poor, the sample size will be increased to include all of the fixed ladders at MSFC. Once all ladders are observed, a committee will rank the findings in order of severity and begin correcting the problems.

Kandy Yarbrough

Programs/Internships Names: Minorities in Science & Engineering (MISE)

Education Institution: Oakwood University

Major: Mathematics

NASA MSFC Mentor: Carolyn Goodloe

Org Code: QD33

Title of Poster: "Likelihood of Deflagration Due to Hydrogen and Oxygen Leaks in the Interstage"

Abstract: The interstage is the main structural interface between the first stage and upper stage of the Ares I. Inside the interstage is the upper stage engine. The only sources of hydrogen and oxygen considered are leaks. The potential exists for hydrogen and oxygen to leak into the interstage region due to various reasons, such as ball valve manufacturing errors and scratches, debris, etc. A process called the Monte Carlo Simulation integrated into Decisioneering's Crystal Ball and Microsoft Excel spreadsheet will be used to calculate the probability of an explosion at any given time, altitude, and pressure using the lower flammability limit (LFL) and the upper flammability limit (UFL) of hydrogen and the limited oxygen index (LOI). The LFL is the percentage of hydrogen needed for an explosion to occur. The UFL is the percentage of hydrogen, if exceeded will not cause an explosion. The LOI is the minimum concentration of oxygen that will sustain flame increase in a combination of fuel, air, and nitrogen. Due to an insufficient amount of pressure essential for deflagration, any time after 117 seconds can be disregarded. After carefully analyzing the data from the spreadsheet, a realistic estimation of the risk will be determined.

Frank W. Barnes IV
Program/Internship Name: NASA MUST Program 2008
Education Institution: Embry-Riddle Aeronautical University
Major: Aerospace Engineering
NASA MSFC Mentor: Van L. Strickland
Org Code: QD34
Title of Poster: Ares I Inadvertent Separation Destruct System (ISDS) Failure Analysis

Abstract: The Inadvertent Separation Destruct System (ISDS) automatically activates the Flight Termination System of the Ares I Crew Launch Vehicle (CLV). Automatic activation occurs in the case of: inadvertent stage separation, structure failure during the ascent phase, or vehicle break-up. The ISDS triggers the FTS through a simple break-wire activation system. This auto-destruct capability of the ISDS minimizes: time delay in response to vehicle break-up (approx. 50ms), launch area risk, and debris dispersion; the ISDS also does not require ground tracking and commanding, eliminating a series of potential failure modes associated with human imprecision and error. Inadvertent separation destruct systems are used for un-crewed launch vehicle flights only, historically being installed on Expendable Launch Vehicles (ELVs) and ballistic missiles. The Ares I Project is currently in the preliminary phase of the design cycle; From a Launch Systems Integration Systems Safety perspective, each system/sub-system level interaction of the Ares I CLV must be thoroughly examined in order to identify potential faults, hazards, and failure modes. The Inadvertent Separation Destruct System was analyzed using a failure identification methodology known as Fault Tree Analysis (FTA). Utilizing the resulting fault tree, the most critical and probable failure modes were identified.

Amanda Campbell
Program/Internship Name: USRP
Education Institution: University of Alabama
Major: physics
NASA MSFC Mentor: Melissa McGrath
Org Code: VP01
Title of Poster: Europa's Tenuous Atmosphere

Abstract: Europa is the smallest of Jupiter's four Galilean moons. It is about the same size and density as Earth's Moon, but is subject to much greater tidal forces from Jupiter. Europa is covered with a water ice crust and has the possibility of a global subsurface ocean of liquid water. Solar radiation and charged particles from Jupiter's magnetosphere bombard the surface of Europa, breaking apart the water and "sputtering" the hydrogen and oxygen components. The lightweight hydrogen molecules escape Europa's gravity while the oxygen molecules accumulate to form a tenuous atmosphere. Observations made by Hubble Space Telescope on October 5, 1999 show the complexities of this atmosphere through HI Lyman–α, OI 1304 Å, and OI 1356 Å emissions.

Benjamin M. DiMiero, EI
Program/Internship Name: Marshall Space Grant Research Project (MSGR)
Education Institution: Norwich University
Major:Mechanical Engineering
NASA MSFC Mentor: Marty Kress
Org Code: VP02/NSSTC
Title of Poster: VCSI Business Model and Current Projects

Abstract: The Von Braun Center for Science and Innovation (VCSI) is a not-for-profit charitable organization (501(c) 3) that has been implemented in Huntsville in order to bring the city's technical innovators together to work cooperatively. The organization serves as Huntsville's front door in order to attract technical and scientific professionals from across the country to the region. The primary focus of VCSI is to push the continued development of desirable technical assets that are not fully developed, which have a technology readiness level (TRL) ratings of either a 4 or 5. VCSI is a bridge for the technical innovation, which can later be developed by other investors at the TRL levels 8 or 9.

The board consists of Huntsville's highest level government, university, and corporate officials, and currently chaired by Marty Kress. The current projects of VCSI consist of a vast array across the technical spectrum; from humanitarian and environmental projects, such as Servir, to robotic applications for soldiers. Projects also consist of biological research in Antarctica to investigate extremophiles, which recently discovered a new life form. VCSI has done over $10 million in business last year; currently running 13 different projects with many technical investors at its front door.

Joseph Holland

Program/Internship Name: NASA Academy

Education Institution: The University of Alabama

Major: Aerospace Engineering

NASA MSFC Mentor: Marty Kress

Org Code: VP02

Title of Poster: The University of Alabama - MSFC: Instrument Validation

Abstract: Through a desire to create a program that fosters cooperation between MSFC and the University of Alabama, my mentor charged me to perform a case study for an instrument validation program using a unique aircraft owned by the University of Alabama. The UA - MSFC Instrument Validation Program is the product of our work and will provide Marshall Space Flight Center projects with an easy to use, cost effective platform for instrument validation. The underlying motivations stem from several issues. While scientists can create truly amazing sensors and instrumentation, flight opportunities can be quite expensive and very difficult to come by. A low cost, available, and local asset for instrument validation is something that could be extremely beneficial to NASA scientists. One reason a scientist can have problems finding flight opportunities is that many times the instrumentation is developed without a platform in mind. If we can put a flight platform into the equation during the research and planning stages of a project, scientists will have a platform readily available when their instrumentation is ready. Secondly, the educational benefits that would arise from students being exposed to such instrumentation and the associated flight campaigns are substantial. Students at the University would have opportunities to work with world class scientists, learn about their instruments, integrate them into the aircraft, and assess the test results and data products. If such a concept could be formulated between NASA MSFC and the University of Alabama, it could easily be expanded to include the U.S. Army, NOAA, TVA, USDA etc.

Kyle Chavez
Program/Internship Name: ESMD
Education Institution: New Mexico Tech
Major: Mechanical Engineering
NASA MSFC Mentor: Carole McLemore and John Fikes
Org Code: VP33
Title of Poster: Size and Composition Variations in Lunar Samples and Simulants

Abstract: Lunar simulants are manmade materials created to replicate physical and chemical properties of lunar soil. These simulants are used by engineers and scientists in experiments pertaining to future lunar missions. In order to aid in current and future simulant development, the lunar soil itself must first be understood. The similarities between these soil samples and simulants must be studied and quantified as well. Natural size variations of Apollo lunar samples were examined. Also, the sizes and compositions of lunar samples and simulants were compared. Data was collected from several credible sources, normalized, and entered into comparison algorithms in the Figure of Merit software developed by Teledyne Brown Engineering, Inc. and NASA. Variations in all the Apollo lunar samples were found, with size similarity between subsamples and an average of Apollo samples ranging from 74% to 99%. The likeness of simulants to these lunar samples also varied. Size similarity between samples and simulants ranged from 48% to 81%. Composition similarity ranged from 32% to 65%. Additional size FoM runs will be performed with other data since the current data contains grain sizes analyzed by different methods. From these studies, it can be seen that creating a single simulant that replicates all lunar soil is impossible. Companies should instead focus on development of many different simulants that instead replicate specific types or characteristics of lunar soil.

Paul Drews, Maegan Grady, Robert Rucker, Jessica Tham
Program/Internship Name: NASA Robotics Academy 2008
Education Institution: MST, SMC and UND, VU, LTU
Major: EE and CompE, Math and EE, EE, ME
NASA MSFC Mentor: Dr. Ken Fernandez, assisted by Richard Fischer
Org Code: VP33
Title of Poster: UAV and UGV Systems Team

Abstract: This project simulates a demonstration in which unmanned air and ground vehicles cooperate to accomplish autonomous surface vehicle docking. These capabilities are necessary for autonomous vehicles to haul loads and cooperate without human intervention. The simulation includes models of the MARCbot and R-Gator UGVs and Raven and Fire Scout UAVs. All simulated models have the ability to follow a list of pre-programmed waypoints. The R-Gator has the additional ability to dock with a trailer using the simulated output of an AVGS automated docking sensor. The Raven first flies in a search pattern to locate the trailer. MARCbots then deploy in order to attain greater situational awareness and allow the R-Gator to more precisely locate the trailer. Lastly, the R-Gator drives in front of the trailer, uses the docking sensor to attach to the trailer, and returns to base. Another program in this project determines the location of an event given the time difference of arrival at 4 different base stations. This has many possible applications, including locating seismic events on the moon, finding the source of a gunshot, or using RF based location to navigate where GPS is not available.

Frank Marturello
Program/Internship Name: MSGR
Education Institution: Boise State University
Major: Mechanical Engineering
NASA MSFC Mentor: Terri Tramel
Org Code: VP33
Title of Poster: Cryogenic Fluid Management: Multi-layer Insulation.

Abstract: One of the goals of Cryogenic Fluid Management (CFM) is to minimize the transfer of heat through the walls of the cryogenic propellant tank in order to prevent boil-off. Multi-layer insulation (MLI) helps to achieve these goals in the vacuum of space where the main source of heat leak is due to radiation. MLI is composed of sheets of double-aluminized Mylar (DAM) separated by layers of Dacron netting. Spray on foam insulation (SOFI) is applied beneath the MLI to prevent heat transfer while on ground hold. MLI is increasingly important as the duration of missions becomes longer. As a result we must analyze possible heat leak and damage from space debris on various densities. In order to conduct these tests a procedure for making samples of MLI was needed.

Brian Taylor
Program/Internship Name: USRP
Education Institution: Missouri University of Science and Technology
Major: Aerospace Engineering
NASA MSFC Mentor: Jimmy Lee
Org Code: VP33
Title of Poster: Automated Rendezvous and Docking Testing and Support of NGAVGS/Time of Flight

Abstract: The NGAVGS (Next Generation Advanced Video Guidance Sensor) and Time of Flight sensor are two systems in development by NASA to be used for Automated Rendezvous and Docking. The Flight Robotics Laboratory has been used to test and support the development of these systems. This project is a part of the Undergraduate Student Research Program (USRP) and supports the testing and development of the NGAVGS and the Time of Flight sensor. Long range tests of the NGAVGS were done at three and five kilometers. Short range tests of the NGAVGS in the Flight Robotics Lab consisted of laser power testing, optical power testing, the characterization of the laser profile, and field of view testing. The Time of Flight underwent range testing as well as lens testing. The analysis of reflector visibility along multiple trajectories was used to support the progress of the NGAVGS. The presentation of the NGAVGS system to commercial companies such as Space X and Orbital Sciences was also supported. The details of these tests and supporting work have been analyzed to improve the performance of the NGAVGS for future Automated Rendezvous and Docking missions.

Xiaoyu Shi
Program/Internship Name: Undergraduate Student Research Program (NASA USRP)
Education Institution: University of Michigan
Major: Biomedical Engineering
NASA MSFC Mentor: Michael Effinger
Org Code: VP52

Title of Poster: Experimental Package Development for Rapid Microbial Detection via Microarray-based Analysis

Abstract: Recent research being conducted by the Lab-on-a-Chip Applications Development (LOCAD) team at Marshall Space Flight Center has focused on the development of a novel biological molecule detection system known as the Microbial Analysis Proof-of-Concept (MAPOC) unit. The MAPOC system, unlike many conventional laboratory instruments, integrates antibody microarray-based technology and analysis equipment in a compact, portable package. As a result, MAPOC has the potential to offer low-cost detection of hundreds of targets including viruses, fungi, and bacteria in a fraction of the time that current analytical methods would require. MAPOC technology will eventually be applied towards the development of tools used to monitor the health of astronauts and to assist in the search for life in missions to the Moon and Mars, among other applications. This particular project will validate basic underlying theory and construct the experimental infrastructure necessary for breadboard evaluation of the MAPOC system in preparation for its deployment in the 2008 Arctic Mars Analog Svalbard Expedition. It has been shown that the use of antibody microarrays to capture fluorescently-labeled samples is a feasible technique for the detection of particular molecules of interest. However, the incorporation of such microarrays into a transportable apparatus capable of full-featured analysis has not yet been achieved. Consequently, the primary goal of the project is to demonstrate the successful operation of the packaged MAPOC system in the field. As of current writing, the MAPOC breadboard unit is being prepared for final assembly and preliminary testing.

Adrian Albert
Program/Internship Name: NASA Academy
Education Institution: Jacobs University Bremen, Germany
Major: Astrophysics
NASA MSFC Mentor: Dr. Hugh Christian/Dr. Richard Blakeslee
Org Code: VP61

Title of Poster: BLITZER: A data analysis package for lightning investigations using electric field change meters

Abstract: Existing field sensor networks such as the Electric Field Mill Network at NASA Kennedy Space Center employ sensors working in the Hz range, capable to detect the variation in electric field at the ground produced by lightning, but unable to resolve the secondary discharge structures (possibly K-strokes or J-strokes) occurring at faster time scales. The upcoming Huntsville, Alabama Field Change Array aims to address this issue, allowing data acquisition in the MHz range, thus opening up the possibility of accurately recreating the lightning charge distribution. To enable processing and analyzing the large amounts of data taken with the FCM, we introduce BLITZER, a dedicated IDL software package. BLITZER allows easy access to the FCM database and data visualization via an intuitive graphical user interface (GUI). The system provides semi-automatic identification and retrieval of lightning events, which results in a significant reduction in memory storage for the data needed for analysis. Moreover, BLITZER implements a peak search algorithm to aid users in consistently identifying notable field changes captured by the FCM network. On the analysis part, we have implemented the current methods of identifying the time and location of lightning initiation using signal time of arrival information (TOA). The user can retrieve the charge transported by the lightning using the electric field change data and an implementation of a chi-square fitting to a point charge lightning model.

Leandra R. Mangieri
Program/Internship Name: USRP
Education Institution: University of Alabama at Birmingham
Major: Biology
NASA MSFC Mentor: Dr. Bill Crosson
Org Code: VP61

Title of Poster: Temperature Change and its Effects on Heat-Related Mortality in Metropolitan Areas

Abstract: The poster will provide graphical evidence for the correlation between deaths caused by oppressive heat events and yearly temperature change over the summer period. Minimum and maximum temperature data for the months May through September of the years 1971 to 2007 was taken for nine metropolitan areas which include the following cities: Chicago, Cincinnati, Dallas, Detroit, Houston, Philadelphia, Phoenix, San Francisco, and Washington D.C. Graphs of average temperatures for each day of the summer months were constructed along with outliers that represented the abnormally high temperatures of heat events. Graphs were done for average min, average max, and average mean temperatures. The poster will also present a chart that displays the ranking of heat-related deaths in the chosen cities for the years 1999-2001. Another series of graphs and charts will show trends of yearly average temperature change year by year for each city. Final conclusions will be drawn by either charts or graphs that correlate the number of heat events, deaths by year, and total deaths for all years with yearly average temperature increase. The ultimate goal is to identify which cities are most susceptible of experiencing a general increase of heat-related deaths based on the nature of their temperature trends. The conclusions presented in the poster constitute the preliminary research for a public-health research project that will investigate the correlation between heat-related deaths, temperature trends, and population density of metropolitan areas and their associated rural areas.

John Sears

Program/Internship Name: NASA Academy

Education Institution: Plymouth State University

Major: Meteorology

NASA MSFC Mentor: Robbie Hood

Org Code: Earth Science VP61

Title of Poster: "Understanding Hurricane Intensity Using Sea Surface Height and Temperature Information"

Abstract: The relationship between sea surface temperature (SST) and tropical storm intensity is very well understood, but the surface is only a piece of the ocean-hurricane relationship. Conventional understanding suggests SST above 80°F and a well mixed warm water layer at least 150ft deep are needed to support storm intensification. This warm water layer can be estimated using satellite observations of Sea Surface Height Anomaly (SSHA). SSHA is the physical elevation of the sea surface and works on the principal of density differences of warm vs. cold water yielding Ocean Heat Content (OHC). We will compare SST and SSHA to aircraft observations of hurricane intensity of three storms in the 2005 season to gain better understanding of the impact of OHC to convective intensity within a hurricane.

Brent Roberts
Program/Internship Name: Graduate Student Researcher's Program (GSRP)
Education Institution: Florida State University Major: Meteorology
NASA MSFC Mentor: Pete Robertson
Org Code: VP61

Title of Poster: Using Neural Networks to Predict Near-Surface Specific Humidity from SSM/I

Abstract: Predicting near-surface specific humidity from satellites provides an effective way to obtain global coverage of a key atmospheric variable. Changes in near-surface specific humidity directly relate to changes in the turbulent exchange of latent heat, a primary component of the global energy cycle. Traditionally, specific humidity is predicted over the ocean from satellites using multiple linear regressions (MLR) found from co-located brightness temperatures and surface observations. This study focuses on using a non-linear neural network to find an empirical relationship capable of predicting the near-surface specific humidity. It is shown that this method can reduce errors in comparison to MLR methods and should be considered as a viable alternative for predicting surface layer humidity over the ocean.

Robert G. West, and Alfredo N. Wetzel
Program/Internship Name: MSGR
Education Institution: Harding University, University of Michigan
Major: Physics, Mathematics and Aerospace Engineering
NASA MSFC Mentor: Dr. Douglas Rickman
Org Code: VP61
Title of Poster: Density Analysis of Lunar Core Radiographs & Stereological Methods for Lunar Core Thin Sections

Abstract: Following each Apollo mission, lunar core samples were radiographed and subsequently dissected. Post mission analysis has given the scientific community a good understanding of the average density values of the lunar regolith and the size distribution of particles smaller than 1mm. The first part of our research addresses variations of the density and porosity, as a function of depth, that are not readily accessible from earlier laboratory analysis. We developed an algorithm for calculating a map of the effective density of the lunar core material given the optical density data from digitized radiographs. In the second part of our research, we used images of the dissected lunar cores to produce approximations for the number frequency of particles bigger than 0.5mm. Using the stereological assumptions of spherical and ellipsoidal particles, we were able to produce histograms of particle frequency and obtain an overall representation of the size composition within the core samples.

Joshua Anthony, and Jasmine McDaniel
Program/Internship Name: MISE
Education Institution: Oakwood University
Major: Biochemistry, Biology
NASA MSFC Mentor: Dr. Richard Hoover, Dr. Elena Pikuta
Org Code: VP62
Title of Poster: Analysis of Bacteria Extremophile Str. ARHSd-7g

Abstract: Astrobiology seeks to find, understand, and explain the origins of life from our Solar System to the outreaching stretches of the universe. Finding life here on Earth that can possibly survive the extreme conditions of space could help explain the origin of our Solar System, discover life on other planets, and could also be utilized to give the human race the ability to survive the unfriendly conditions without the confines of Earth's atmosphere. There are extreme environments on Earth that do not support life in general because of temperature, salinity, pressure, radiation, or pH, very similar to the conditions of outer space. Bacteria that can live in these extreme Earth environments are called extremophiles. These bacteria are further divided into the classes of aerobes (oxygen dependent) and anaerobes (oxygen independent). The bacteria chosen for this research are anaerobes because they are the only life for that would thrive in space because of the absence of oxygen. The implications of discovering such life forms that have space survival components would prove to be astounding for the Space Program. The components allowing bacteria to survive in these conditions could be integrated into human cells thus allowing for human survival and long term exploration in the far reaches of space. The focus of this research is a new strain of bacteria extremophile, Str. ARHSd-7g, isolated from the guano of African Penguins in South Africa. The purpose of this experiment is to analyze and describe this strain.

Jenny Erwin
Program/Internship Name: ESMD
Education Institution: Middlebury College
Major: Physics
NASA MSFC Mentor: Mark Christl, Nassar Barghouty
Org Code: VP62

Title of Poster: Bridging the Gap between Known and Unknown: Cosmic Ray Detector Calibration

Abstract: Cosmic rays are high energy charged particles that enter the solar system and constantly bombard Earth's atmosphere. The Advanced Thin Ionization Chamber (ATIC) instrument uses high altitude balloon flights to study cosmic rays in hopes of explaining their origins and their 50+GeV energies. After ATIC flights, external calibrations of the instruments and synthesis of internal calibrations allow for a clearer analysis of the data collected. All calibrations are completed by inputting specific DAC signals across the circuit boards and reading the ADC counts. By comparing the output ADC counts to expected yields, it is possible to determine the slight difference in each channel's read of a signal. The characteristics of the microelectronics change during long periods of time and extended use, requiring up-to-date calibrations. By using in flight calibration data and ground calibration data, this internship modeled each channel's response, removed temperature dependence, and identified problem channels. The work from this internship created a normalization scheme for the data collected on the last ATIC flight, allowing others to study the cosmic rays detected in hopes of answering profound questions about the nature of the universe and the matter it contains.

Curran D. Muhlberger
Program/Internship Name: NASA Academy
Education Institution: Cornell University
Major: Physics
NASA MSFC Mentor: Charles A. Meegan
Org Code: VP62
Title of Poster: On-Orbit Performance of the GLAST Burst Monitor

Abstract: With the Gamma-ray Large Area Space Telescope now in orbit, it is necessary to evaluate the performance of the GLAST Burst Monitor in order to tune calibration parameters, flight software, data pipelines, and operational procedures prior to the onset of normal operations and the publication of science data. To support this effort, we developed a collection of software to assist both the scientific and operational components of the mission during on-orbit checkout. New capabilities provided by our tools include real-time orbit visualization, consistency checks for science data products, parsing of diagnostic files related to automatic gain control and observatory timelines, and web access to pipeline databases. Additionally, we have authored programs for generating high-resolution lightcurves with optimal signal-to-noise ratios to support the InterPlanetary Network and for computing coincidence rates for burst trigger algorithms to inform decisions concerning their thresholds. Our development work has enabled the GBM team to make steady progress in preparing NASA's newest cosmic observatory to study the universe's most energetic phenomena.

Danielle Nuding

Program/Internship Name: Undergraduate Student Research Program

Education Institution: University of Alabama Huntsville

Major: Physics

NASA MSFC Mentor: Barbara Cohen

Org Code: VP62

Title of Poster: Characterization of Rock Types at Meridiani Planum, Mars, Using 13-Filter Pancam Spectra

Abstract: The Opportunity Mars Exploration Rover (MER) has been operating on the surface of Mars since January 2004, traveling over 10 kilometers (km) along Meridiani Planum taking numerous multispectral Pancam images of rocks along its traverse path. The bedrock does not vary along the traverse, but numerous cobbles of unknown origin lie on top of the bedrock. These cobbles along the path can be characterized, to help understand their origin and mineralogy, by studying their reflectance spectra in Pancam 13 filter images. We used nine spectral parameters to quantify differences among 13-filter spectra. Out of hundreds of analyzed cobbles, several were found to be very different, having parameters indicating a one-micron absorption band at shorter wavelengths than most rocks. Though other studies have suggested a link between one of our identified rocks and meteorites, we did not see that correlation.

Laura Seward
Program/Internship Name: GSRP
Education Institution: University of Alabama in Huntsville
Major: Physics - Astrophysics
NASA MSFC Mentor: Dr. Chryssa Kouveliotou
Org Code: VP62
Title of Poster: Investigating the Mystery of Gamma-ray Bursts

Abstract: Over four decades since their discovery, gamma-ray bursts (GRBs) are still one of the largest mysteries in astrophysics. Ongoing studies of these short-lived fireballs of gamma-ray photons and their evolution are required to further the understanding of their physics. This study entails investigating the high-energy spectral and temporal properties of GRBs and searching for correlations between their prompt and afterglow emissions. We aim to further the understanding of the physics of the central engines and emission mechanisms of GRBs and their afterglows

Kendra Albers
Program/Internship Name: USRP
Education Institution: Rose-Hulman Institute of Technology
Major: Optical Engineering
NASA MSFC Mentor: Ron Eng
Org Code: VP63
Title of Poster: Cryogenic Adhesive Testing

Abstract: In the summer of 2008, five single crystal silicon (SCS) test plano samples were cryogenically tested to see which epoxy thickness would have the least amount of flatness changed at temperatures from 290 K (ambient) to 35 K. The SCS test plano samples each consisted of space qualified epoxy of different thicknesses placed between two SCS plano wafers. The five test samples were mounted on a carousel inside a vacuum chamber with a cryogenic enclosure. Then a vibration insensitive Twyman-Green interferometer was used to collect data at 290 K, 100 K, 35 K, 97 K, 36 K, 101 K, and 291 K. The interferometer is an optical instrument that uses the interference of light to make precise measurements of surfaces. The results showed that varying the epoxy thickness can affect the resulting power which measures the flatness of the test samples. The test results will be used to verify finite element models of the components at the cryogenic temperatures. This information will aid in the production of the James Webb Space Telescope, a 6.5 meter diameter telescope, currently in development and scheduled for launch in 2013 with an operating temperature around 50 K.

Meghan Boudreaux

Program/Internship Name: Undergraduate Student Research Program

Education Institution: The University of Alabama

Major: Chemical Engineering

NASA MSFC Mentor: Jeff Kegley

Org Code: VP63

Title of Poster: Helium Injection System

Abstract: Marshall Space Flight Center's X-ray Calibration Facility utilizes helium gas conduction properties in cryogenic vacuum environments. In the chambers, helium is manually injected to augment heat transfer between an actively-cooled shroud and test articles. An automated helium injection system was developed to generate a precisely controlled injection procedure while maintaining consistent heat transfer. Specifically, helium needs to increase the chamber pressure from 1×10^{-7} Torr to 5×10^{-4} Torr in less than one hour. The automated system needs to control the chamber pressure in increments of 1×10^{-6} Torr. Interface operations of the system are desired to be local or remote.

A test plan was followed to successfully deliver an automated helium injection system on the small vacuum chamber. First, a flow controller was procured to meet the specified chamber pressure and flow rate conditions. A two standard cubic centimeters per minute flow controller with three modes of injecting helium into the vacuum chamber based on mass, volume, or pressure was selected. Once assembled, verification tests of each mode and system analysis were performed to ensure that facility and interface requirements were met. The mass flow mode preferably met the system requirements. A final system was successfully delivered for the small vacuum test chamber, and flow verifications and analysis are planned for the existing helium system located on the facility's large test chamber.

Jeffrey Scogin
Program/Internship Name: USRP
Education Institution: University of Arizona
Major: Optical Sciences and Engineering
NASA MSFC Mentor: Dr. Philip Stahl
Org Code: VP63

Title of Poster: 8m Monolith Space-Bound Telescope: Initial Project Design and Feasibility Study

Abstract: The first ever space bound 8m monolith telescope has entered into its design stages due to the planned NASA Ares V heavy cargo vehicle. With a 10m fairing diameter and load capacity of 55,600 kg, the advent of the Ares V will enable more mass and volume to travel further into space than any existing space launch vehicle; specifically the Sun-Earth L2 point. Based on the Hubble Space Telescope (diffraction limit at 500nm and spectral range from 110nm-2500nm) the advantages of placing an 8m monolith in space will not only dramatically expand but will reshape the future of space science missions. The Hubble is currently the largest monolith in space with a mirror diameter of 2.4m. To make the most of its scientific applications and to ensure the success of its overall mission, scientist and engineering teams have devised preliminary studies demonstrating the feasibility of such a mission. Key studies include cost modeling, trajectory, thermal, and mechanical stability. Research into the development of an Aluminum-Gallium alloy is also discussed as a possible candidate for future space telescope mirrors seeking similar spectral coverage.

Christa N. Smith
Program/Internship Name: Minorities in Science and Engineering
Education Institution: Alabama A&M University
Major: Computer Science
NASA MSFC Mentor: David A. Hieber
Org Code: BTI
Title of Poster: Software Development and Design in Support of Safety & Mission Assurance (S&MA)

Abstract: The responsiblities of my internship included the participation in software development of products in support of Safety & Mission Assurance (S&MA). At the start of my internship I was introduced to a popular server-side scripting language known as PHP (Hypertext Preprocessor) which is used in the creation of dynamic web content. I have become familiarized with HTML, PHP, SQL Databases and the principles of software release management and object-oriented application design.

Luis L. Bill, Joshua Eliser, Jason Frisk, and Amitha Mathew
Program/Internship Name: NASA Robotics Academy
Education Institution: Skyline Community College,
University of Alabama in Huntsville, Penn State Erie,
The Behrend College, and the University of Texas at Dallas
Major: Mechnaical Engineering, Computer Engineering,
Computer/Electrical Engineering, Electrical Engineering
NASA MSFC Mentor: Dr. Yuri B. Shtessel
Org Code: UAH
Title of Poster: Return to the Moon

Abstract: NASA is planning to resume manned missions to the Moon by 2020 with the goal of using the lunar surface as a launching point for further exploration. Although the emphasis is on manned missions, robots will likely play vital roles in the endeavor. In recognition of this fact, our research focused on the concept of using a beacon-based navigation system to aid autonomous robotic rovers in safely traversing potentially hazardous terrain. Our project also used the research proposed in some papers published by JPL in which fuzzy control is used as a navigation algorithm for robot traversability. This type of navigation system could serve as a possible alternative or interim solution to a future lunar satellite positioning system. After determining that radio beacons were the most practical type of beacon for this application, several intermediate test stages were set for the project. The first test was navigating the robotic test bed by means of R/C control. This series of tests established the mobility capability and limitations of the rover platform. In the next level test, the robot navigated autonomously from point-to-point using radio beacons for localization. In a follow-up stage, the robot will avoid mapped and unmapped hazards while navigating autonomously to a predetermined destination. In the final stage, the robot will use dead reckoning to return to a safe position in case of loss of signal from the radio beacons. Over the course of the project, the team demonstrated that a system of radio beacons is a feasible and effective navigation method for future robotic rovers and further research into such a system should be conducted.

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