**Appendix D: NASA Education AS&ASTAR Fellowship Opportunities by Center**
**Updated 11/22/2016**

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**---------- Armstrong Flight Research Center (AFRC) ----------**

If you have questions about any of the following opportunities at Ames Research Center, please contact Rebecca Flick rebecca.m.flick@nasa.gov or 661.276.3949

**----------Ames Research Center (ARC) ----------**

If you have questions about any of the following opportunities at Ames Research Center, please contact Elizabeth Cartier elizabeth.a.cartier@nasa.gov or 650-604-6958.

**----------Glenn Research Center (GRC) ----------**

If you have questions about any of the following opportunities at Glenn Research Center, please contact Mark D. Kankam Ph.D. at Mark.D.Kankam@nasa.gov or 216-433-6143.

**----------Goddard Space Flight Center (GSFC) ----------**

If you have questions about any of the following opportunities at Goddard Space Flight Center, please contact Mablelene S. Burrell at Mablelene.S.Burrell@nasa.gov or 301-286-1122.

**----------Jet Propulsion Laboratory (JPL) ----------**

If you have questions about any of the following opportunities at Jet Propulsion Laboratory, please contact Petra Kneissl-Milanian at petra.a.kneissl-milanian@jpl.nasa.gov.

**----------Johnson Space Center (JSC)----------**

If you have any questions about the following opportunities at Johnson Space Center, please contact Bryan Dansberry at bryan.e.dansberry@nasa.gov or 281.483.0707.

**----------Kennedy Space Center (KSC) ----------**

If you have questions about any of the following opportunities at Kennedy Space Center, please contact Grace Johnson at grace.k.johnson@nasa.gov or 321.867.4332.

**----------Langley Research Center (LaRC) ----------**

If you have questions about any of the following opportunities at Langley Research Center, please contact Karen Fallon at karen.fallon@nasa.gov.

**----------Marshall Space Flight Center----------**

If you have any questions about any of the following opportunities at Marshall Space Flight Center, please contact Jennifer Simmons at Jennifer.Simmons@nasa.gov or 256.961-1525.

**----------Stennis Space Center----------**

If you have any questions about any of the following opportunities at Stennis Space Center, please contact Joy Smith at joy.l.smith@nasa.gov or 228.688.2118.

| Opportunity Number | Opportunity Title | Opportunity Description/Objective (specific student assignment) | Desired Student Academic Level | Technical Adviser | Technical Adviser's email | Technical Adviser's Phone Number | Co-Technical Adviser's | Co-Technical Adviser's email | Co-Technical Adviser's Phone Number |
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| **ARC-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |
| **ARC-001** | Developing an Intelligent Integrated Energy Management Control and Alarm System for Sustainability Base | The fellow will be responsible for developing a detailed model of Sustainability Base using Energy Plus or equivalent modeling framework. The fellow may alternatively investigate constructing a model empirically based upon data acquired from Sustainability Base by employing advanced data mining algorithms to learn how the building operates and then monitor how it is performing over time, or some combination of the two approaches. Specifically, algorithms will be used to detect changes in individual energy use via plug load monitoring, circuit-level disaggregation technologies, and DEMs (Direct Energy Meters). The fellow will also become familiarized with the building operations sequence and existing constraints to be imposed as part of an optimization of the overall objectives stated previously. The optimization will be conducted using Stochastic Model Predictive Control (SMPC) techniques, that yield control actuation and guidance strategies. These control sequences can be derived for various HVAC system components such as pumps and fans, and even for lighting and other plug loads. The integrated control and alarm system will minimize overall energy expenditure and performance objectives - such as response rate and actuator effectiveness in an uncertain environment while providing a robust constraint violation risk-management strategy via an optimal alarm system. Constraints to be imposed may include equipment and/or environmental limits, as well as thermal comfort limits. Near-optimal plans to roughly approximate the guidance strategies recommended by the MPC optimization will be developed by the fellow in the context and constraints established by the existing building operations sequence, through a combined utilization of available actuators. Additional information on Sustainability Base can be found here: http://www.nasa.gov/sustainability-base/. | Pursuing Master's Degree or Pursuing Doctoral Degree | Rodney Martin | rodney.martin@nasa.gov | 650.604.1334 | | | |
| **ARC-002** | Development of High-order Scale-resolving Methods for Complex Flows | This opportunity is in the area of developing novel methods for high-order scale-resolving (LES, DNS) simulations of complex flows and physics. Potential topics of interest include, but are not limited to, geometry representation and mesh generation, physical model development, e.g. wall-modeled LES or compressible LES models, high-order visualization and unsteady data processing, and novel numerical methods for high-order finite-element methods. The fellow will be expected to interact with the eddy group at NASA Ames Research Center. | Pursuing Doctoral Degree | Scott Murman | scott.murman@nasa.gov | 650.604.4470 | Nagi Mansour | nagi.n.mansour@nasa.gov | 650.604.6420 |
| **ARC-003** | Experimental and Directed Evolution: Top-Down Astrobiology and Bioengineering | A current team of students working on developing a system to automate simulation and measurement of microbe/environment interactions is expanding. Active areas of the project include both traditional micro- and molecular biology and traditional mechanical/electrical/software engineering, but preference will be given to students with background or experience in both. Students will have the opportunity to work on baseline bioscience experiments (such as microbial survival assays and sequencing), the development of the automated system (including sensor selection, fluidics fabrication, software control, and user interface design), and design and implementation of biogeochemical experiments using the automated system. Environmental stresses under study include UV irradiation, thermal stress, heat shock, freeze/thaw cycles, and peroxide/pH exposure. Sensor and actuation subsystems include optical sensing at multiple wavelengths (basic spectrophotometry) for growth and metabolism, fluidic mixing and flow control, UV light control, and temperature control. The students will learn about the history and current state of bioengineering and directed evolution, basic microbiological and environmental (toxicology, DNA damage, etc.) assays, challenges in lab automation, testing for biocompatibility, and other areas. They will gain real-world experience in working on a multidisciplinary team, developing and meeting science and engineering requirements, experimental design and documentation, and statistics and data analysis. | Pursuing Master's Degree or Pursuing Doctoral Degree | Diana Gentry | diana.gentry@nasa.gov | 650.604.5441 | James Brass | james.a.brass@nasa.gov | 650.604.5232 |

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| **ARC-004** | Fog/Cloud Water Biological Sampling from UAVs | A small group of students with backgrounds in engineering and bioscience will, with the guidance of senior researchers and engineers, design and test a sampling payload to be flown on small, low-altitude autonomous air vehicles. The goal is to capture fog and cloud droplets and test them for basic microbiological properties (cell count, ATP concentration, etc.). The students will go through the processes of drawing up science requirements, such as sterility, minimum sample size, and minimum sample number, and of documenting, proposing, and getting approval for a test flight within or near the Bay Area. Time and approval permitting, the students will have the opportunity to fly their payload in multiple locations and analyze the returned results. The students will learn about the history and current state of aerobiology, basic microbiological and environmental (toxicology, etc.) assays, testing for biocompatibility, and other techniques. They will gain real-world experience in working on a multidisciplinary team, scientific uses of UAVs, developing and meeting science and engineering requirements, and statistics and data analysis. | Pursuing Master's Degree or Pursuing Doctoral Degree | Diana Gentry | diana.gentry@nasa.gov | 650.604.5441 | James Brass | james.a.brass@nasa.gov | 650.604.5232 |
| **ARC-005** | Graphene Composite Materials for Supercapacitor Electrodes | Electrochemical capacitors, or supercapacitors, have gained the most intense interest as an alterna¬tive to traditional energy storage devices in the recent years. The demands of the potential supercapacitor applications range from plug-in hybrid electric vehicles (PHEVs) to backup power sources. While the power density of supercapacitors surpasses that of most batteries, most commercially available batteries have a significantly higher specific energy density than supercapacitors. Our current research focus is to develop electrode composite materials that combine graphene with a metal oxide nanocomposite of MnO2 and Co3O4. A scalable, integrated materials synthesis and device fabrication process will be used to optimize specific capacitance as well as cycling life time and device reliability. Both graphene oxides and metal nanowires will be characterized with Raman, FTIR and x-ray photoelectron (XPS) spectroscopy, as well as atomic force (AFM) scanning electron (SEM) and transmission electron (TEM) microscopy. Reduced graphene oxide (rGO) films were obtained by electrophoretic deposition (EPD), and the resultant capacitor electrodes will be characterized with cyclic voltammetry (CV), surface area analyzer and a probe station. Expected outcome and student background: The student will be working in a stimulating multidisciplinary group with electrical and mechanical engineers, physicist, chemist and materials scientists. | Pursuing Master's Degree or Pursuing Doctoral Degree | Bin Chen | bin.chen-1@nasa.gov | 650.604.0310 | Jing Li | jing.li-1@nasa.gov | 650.604.4352 |
| **ARC-006** | Hardware Implementations of Online Learning | State of the art hardware acceleration for machine learned algorithms still relying on traditional von Neumann architectures to learn the appropriate circuit structures. We are interested in computing hardware that can perform learning in hardware in either a supervised or unsupervised fashion. Key technology under investigation would be adaptive elements such as memristors or single transistor learning components. | Pursuing Master's Degree or Pursuing Doctoral Degree | Padraig Furlong | padraig.m.furlong@nasa.gov | 650.604.4532 | Mark Micire | mark.j.micire@nasa.gov | 650.604.0135 |
| **ARC-007** | Integrated Simulation and Modeling of Microbial Communities in Sedimentary Systems | On Earth, significant amounts of solar energy capture occur in sediment inhabiting complex microbial communities. In addition to growing within pore spaces and cracks in rocks, minerals, and sediments, some microbial consortia also act to facilitate precipitation of new minerals, thus modifying the cohesion, stability, reflectance and chemical content of these sediments (through both mineralization, and the creation of organic biomass). Thus these systems are of great Astro-biological interest particularly with a focus on the complex interactions and influences between microbes and their physical-chemical environment. These communities also generate many of our key target biosignatures including biogenic gasses, biominerals, biofabrics and organic carbon compounds (lipids, kerogens etc.), that continues to inform us about both past life on Earth and inform our search for extraterrestrial life on Exoplanets, Mars and Icy Worlds.<br>This interdisciplinary geobiological project will entail a review of our current state of knowledge of this phenomenon and include a component of hypothesis generation, testing, and modeling for a variety of sedimentary environments of interest including siliciclastic, carbonate, and evaporitic environments. The fellow would work with a variety of investigators with expertise in microbial ecology, molecular sedimentary geology, radiative transfer and biogeochemical modeling. Specific target environments will be delineated according to best overlap between the Fellow's experience and interest and current near-term NASA research objectives. | Pursuing Master's Degree | Leslie Bebout | leslie.e.bebout@nasa.gov | 650.604.3826 | Brad Bebout | brad.m.bebout@nasa.gov | 650.604.3227 |
| **ARC-008** | Investigations of the Current and Past Climates of Mars | Climate models for Mars are used in conjunction with a variety of observational data sets to address critical questions regarding the atmosphere and its climate. Specific research areas include: investigating the dust, water and carbon dioxide cycles, their mutual interactions, and how they influence the current climate system; characterizing how the climate has changed in the recent past due to Mars' orbital variations; and understanding the nature of the early Mars climate. Such research topics are consistent with NASA's exploration goals and objectives in planetary science because they seek to further our understanding of the content, origin, and evolution of the Solar System. | Pursuing Doctoral Degree | Melinda Kahre | melinda.a.kahre@nasa.gov | 650.604.3863 | Robert Haberle | robert.m.haberle@nasa.gov | 650.604.5491 |

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| **ARC-009** | Laboratory Investigations of Cloud Formation on Earth and Mars | Cloud formation processes on Earth and Mars are studied with a variety of laboratory techniques, and this opportunity calls for proposals to develop theoretical treatments which can synthesize results collected using a variety of disparate techniques. In addition, the project will include experimental development and data collection to augment existing data sets. On both planets, cloud formation can occur on a variety of substrates, including dusts, salts, or organic materials. Possible studies in the NASA laboratory could include cloud nucleation and growth experiments with a variety of substrates, as well as different gas components relevant to Mars. Our group examines the interactions between gases and solid substrates representative of atmospheric aerosol and cloud particles on Earth, Mars, or other bodies with atmospheric pressures between 1 X 10-6 and 1000 hPa (1 X 10-9 - 1 bar). We use infrared spectroscopy and a vacuum chamber that can sustain low pressure and low temperature conditions (155 - 298 K) in order to simulate the atmospheres of Earth and Mars. Collaborations which offer additional experimental capabilities at the home institution are especially welcome. | Pursuing Doctoral Degree | Laura Iraci | laura.t.iraci@nasa.gov | 650.604.0129 | Delia Santiago-materese | delia.santiago-materese@nasa.gov | 650.604.1671 |
| **ARC-010** | Machine Learning based Safety Monitoring of the NAS | The national airspace (NAS) is getting more and more complicated with more traffic, advanced automation, autonomy and transformational vehicle designs. Current safety monitoring systems, being reactive, are not best suited to meet this complexity. Future safety assurance systems need to be predictive in detecting unsafe events, performing risk management and recommending solutions to assist current human based and future autonomy based systems. With the explosion in availability of data from the NAS from the flight level to the airspace level, machine learning and data mining based approaches may offer a scalable solution to aviation safety monitoring. To this end, this opportunity seeks novel ideas and approaches based on scalable machine learning and data mining that address the problems of future aviation safety monitoring. Some key problems within the safety monitoring include digesting large volumes of data that is heterogeneous, multimodal, hierarchical (data at several levels such as engine, flight, flight procedures, sector space, center space and the NAS), temporal and unlabeled to perform the following three tasks: detecting unsafe issues prior to occurrence, explanation of causes and correlations, and recommendation of actions for both human and autonomous decision making. The project will be valuable in getting insights on some of the key risks in design and deployment of new aviation procedures and vehicles, understand interactions of autonomous agents and drones, designing future monitoring and decision support tools for assisting human as well as autonomous systems in the NAS. The student will work on developing scalable computational methods in machine learning that has the potential to solve this problem for aeronautics as well as extend applications to other domains such as earth science and space science. | Pursuing Master's Degree or Pursuing Doctoral Degree | Vijay Manikandan Janakiraman | vijaymanikandan.janakiraman@nasa.gov | 650.604.0649 | Nikunj Oza | nikunj.c.oza@nasa.gov | 650.604.2978 |
| **ARC-011** | Multi-agent Planning Under Uncertainty | The student will conduct experimental research in automated path planning involving teams of agents (such as autonomous wheeled rovers or flying drones) in known or partially known environments. This environment is changing over time in ways that are only partially known, and which may create constraints that affect the ability to complete a plan. The student will develop algorithms and models for planning under uncertainty and test them on realistic applications, such as planning taxi routes on busy airports. | Pursuing Master's Degree or Pursuing Doctoral Degree | Robert Morris | robert.a.morris@nasa.gov | 650.604.2974 | Jeremy Frank | jeremy.d.frank@nasa.gov | 650.604.2524 |
| **ARC-012** | Multiscale Modeling of Materials for Energy Storage | Research at the NASA Ames Research Center recently has focused on multiscale computational modeling of energy storage systems, specifically high energy density batteries. NASA is interested in electric aircraft which have significantly higher energy storage requirements than any other application. Innovative projects related to atomistic modeling (ab initio, MD simulations, etc) of battery components (electrolytes, cathodes, anodes) as well as multiphysics modeling and optimization are especially of interest. Advanced, "beyond Li ion" chemistries are essential, such as Li-Air, etc, for these applications. Experimental validation of modeling results is also crucial. | Pursuing Doctoral Degree | John Lawson | john.w.lawson@nasa.gov | 650.604.6189 | Charles Bauschlicher | charles.w.bauschlicher@nasa.gov | 650.604.6231 |

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| **ARC-013** | NASA Ames SPHERES/Astrobee Facility | The NASA Ames SPHERES/Astrobee Facility supports Assistive Free-Flyer (AFF) technology to enhance the capabilities and performance of small, free-flying robots that assist humans. AFF's can complement astronauts in space by performing tasks that are tedious, highly repetitive, dangerous or long-duration. AFF's can also provide side-by-side assistance to astronauts by carrying tools/materials, providing procedure support, etc. AFF's can potentially be applied to a wide variety of tasks including in-flight maintenance, spacecraft health- management, environmental monitoring surveys (air quality, radiation, lighting, sound levels, etc.), and automated logistics management (inventory, inspection, etc.). AFF's can be used when humans are present to off-load routine work, to increase human productivity, and to handle contingencies. AFF's can also be used when humans are not present, such as during "pre-deployment" and quiescent periods, to perform spacecraft caretaking. In particular, AFF's could be used to enable mobile monitoring, maintenance, and repair of spacecraft before, and between, crews. The objective of a successful proposal would be to develop technology (hardware or software) that can be integrated as payloads on assistive free- flyers (AFF). A key characteristic of AFFs is that they can perform assistive tasks while co-located in human environments. On the International Space Station (ISS), for example, the SPHERES robots have shown how AFF's can perform environment surveys, inspection, and crew support. During 2015-2018, NASA will develop a new AFF as part of the Human Exploration Telerobotics 2 (HET-2) project. This new robot will carry out inventory, sound monitoring, and other routine tasks on the ISS. Proposals are sought to create AFF payloads that can be integrated for application-specific functions, or that can provide general capability enhancements in several areas: - Sensor Payloads - Compact sensors that can be used for environment monitoring, including detection of combustibles, air quality (CO2 levels), illumination (light spectrum), radiation, etc. - Appendages - Mechanisms that can be used for docking/perching, prodding/pushing, etc. This includes deployable structures and universal end-effectors (e.g., jamming granular gripper). - Algorithms – GNC software that can improve performance and robustness to unknown conditions. This can include on-line path planning or optimization in response to changing environmental conditions. | Pursuing Master's Degree or Pursuing Doctoral Degree | Jose Benavides | jose.v.benavides@nasa.gov | 650.604.4401 | Jonathan Barlow | jonathan.s.barlow@nasa.gov | 650.604.3378 |
| **ARC-014** | NASA WorldWind Virtual Globe Platform | Work with the internationally renowned virtual globe platform, NASA WorldWind, often referred to as 'Google Earth on steroids.' You would be part of the European Space Agency and NASA team jointly developing this platform, along with major international corporations. We need a Software Engineer to 'expand' the WorldWind Explorer 'reference app'. You would add functionalities typically needed by cities to manage their urban infrastructure. You would also be working independent of but in coordination with the City of Springfield Oregon which has begun development of a CitySmart GIS application. | Pursuing Master's Degree or Pursuing Doctoral Degree | Patrick Hogan | Patrick.Hogan@nasa.gov | 650.604.5656 | | | |
| **ARC-015** | Planning observations of protostars and planets with the James Webb Space Telescope | The student will work with the mentor in planning observations of protostars and exoplanets with the James Webb Space Telescope (JWST). This will involve researching the scientific opportunities and developing the details of these programs sufficiently to assess feasibility and to populate observing proposals. The expected scientific outcomes, exposure times, and instrument modes will be determined by analyzing existing observations and performing new simulations. | Pursuing Master's Degree or Pursuing Doctoral Degree | Thomas Greene | tom.greene@nasa.gov | 650.604.5520 | | | |
| **ARC-016** | Prognostics and Health Management | Explore prognostic and forecasting concepts in the context of aeronautics vehicles and airspace operations. Prognostics is defined as the estimation or remaining useful life in the presence of degradation. The task involves literature review, algorithm development (likely in matlab) and realization of some of the concepts in relevant aeronautics simulations. It may also involve some lab experiments during which the candidate would age components relevant in an aeronautics context | Pursuing Doctoral Degree | Kai Goebel | kai.goebel@nasa.gov | 650.604.4204 | Matthew Daigle | matthew.j.daigle@nasa.gov | 650.604.4583 |

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| **ARC-017** | Psychophysiological adaptation training for long duration spaceflight | NASA developed methods for training control of multiple autonomic responses has been used to facilitate adaptation to space and re-adaptation to Earth. Spaceflight risks to be addressed include biomedical and behavioral effects of long duration spaceflight which include:spatial dis-orientation, space motion sickness, post-flight orthostatic intolerance, high workload, sleep deprivation, isolation, environmental stress, etc. Test will be conducted in spaceflight analog environments which simulate some of the conditions crew may experience during long duration spaceflight. | Pursuing Doctoral Degree | Patricia Cowings | patricia.s.cowings@nasa.gov | 650.604.5724 | William Toscano | bill.toscano@nasa.gov | 650.604.2324 |
| **ARC-018** | Research in Microbial Ecology and Space Biology | Our laboratory is studying the ecology of complex microbial ecosystems. We are conducting research on naturally occurring communities of algae and cyanobacteria known as microbial mats. We are interested in these communities for a number of reasons including: 1) they are modern analogs of some of the earliest ecosystems on Earth, 2) they are informing our search for life elsewhere, and 3) they may be useful microbial ecosystems to study the effects of spaceflight on microbes. We are also conducting a number of projects in our laboratory which are directed at utilizing cyanobacteria and microalgae from extreme environments for NASA applications (bioregenerative life support and biological in situ resource utilization) as well as for "Greentech" applications on Earth (e.g., microalgae for biofuels and higher value co-products). We use a variety of experimental techniques in our research including: photophysiological and biogeochemical measurements as well as molecular ecological and 'omics tools. | Pursuing Master's Degree or Pursuing Doctoral Degree | Brad Bebout | brad.m.bebout@nasa.gov | 650.604.3227 | | | |
| **ARC-019** | Rotorcraft Aeromechanics | The Aeromechanics Office is responsible for aeromechanics research activities that directly support the civil competitiveness of the U.S. helicopter industry and the Department of Defense. The aeromechanics research portfolio includes manned and unmanned vehicles/platforms, including UAV systems, small to large. Branch programs address all aspects of the rotorcraft and advanced vertical lift aircraft which directly influence the vehicle's performance, structural, and dynamic response, external acoustics, vibration, and aeroelastic stability. The programs are both theoretical and experimental in nature. Advanced computational methodology research using computational fluid dynamics and multidisciplinary comprehensive analyses seeks to understand the complete rotorcraft's operating environment and to develop analytical models to predict rotorcraft aerodynamic, aeroacoustic, and dynamic behavior. Design cycle tools from conceptual design and sizing for specific mission requirements to detailed design and design verification research is conducted. Experimental research seeks to obtain accurate data to validate these analyses, investigate phenomena currently beyond predictive capability, and to achieve rapid solutions to flight vehicle problems. Databases from the flight and wind tunnel experimental programs are validated, documented and maintained for the benefit of the U.S. rotorcraft technology base. | Pursuing Master's Degree or Pursuing Doctoral Degree | William Warmbrodt | william.warmbrodt@nasa.gov | 650.604.5642 | Anita Abrego | anita.i.abrego@nasa.gov | 650.604.2565 |
| **ARC-020** | Study on thermal transport in nanoscale structure | Study on thermal transport in nanoscale structure for advanced research in the areas of nanoscale heat transfer, thermal management, thermoelectric power generation, thermal protection systems and materials, materials characterization, phonon transport, etc.,<br>Study on thermal transport in nanoscale structure to establish fundamental understanding of thermal transport in novel nanomaterials, characterize electrical and thermal transport properties, develop a predictive model, evaluate thermal protection systems, analyze thermal management systems, thermoelectric energy efficiency, analyze thermal management systems, predict and improve thermoelectric efficiency, improve thermal insulation,<br>Goals of study on nanoscale thermal transport are to advance breakthroughs in thermoelectric power generation, thermal protection systems, or thermal management systems, to provide safe, reliable, and long-lasting energy required for space exploration, and to close the gap between basic research in thermal sciences and aerospace technologies in the interest of NASA. | Pursuing Master's Degree or Pursuing Doctoral Degree | Jin-Woo Han | jin-woo.han@nasa.gov | 650.604.3985 | Meyya Meyyappan | m.meyyappan@nasa.gov | 650.604.2616 |
| **ARC-021** | Tensegrity Aeronautics Research Vytas Sunspiral | We are exploring how tensegrity (continuous tension network) robots can be used for NASA missions while also drawing inspiration from biological examples of tensegrity structures in cells and animal physiology. This opportunity is for students who will research the design, construction, and control of dynamic tensegrity robots. In specific, this aeronautics focused internship will investigate the design and active control of a tensegrity wing for flutter suppression. | Pursuing Master's Degree | Vytas Sunspiral | vytas.sunspiral@nasa.gov | 650.604.4363 | Matt Deans | matthew.deans@nasa.gov | 650.604.1874 |

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| **ARC-022** | Tensegrity Robotics Research<br>Vytas Sunspiral | We are exploring how tensegrity (continuous tension network) robots can be used for NASA missions while also drawing inspiration from biological examples of tensegrity structures in cells and animal physiology. This opportunity is for students who will research the design, construction, and control of dynamic tensegrity robots. Depending on the skills of the student, project work may include physical design and construction of prototype robots, simulated design work in a physics simulation environment, or designing and evaluation control approaches for the robots. To learn more about our research, please visit: http://www.magicalrobot.org/ Review our publications at: http://www.magicalrobot.org/BeingHuman/vytas-sunspirals-publications And explore our open source tensegrity robotics simulator: http://ti.arc.nasa.gov/tech/asr/intelligent-robotics/tensegrity/ntrt/ | Pursuing Master's Degree or Pursuing Doctoral Degree | Vytas Sunspiral | vytas.sunspiral@nasa.gov | 650.604.4363 | Matt Deans | matthew.deans@nasa.gov | 650.604.1874 |
| **ARC-023** | Towards Developing Science Analysis Systems for Future Planetary Missions | Towards developing science analysis systems for future planetary missions. We use innovative techniques, including Raman spectroscopy and image processing, to analyze rock and mineral samples. Resulting data is used to develop automated mineral, sediment and rock classifiers, and to identify biosignatures as part of an automated science analysis system to be used on future rover missions. Students would work to acquire images and Raman spectra of our samples and perform hand sample and/or thin section analysis. Students would also work towards improving our automated classifier algorithms and towards building an integrated automated science analysis system. Background in geology, earth or planetary science, computer science, electrical engineering, and/or physics preferred. | Pursuing Master's Degree or Pursuing Doctoral Degree | Virginia Gulick | virginia.c.gulick@nasa.gov | 650.604.0781 | Hargitai, Henrik | | |

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| **AFRC-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |
| **AFRC-001** | Aerodynamic load sensing from measured unsteady strain | Recently, a simple approach for computing unsteady aerodynamic loads from measured strain data has been proposed at NASA Armstrong research center. This proposed approach was successfully applied to a cantilevered rectangular wing model using computer simulated strain data with random white noise together with the CFL3D based total induced drag, spanwise, and lift loads as well as MSC/NASTRAN based deflection, velocity, and acceleration. In this approach, deflection and slope of the structure are computed from the unsteady strain using the piecewise least squares method, Akima spline, and integration of the splined function twice. Velocities and accelerations of the structure are computed using the sine butterworth low pass filter, AutoRegressive Moving Average model, on-line parameter estimator, and a least-squares curve fitting method together with an analytical derivatives with respect to time. Finally, aerodynamic loads over the wing are computed using modal aerodynamic influence coefficient matrices, a rational function approximation, time-marching algorithm, and pseudo matrix inversion based on singular value decomposition. In this study, this proposed approach should be applied to a real aircraft configuration with measured ground as well as flight test data. | Pursuing Master's Degree or Pursuing Doctoral Degree | Chan-gi Pak | Chan-gi.Pak-1@nasa.gov | 661.276.5698 | | | |
| **AFRC-002** | Low Reynolds Number High Speed Aerodynamic Modeling and Flight Test Data System Identification Comparisons | Student would use aerodynamic modeling codes to develop a set of tools to characterize existing and novel aircraft configurations in a low Reynolds number high speed flight environment. This information would be used to inform designs for high altitude flight testing planned over the next several years. Flight test data would then be reduced and system/parameter identification would be conducted by the student for comparison and improvement of the aerodynamic prediction tools. The applications are for the development of upper atmospheric scientific platforms and aircraft on other planets/planetary bodies. | Master's Degree or Doctoral Degree | Dave Berger | dave.e.berger@nasa.gov | 661.276.5712 | Albion Bowers | albion.h.bowers@nasa.gov | 661.276.3716 |

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| **GRC-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |
| **GRC-001** | Active Suppression of Sonic Boom using Electromagnetic Flow Control Techniques | The sonic boom (SB) has been a major obstacle to commercial supersonic flight over land, and its mitigation is currently one of six strategic thrusts of the NASA to "achieve a low-boom process satisfying FAA standards". While some mitigation of the SB can be achieved by aerodynamic shaping and optimized propulsion/airframe integration, such modifications may be insufficient, and may lead to a reduction in the aircraft aerodynamic performance. Thus, potential new technologies related to shockwave manipulation and flow control based on volumetric energy deposition should be investigated to meet the SB goal. Methods for mitigation of the SB using active electromagnetic control methods will be investigated. The student will pursue novel methods such as modifying the oncoming flow using strategically-placed forward energy plasma deposition. Such an approach may significantly diffuse/dissipate, change the relative position, or eliminate the shock systems the aircraft generates. The proposed research is a multidisciplinary, disruptive, and innovative and may be used by itself or in conjunction with a shaped low-boom supersonic vehicle configuration. Concept studies and physics-validation of critical components and subsystem details will be performed, as well as the feasibility of the approach. Owing to the multidisciplinary nature of the technology, its implementation will lead to development of several ancillary technologies. | Pursuing Doctoral Degree | Isaiah M. Blankson | Isaiah.M.Blankson@nasa.gov | 216.433.5823 | | | |
| **GRC-002** | Additive Manufacturing of Ceramic Materials and Structures for Extreme Environments | In order to improve fuel economy in commercial aircraft, ceramic matrix composites (CMCs) are widely considered a leading material system to replace metal-based turbine engine components, due to the lower density and high-temperature capabilities of CMCs compared with other conventional structural materials. However, the current inability to manufacture complex-shaped CMCs in an economical, high-throughput manner remains a barrier to their full implementation in aviation applications and beyond. Additive manufacturing, or 3D printing, has the potential to rapidly produce near-net shape components of a variety of material systems, including ceramics, yielding parts with complex geometries. *The aim of this project is to develop an additive manufacturing process to more quickly and efficiently produce complex-shaped CMCs with material properties comparable to parts prepared by other more traditional CMC processing methods.* | Pursuing Master's Degree or Pursuing Doctoral Degree | Valerie L. Wiesner | valerie.l.wiesner@nasa.gov | 216.433.5427 | | | |
| **GRC-003** | Airframe Icing | Airframe icing research at NASA is supported under Aeronautics Research Mission Directorate (ARMD) programs. Airframe icing is a key challenge whose aim is to develop improved computational and experimental simulation tools for civil airplanes operating in atmospheric icing including freezing drizzle and freezing rain. The objective of this research is to develop improved models for the multi-phase, multi-scale physical phenomena associated with water transport and heat transfer during initial stages of ice build-up. Experimental and computational studies are needed to further elucidate these complex phenomena. | Pursuing Master's Degree or Pursuing Doctoral Degree | Andy Broeren | abroeren@nasa.gov | 216.433.5338 | | | |
| **GRC-004** | Bio-inspired Multifunctional Structures for Hybrid Electric Aircraft | Biomimicry is the imitation of life. Nature has been evolving for over 3.8 billion years and typically uses ingenious structures based on environmental information instead of energy and materials. This fellowship will involve working closely with the MSHELLS (Multifunctional Structures for High Energy Lightweight Load-bearing Storage) project at NASA. The focus area of interest to NASA includes applying nature-inspired methods of structural energy storage for multifunctional structures and hybrid electric propulsion for N+3/N+4 (N is current generation) aircraft. The prospective student must have a background in biology. Additional background in either electrochemistry or structural engineering is preferred. | Pursuing Doctoral Degree | Vikram Shyam | Vikram.shyam-1@nasa.gov | 216.433.3511 | Patricia L. Loyselle | patricia.l.loyselle@nasa.gov | 216.433.2180 |
| **GRC-005** | Bio-inspired Turbines for Hybrid Gas Electric Propulsion | Biomimicry is the imitation of life. Nature has been evolving for over 3.8 billion years and typically uses ingenious shapes and structures that elude our most complex design systems. Gas turbines that are part of a hybrid electric propulsion system will be subject to varying loads that necessitate a wide range of incidence angles for the turbine. In addition, interaction between blade rows becomes a significant factor. The fellow will investigate ways to create low drag, incident tolerant geometry/systems to solve this problem. An example of a biological model that has shown promise is harbor seal vibrissae. The fellow will also investigate ways to enhance the current design system to incorporate more nonlinear, 3D design concepts through advanced optimization algorithms and integrated design. | Pursuing Doctoral Degree | Vikram Shyam | Vikram.shyam-1@nasa.gov | 216.433.3511 | Philip E. Poinsatte | poinsatte@nasa.gov | 216 433-5898 |

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| **GRC-006** | Characterization of High Temperature CMCs (Ceramic Matrix Composites) for Turbine Engine Hot Section Component Applications | This is for the FY17 NASA Education AS&ASTAR Fellowship Call. SiC/SiC (silicon carbide fiber reinforced silicon carbide) ceramic matrix composites (CMCs) are candidate materials for various turbine engine hot section component applications because of their high specific strength and good creep and oxidation resistance at temperatures >2000°F. Understanding the environmental degradation of SiC/SiC CMCs subjected to typical operation stresses and temperatures is critical to being able to predict the long term durability of the composite material. This will involve characterizing and understanding 1) the degradation of composite constituents, and 2) cracking of the composite as a function of stress in order to generate data to support NASA GRC modeling of SiC/SiC environmental degradation. Mechanical property testing and microstructural characterization could be used to investigate how cracks form in CMCs and how material degradation occurs during testing. This investigation could include experimental evaluation of degradation, simulations, or a combination of the two. | Pursuing Master's Degree or Pursuing Doctoral Degree | James D. Kiser | james.d.kiser@nasa.gov | 216.433.3247 | | | |
| **GRC-007** | Development of a High Power, High Efficiency, Class-F Type, Gallium Nitride (GaN), Solid-State Power Amplifier (SSPA) | Power amplifiers used in modern telecommunication systems flying on board satellites and unmanned aerial vehicles (UAVs) are a key microwave component and determine the system performance, cost, power consumption, and reliability to a considerable extent. Traditionally, microwave vacuum electronics based traveling-wave tube (TWT) amplifiers have efficiently served this role. Recently, solid-state or semiconductor based technology has made significant strides for terrestrial as well as space applications and is a viable alternate to vacuum electronics based technology. This is particularly true in the light of the recent advances made in the area of GaN based transistor technology for microwave transceivers. GaN is a wide bandgap semiconductor that has high breakdown voltage and consequently allows operation at higher voltages than the traditional silicon (Si) and gallium arsenide (GaAs) based devices. Higher voltage operation results in higher output power. Additionally, the saturation velocity of electrons in GaN is also higher which increases the unity current gain cut-off frequency (Ft). Higher Ft allows operating the transistors at higher microwave frequencies.<br>The purpose of this AS & ASTR Fellowship activity is to enable the application of microwave solid-state power amplifiers (SSPAs) for NASA's aeronautics, near-Earth and deep space missions. The aeronautical application is relatively a new application, which emerged with the advent of UAVs. The SSPA allows the UAVs to communicate at distances beyond the line-of-sight such as during transoceanic flights, using a satellite. The goal is to investigate the feasibility of developing monolithic microwave integrated circuit (MMIC) technology based high power, high reliability, high efficiency, and Class-F type GaN SSPAs operating at frequencies of interest to NASA aeronautical and space missions. These frequencies are at S-band (2.2 to 2.5 GHz), X-band (8.0 to 8.5 GHz), and Ka-band (25.5 to 27.0 GHz) and (31.8 to 32.3 GHz). The target output power of a single chip is typically on the order of few watts. If higher power is desired, the output from several such chips are efficiently combined using a power combiner resulting in several tens of watts.<br>The key features involved in the design of the GaN SSPA are output power, gain, power added efficiency (PAE), impedance matching, reliability, thermal performance, and packaging. The design process encompasses a wide range of activities including large signal model extraction from measured scattering parameters, large signal model validation using load pull data, nonlinear harmonic balance simulations using commercially available software tools, stability analysis, impedance matching network synthesis using microwave circuit simulation software, mask layout, device fabrication at a foundry, die attach, packaging, and high power testing. | Pursuing Doctoral Degree | Rainee N.Simons | Rainee.N.Simons@nasa.gov | 216.433.3462 | Felix A. Miranda | Felix.A.Miranda@nasa.gov | 216.433.6589 |
| **GRC-008** | Periodic Table of Life (PeTaL) | The origins and operating envelope of life have been a great mystery to humanity. In an attempt to understand how life evolved, whether there are overarching patterns to life's building blocks, whether it is possible to predict where life might exist and what form life might take or might have taken based on existing knowledge of natural history, a digital multidimensional Periodic Table of Life (PeTaL) is being developed that searches for and classifies the patterns that exist in life. Such patterns have already been identified in the hierarchical structures of life, the adhesion characteristics of insects and in the aerodynamics of birds and insects. The student will participate in multidisciplinary workshops that will be held to identify and implement the framework of the periodic table. As a first step, validation of the Periodic Table concept will be undertaken using known patterns that are published in the literature. The fellow will then lead a citizen science effort to populate other areas of the periodic table. This would enable researchers to quickly look up solutions to technical challenges from a biomimicry database. It would enable researchers to predict where life may be found in the universe, extinct species or even species that are yet to be discovered on earth. The benefits of this work are to all NASA missions. The student will also participate in collaborations with regional partners to aid in the understanding of biological and natural systems. | Pursuing Doctoral Degree | Vikram Shyam | Vikram.shyam-1@nasa.gov | 216.433.3511 | Herbert W. Schilling | hschilling@nasa.gov | 216.433.8955 |

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| **GRC-009** | Plasma-liquid Interaction for Water Re-use | Water is a critical resource for space missions, especially those involving life-support systems. Storage and transport requirements place strict limitations on the amount of water available for these missions; thus, effective water recycling is essential. Plasma discharges have the ability to induce liquid chemistry through the production and diffusion of reactive species that can lead to the sterilization of water. A plasma-based water purification system will require a compact, robust, and scalable design, capable of meeting mission-specific power restraints and processing flowrates. The student will investigate the time-evolution of plasma discharges using optical emission spectroscopy, imaging, and simulation to reveal the advanced oxidation dose and the manner in which the dose is delivered in a practical plasma reactor. Scalability, throughput, electrical efficiency, and chemical conversion efficiencies will be considered in the context of a water purification system for space missions. | Pursuing Doctoral Degree | Isaiah M. Blankson | Isaiah.M.Blankson@nasa.gov | 216.433.5823 | | | |
| **GRC-010** | Methods and Tools for Verification of Complex Propulsion Control Algorithms | In recent years, NASA researchers have developed advanced propulsion control algorithms such as model-based engine controllers that employ engine models that provide onboard estimations of specific engine parameters. Verification and validation (V&V) of these complex algorithms to assure their safe operation in production aircraft is expected to be challenging using current V&V practices. As a result, new design-time verification methods and tools need to be identified, evaluated and validated to help meet this challenge. NASA GRC has developed a high-fidelity engine control simulation platform that may be useful for evaluating such V&V tools. This opportunity entails the identification and evaluation of new design-time V&V methods and tools; along with the adaptation and application of these tools to the successful V&V of complex propulsion control algorithms, which may potentially lead to eventual flight certification in the future. | Pursuing Master's Degree or Pursuing Doctoral Degree | Edmond Wong | edmond.wong@nasa.gov | 216.433.8917 | Sanjay Garg | sanjay.garg@nasa.gov | 216.433.2685 |

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| **GFSC-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |
| **GFSC-001** | Advanced algorithm development for Synthetic Aperture Radar Remote Sensing | At NASA Goddard Space Flight Center we operate conventional and digital beamforming synthetic aperture radar systems. The proposed research should focus on developing advanced remote sensing techniques based on the capabilities of the airborne instruments such as DBSAR, EcoSAR and WISM. More information on these sensors can be found online. Potential keywords/topics of research are: Synthetic Aperture Radar (SAR), Interferometric SAR (SAR), Polarimetric SAR (PolSAR), PolInSAR, Multi-Aperture SAR, Multi-Frequency SAR, Waveform Design, SAR Autofocus, SAR Motion Compensation, SAR RFI Mitigation, SAR Calibration | Doctoral Degree | Batuhan Osmanoglu | batuhan.osmanoglu@nasa.gov | 301.614.6690 | Rafael Rincon | rafael.f.rincon@nasa.gov | 301.614.5725 |
| **GFSC-002** | Advanced Studies in Ocean Color Remote Sensing Data Quality | The objective is to estimate uncertainty of a selected ocean color remote sensing data product and identify/quantify major contributors of uncertainty to that data product. The student will perform analysis of remote sensing data taken over the ocean or inland water bodies. This could include radiometric measurements from a space borne or airborne sensor (ideally measurements with high spatial or high spectral resolution), calibration data, and in situ validation or training data. Ancillary environmental and relaunch/preflight instrument characterization data may also be required. Algorithms would be applied to retrieve specific biophysical properties of the water column, benthic, or wetland community. Results will then be evaluated for their level of uncertainty, including accuracy and precision estimates. Sensitivity analyses will be applied for various potential error sources. | Master's Degree or Doctoral Degree | Kevin Turpie | kevin.r.turpie@nasa.gov | 301.286.9996 | Carlos Del Castillo | carlos.e.delcastillo@nasa.gov | 301.286.8787 |
| **GFSC-003** | Aeolian Fertilization of Marine Ecosystems | There is a long-standing hypothesis that atmospheric transport and deposition of nutrients to the oceans significantly affects oceanic ecosystems and the carbon cycle at scales important for climate. Previous studies have demonstrated the potential link between ocean ecosystems and Aeolian deposition of desert dust and volcanic ash on an event-by-event basis. However there is a lack of systematic analysis of these events to understand when, where, and what type of oceanic response is to be expected from different types of minerals and atmospheric conditions. In the last decade, significant advances have been achieved in satellite remote sensing of ocean ecology and atmospheric transport and deposition of desert dust and volcanic ash. We are now beautifully positioned to carry out an interdisciplinary investigation of the Aeolian fertilization of marine ecosystems on a global scale and over the duration of decades. The overarching goal of this project is to comprehensively evaluate the above hypothesis with the existing satellite measurements and acquire deeper processlevel understanding of the responses of marine ecosystems to the Aeolian deposition of nutrients. We seek a motivated, enthusiastic PhD student to work on this interdisciplinary project. It is anticipated that the student will work with NASA GSFC atmospheric scientists to characterize the transport and deposition of dust and volcanic ash with an array of satellite measurements (e.g., MODIS, VIIRS, OMI, OMPS, CALIOP, CATS) and NASA MERRA-2 aerosol assimilation products. The student supervised by university professor of ocean ecology expertise will analyze satellites observations of chlorophyll, phytoplankton biomass, and fluorescence from SeaWiFS, MODIS, VIIRS, and upcoming PACE to detect and distinguish the type of ocean cosystem response to the Aeolian deposition. The student will work with the university professor and NASA scientists to synthesize and publish results in scientific journals. | Doctoral Degree | Hongbin Yu | hongbin.yu-1@nasa.gov | 301.614.6209 | Lorraine Remer | laremer@hotmail.com | 410.908.0836 |
| **GFSC-004** | Analysis and use of solar-induced fluorescence (SIF) and other vegetation parameters in data assimilation | This work may encompass a variety of topics including generation and analysis of satellite vegetation data sets, analysis of aircraft and field data as well as use of satellite data within a land-surface model using data assimilation or other methods of parameter estimation. It may involve running a canopy radiative transfer model (SCOPE). | Doctoral Degree | Joanna Joiner | joanna.joiner-1@nasa.gov | 301.614.6247 | Elizabeth Middleton | elizabeth.m.middleton@nasa.gov | 301.614.6670 |

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| **GFSC-005** | Analysis of X-ray observations of active galactic nuclei | The student will analyze X-ray observations of active galactic nuclei. The student will use data from the latest X-ray astronomy satellites, such as Chandra, XMM-Newton, NuSTAR and ASTRO-H. The goal is to study the physics of accretion and outflows from supermassive black holes and their influence on galaxy evolution. | Doctoral Degree | Francesco Tombesi | francesco.tombesi@nasa.gov | 301.286.2661 | Robert Petre | robert.petre-1@nasa.gov | 301.286.3844 |
| **GFSC-006** | Assessing the diurnal and seasonal dynamics in photosynthetic function and associated optical and chlorophyll fluorescence properties of vegetation | Chlorophyll fluorescence has strong potential to assess plant photosynthesis over large areas using Earth observation technology. However, more work is needed to determine the impact of the dynamics in vegetation properties and illumination conditions on the remote estimation of plant photosynthesis. The goals of the project are to better understand the dynamic relationships between vegetation photosynthetic function and its spectral fluorescence and reflectance properties, at different light levels, phenology periods. The student will process existing and collect additional field optical and plant physiology measurements, required to characterize vegetation function. The study will focus on major crop and forest species. The data will be analyzed within a modeling framework to investigate the dependence of leaf and canopy level photosynthetic function, and the associated reflectance and fluorescence properties, on environmental actors. The project would produce an improved capability for monitoring vegetation function trough remote sensing. | Master's Degree or Doctoral Degree | Elizabeth Middleton | elizabeth.m.middleton@nasa.gov | 301.614.6670 | Petya Campbell | petya.k.campbell@nasa.gov | 301.614.6784 |
| **GFSC-007** | Assessments of and Enhancements to the SMAP Passive Microwave Soil Moisture Retrieval Algorithm | The radiometer from the Soil Moisture Active Passive (SMAP) mission has been collecting routine science data since March 31, 2015. The brightness temperatures from the SMAP radiometer are input into the Level 2 passive soil moisture retrieval algorithm along with a variety of ancillary data to generate SMAP surface soil moistures (L2_SM_P and L2_SM_P_E). While a number of retrieval algorithms are implemented, they are all based on the tau-omega model. This research opportunity involves conducting different analyses to understand the performance of SMAP soil moisture retrieval algorithms and to assess the accuracy of the retrieved soil moistures with the ultimate goal of improving the baseline algorithm. Analyses could include (but are not limited to) comparing the use of a 13-year NDVI climatology versus real-year vegetation estimates; assessing the value of time-varying tau-omega model parameters (b, ?, h) against a static model parameter approach in terms of noise reduction and improved accuracy; developing a more effective soil temperature correction scheme; and comparisons of retrieved soil moisture, in situ soil moisture, and Global Precipitation Mission data to address the issue of a time lag before the impact of a rainfall event is evident in the 5 cm in situ soil moisture sensor. Although the focus of the research will be on improving our scientific understanding of the factors affecting satellite soil moisture retrievals, the potential ease of implementing a change to the SMAP operational processor based on the work will be a consideration. | Doctoral Degree | Peggy O'Neill | peggy.e.oneill@nasa.gov | 301.614.5773 | Matthew Rodell | matthew.rodell@nasa.gov | 301.286.9143 |
| **GFSC-008** | Atmospheric Radiative Transfer Calculations for Remote Sensing of Greenhouse Gases | Radiative transfer calculations in the atmosphere is essential for remote sensing of greenhouse gases which have been understood to exert a critical influence on global climate change. This opportunity provides graduate student to use high resolution atmospheric radiative calculation model and spectroscopy database to simulate measurements, help mission concept and sensitivity studies, assist instrument development and data analysis for ground-based, airborne and space-based remote sensing of greenhouse gases (CO2, CH4, H2O, etc). | Doctoral Degree | Jianping Mao | jianping.mao@nasa.gov | 301.614.5551 | Emily Steel | emily.l.wilson@nasa.gov | 301.614.6155 |
| **GFSC-009** | Balloon Experimental Twin Telescope for Infrared Interferometry (BETTII): Graduate Fellowships | We are developing a new experiment for flight on a highaltitude balloon, the Balloon Experimental Twin Telescope for Infrared Interferometry (BETTII). BETTII will be an 8-meter long system with two telescopes, designed to provide high angular resolution measurements in the far-infrared. Graduate students with an interest in astronomical instrumentation, including interferometry, far-infrared instrumentation, or detectors are particularly encouraged, but we welcome applications from all candidates. Ultimately, a successful candidate will have the opportunity to work on an innovative new experiment that will provide unique new scientific data, and will gain a broad understanding on the development of missions and the system-level problems that must be solved to make these missions successful. | Master's Degree or Doctoral Degree | Stephen Rinehart | stephen.a.rinehart@nasa.gov | 301.286.4591 | David Leisawitz | david.t.leisawitz@nasa.gov | 301.286.0807 |

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| **GFSC-010** | Cloud-based Gateways for interface to space communications ground stations | Development of concepts and prototypes for cloud-based systems to provide gateways between user locations such as a mission operations center and NASA ground stations. These gateways will provide data delivery and telecommand functions, formatting of data, and security (Authentication, confidentiality, data integrity, non-repudiation, and access control). These IaaS gateways will have formal descriptions and be prototyped in a cloud environment | Master's Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | George Bussey | george.d.bussey@nasa.gov | 301.286.6904 |
| **GFSC-011** | Coding, Compression and Modulation optimization for CubeSat communications | Cubesats are generally EIRP limited communications platforms. The goal of the research is to increase the capability of Cubesat to ground or Cubesat to space relay link. This research requires an integrated look at how highly aggressive data compression with near-Shannon limited FEC and optimal selection of modulation can be used to improve CubeSat communications. The student must be capable of balancing the schemes against factors such as implementation loss, error rate and other factors. The student must also be capable of assessing performance of commercial standards such as DVB-S2 that might be adapted in whole or in part. | Master's Degree or Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | Haleh Safavi | haleh.safavi@nasa.gov | 301.614.5610 |
| **GFSC-012** | Cognitive communications technology | Development of cognitive communications technology focusing on radios and antennas. The student will propose and develop new cognitive communications technology for NASA space or ground usage. The student will develop a concept of operations for the technology and a mission concept that would benefit from the use of this technology | Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | Serhat Altunc | serhat.altunc@nasa.gov | 301.286.2933 |
| **GFSC-013** | Complex Molecules and Hazes on Titan, Jupiter and Saturn | Since 2004, the Cassini spacecraft has been orbiting Saturn, and made more than 100 close flybys of the giant moon Titan in the last decade - the only moon in the solar system with a significant atmosphere. Both Saturn and Titan exhibit an active atmospheric chemistry, that leads to the creation of complex organic molecules that may be precursors to astrobiology. Carried on-board the spacecraft is the Composite Infrared Spectrometer (CIRS), built and managed by NASA Goddard Space Flight Center. CIRS is a versatile instrument, capable of making diverse measurements of planetary atmospheres including temperatures, gas abundances, cloud properties and isotopic and elemental ratios. These data inform scientists about the formation, evolution and present day processes on solar system bodies. This exciting student fellowship opportunity is to activity participate in the analysis of CIRS data, focusing on modeling the spectra to make important estimates of the abundances of the complex organic molecules, and even larger organic particles. Uncovering the links from the molecules to the haze particles will be a primary goal of the this research project. | Doctoral Degree | Conor Nixon | conor.a.nixon@nasa.gov | 301.286.6757 | F. Flasar | f.m.flasar@nasa.gov | 301.286.3071 |
| **GFSC-014** | Creating an Air Quality Exposure Picture for Major Urban Regions | Airborne particles concentrated in and downwind of urban environments can have both acute and chronic impacts on human health. Surface sampling around many cities provides the most detailed information about particle properties, but only at a very limited number of ground sites, and rarely in the downwind direction. Regional air-quality modeling is commonly used to create a regional picture, but unconstrained assumptions and model biases raise uncertainties about the results. Satellite data, especially multiangle, multi-spectral observations from instruments such as the NASA Earth Observing System's Multi-angle Imaging SpectroRadiometer (MISR), can help fill the gap in assessing regional air quality, offering frequent total-column aerosol amount (AOD) as well as column-effective aerosol type mapping from space. Aerosol vertical distribution can be constrained by a combination of modeling results and where available, space-based lidar, e.g., from the CALIOP instrument. This opportunity focuses on applying MISR data to constrain regional aerosol air mass type over urban regions, taking advantage of a 16+ year record of approximately once-weekly global measurements, supplemented with AOD from MISR and MODIS, and aerosol vertical distribution from CALIOP and regional aerosol transport modeling. The aim is to create regional air quality pictures having enough detail and accuracy to monitor spatial and temporal exposures for major urban areas, globally. | Doctoral Degree | Ralph Kahn | ralph.a.kahn@nasa.gov | 301.614.6193 | Mian Chin | mian.chin-1@nasa.gov | 301.614.6007 |

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| **GFSC-015** | CRESST - X-ray studies of galaxies near and far | This opportunity covers studies of X-ray emission from starforming and normal galaxies. This X-ray emission, which is studied via analysis of X-ray datasets from NASA and other space-based instrumentss, including emission from neutron star and black hole opulations and the hot interstellar medium. We will study the connection between the X-ray properties of these various components of galaxies and galaxy parameters such as stellar mass, metallicity, and overall star formation rate. The work involves datasets from missions and instruments developed at or in collaboration with the NASA GSFC X-ray astrophysics laboratory, including microcalorimeters, X-ray optics and other technology. We are a team of 8 PhD scientists (Ann Hornschemeier Cardiff, Andrew Ptak, Antara Basu-Zych, Panayiotis Tzanavaris, Mihoko Yukita, Daniel Wik Vallia Antoniou and Neven Vulic) and our students join the group working side-by-side with us. | Master's Degree or Doctoral Degree | Ann Cardiff | ann.h.cardiff@nasa.gov | 301.286.7632 | Andrew Ptak | andrew.ptak@nasa.gov | 301.286.1154 |
| **GFSC-016** | Deep space and planetary communications and navigation | Development of novel communications for deep space missions including space-to-space and space to ground communications. The entire electromagnetic spectrum is open for discussion and quantum communications is part of the discussion. This research should break new academic ground and not repeat previously investigated or implemented ideas. Research will include development of credible concepts of operations in which the communications concept can be implemented. Research will also include development of specific mission concepts that would benefit from the communications concept | Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | Armen Caroglanian | armen.caroglanian-1@nasa.gov | 301.286.4340 |
| **GFSC-017** | Development of a Saturn Net Flux Radiometer | The graduate student will work with Goddard scientists to develop radiative transfer and scattering models of atmospheric radiation divergence as a function of altitude in the Saturnian atmosphere. The fellow will also help build, design and and test a net flux radiometer. Additional duties include the following: Testing of electronic boards with thermopile detectors Communication of readout electronics with FPGA board Data collection and processing Radiometric testing at cold temperatures Testing of thermopile detectors The student will be involved in all aspects of research, development, build, test and validation. | Doctoral Degree | Shahid Aslam | shahid.aslam-1@nasa.gov | 301.614.6961 | Tilak Hewagama | tilak.hewagama@nasa.gov | 301.286.9130 |
| **GFSC-018** | Development of the Next Generation X-ray Polarimeter | The student will assist with the development of a polarimeter 10 times more sensitive than currently available and able to study the behaviour of black holes. We have modelled a design and need a student to help implement and test the new design. The student will use laboratory based X-ray generators to test the performance and to characterise the sensitivity. Interest in laboratory work is a must. Experience with vacuum systems, X-ray Source and detectors is a plus but not required. | Doctoral Degree | Joanne Hill-Kittle | joanne.e.hill@nasa.gov | 301.286.0572 | Keith Jahoda | keith.m.jahoda@nasa.gov | 301.286.3527 |
| **GFSC-019** | Exoplanet direct imaging science and mission technology | The selected Fellow will model known and hypothetical exoplanetary system orbits and atmospheres to be paired with simulated performance of current, upcoming, and future NASA missions. The work will be applied to quantifying the significance of detecting signatures of molecules needed to sustain life as we know it. The fellow will have the opportunity to assist with ongoing laboratory research and development using active and adaptive high-contrast imaging systems and techniques (coronagrpahy including nulling interferometry), and component technologies such as optical masks, detectors, deformable mirrrors. | Master's Degree or Doctoral Degree | Brian Hicks | brian.a.hicks@nasa.gov | 301.286.1927 | William Danchi | william.c.danchi@nasa.gov | 301.286.4586 |
| **GFSC-020** | Exoplanet Gravitational Microlensing | Microlensing lightcurves can take an extraordinary variety of forms with very subtle features. They contain a great wealth of information, but extracting it can be a challenge. For example, the most simple binary lens models typically include at least 11 parameters, and finding the best-fitting model to the data is a complex minimization process with multiple degeneracies. Incumbent will propose an approach to a solution for this opportunity in response to this significant challenge. | Doctoral Degree | Richard Barry | richard.k.barry@nasa.gov | 301.286.0664 | Jeffrey Kruk | jeffrey.w.kruk@nasa.gov | 301.286.8758 |

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| **GFSC-021** | Exploring the Heating and Dynamics of the Solar Corona | How the solar corona is heated to over a million degrees is a central and longstanding problem of solar physics. This is an opportunity to use temperature, density, and velocity diagnostics in the spectra of a successful sounding rocket instrument (EUNIS), together with coordinated observations from other space- and ground-based instruments, to explore the spatial and temporal variability of solar coronal structures and to test theories of coronal heating such as the nanoflare mechanism. The Extreme Ultraviolet Normal Incidence Spectrograph (EUNIS) is a sounding rocket instrument that has made three successful flights, most recently in April 2013. There is also an opportunity to work on the EUNIS instrument in the laboratory in preparation for the upcoming 2017 flight, depending on the fellow's interest. | Master's Degree or Doctoral Degree | Adrian Daw | adrian.daw@nasa.gov | 301.286.2278 | Douglas Rabin | douglas.rabin@nasa.gov | 301.286.5682 |
| **GFSC-022** | Flexible electronics and communications for astronaut state of health monitoring | Development of prototype multifunctional hardware and software for monitoring astronaut state of health. Hardware is expected to highly miniaturized and physically flexible such that it can be a wearable technology, for example bandagelike substrates. Network communications via IEEE 802.11ad 60 GHz technology is targeted to create sensor network | Master's Degree or Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | Steve Sirotzky | steve.sirotzky@nasa.gov | 301.286.4005 |
| **GFSC-023** | Galaxy evolution research relevant to the James Webb Space Telescope | I welcome fellows interested in researching topics in galaxy evolution and supermassive black hole growth, particularly on subjects that are relevant to the science goals of the James Webb Space Telescope (JWST). | Master's Degree or Doctoral Degree | Jane Rigby | jane.r.rigby@nasa.gov | 301.286.1507 | Jonathan Gardner | jonathan.p.gardner@nasa.gov | 301.286.3938 |
| **GFSC-024** | Global Optimization of Spacecraft Trajectories | This opportunity is for now global optimization techniques for spacecraft trajectory design, which can include interplanetary trajectories, trajectories near planets, and/or trajectories near small bodies or in multi-body systems. Proposals for single-vehicle and/or multi-vehicle optimization techniques are welcome. Spacecraft trajectory optimization is a complex problem, the solution to which is often dependent on a priori knowledge of the solution. Most current optimization techniques are "local optimizers" meaning that they can only find solutions in the vicinity of an initial guess that depends on a priori knowledge of the solution. Recent work has investigated "global optimizers" which do not require a priori knowledge of the solution. This opportunity is to either improve those existing global trajectory optimization techniques or invent entirely new ones, and encompasses the following fields of study: 1. Creation of novel problem transcriptions for any regime of trajectory optimization that perform well when coupled with existing global optimization techniques. 2. Creation of new global optimization techniques that can solve constrained trajectory optimization problems with many local optima but may also be broadly applicable to many other types of optimization problems. | Master's Degree or Doctoral Degree | Jacob Englander | jacob.a.englander@nasa.gov | 301.286.4710 | Jeremy Knittel | jeremy.m.knittel@nasa.gov | 301.286.8063 |
| **GFSC-025** | Hardware Agnostic Cubesat communications platforms | Develop Cubesat radios capable of transmitting and receiving from the three NASA networks at S-band, including spread spectrum compatibility with the TDRS space network. Any aspect of the radio that is software defined will be hosted within a Cubesat on-board computer. The software defined portion shall be hardware agnostic. Any aspect of the radio design that cannot be hosted within an on-board computer will reside in a separate box. | Master's Degree or Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | Peter Fetterer | peter.r.fetterer@nasa.gov | 301.286.1485 |
| **GFSC-026** | High Energy Energetic Particles in the Heliosphere | Student will work on the calibration and testing of the Energetic Particle Instrument - High Energy (EPI-Hi) for the Solar Probe Plus mission which will launch in 2018. This will lead to data analysis and science research after launch. EPIHi measures electrons and ions from the Sun at energies between about 1 and 100 MeV. The Solar Probe Plus mission will approach within 4 million miles of the surface of Sun, far closer than any other mission. | Doctoral Degree | Eric Christian | eric.r.christian@nasa.gov | 301.286.2919 | Adam Szabo | adam.szabo-1@nasa.gov | 301.286.5726 |
| **GFSC-027** | High Gain Antennas for CubeSats | Developing antennas and feed systems for CubeSat high gain antennas that can be stowed within 1U. Parabolic reflector and horn antenna systems are targeted. Work includes development of antenna structure, reflector development, antenna feed, diplexer. Frequency ranges are S-band, X-band, Ka-band | Master's Degree or Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | Peter Fetterer | peter.r.fetterer@nasa.gov | 301.286.1486 |

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| **GFSC-028** | Improving the CARMA Aerosol Micorphysical Model Codes in the NASA GEOS-5 Earth System Model | The NASA GEOS-5 model is a global model linking many components of the Earth system into a common framework, including the atmosphere, ocean, land, and cryosphere. Within the atmospheric component our group focuses on issues of chemistry and aerosols, which play roles in clouds, climate, the ozone hole, air quality and human health. For this project we are looking for help in improving the representations of aerosols in GEOS-5. Aerosols are airborne particles from natural (for example, dust, volcanoes, and sea spray) and man-made sources (for example, agricultural burning and power plant emissions). Because of the complexities of aerosol sources and how aerosols evolve in the atmosphere we have developed models that try to treat their detailed processes, such as how they mix together and change in size, important because this affects how they interact with clouds and radiation. The aerosol model we are working with here is called CARMA, and CARMA is already embedded and used in the GEOS-5 system. What we would like help with is in improving the coupling of CARMA to the GEOS-5 system in order to make it extensible and more flexible, as well as evaluating its performance with respect to NASA Earth observations. One aspect of this, for example, is to improve the interface to the user-provided configuration files used to set up problems to be run with CARMA so that different configurations can be run without having to manually edit Fortran code. Other activities involve the coupling of CARMA to other processes in the model (for example, coupling of CARMA to cloud and radiation schemes), as well as improvements to the CARMA module itself to improve its stability and efficiency. | Doctoral Degree | Peter Colarco | peter.r.colarco@nasa.gov | 301.614.6382 | James Gleason | james.f.gleason@nasa.gov | 301.614.5736 |
| **GFSC-029** | Instrumentation for Inflationary Cosmology | The project develops instrumentation, analysis, or supporting technologies for balloon-borne and satellite observations of the cosmic microwave background. Ongoing projects at the Goddard Space Flight Center seek to measure the polarization of the cosmic microwave background and detect small distortions about the mean blackbody spectrum. Research opportunities include instrumentation for cryogenic detectors at far-IR wavelengths, analysis techniques to separate cosmic emission from diffuse astrophysical foregrounds, and electromechanical mechanisms for balloon and satellite payloads. | Master's Degree or Doctoral Degree | Alan Kogut | alan.j.kogut@nasa.gov | 301.286.0853 | Eric Switzer | eric.r.switzer@nasa.gov | 301.614.5174 |
| **GFSC-030** | Interplanetary Mission Design Tool with Application to Atmospheric Probes, Sample Return, Aerogravity Assist, Aerocapture, and NASA's Journey to Mars | The design of atmospheric probes, sample return capsules, and entry capsules for human missions, may dramatically influence the interplanetary trajectory design required for a mission with any such elements, and vice versa. It is therefore beneficial to account for these mission elements in the design of the interplanetary trajectory in order to find an optimal trajectory solution for the mission. Aerogravity assist and aerocapture are other means of using a body's atmosphere, which may dramatically impact trajectory flight time and delivered mass, as well as the design of the spacecraft itself. Such techniques may enable future science and humancrewed missions, and quantifying the benefits of these techniques by identifying game-changing interplanetary trajectories that make use of them, may influence the development of these technologies. For this work, the student researcher will investigate low/medium-fidelity models for atmospheric entry, probe design, aerocapture, and aerogravity assist, to be integrated into medium-fidelity interplanetary mission design tools. | Master's Degree or Doctoral Degree | Kyle Hughes | kyle.m.hughes@nasa.gov | 301.286.4573 | John Adams | john.c.adams@nasa.gov | 301.286.8690 |
| **GFSC-031** | Investigation of Space Plasmas with Measurements from Magnetospheric Multiscale's Fast Plasma Instrumention | Goddard Space Flight Center is home to the Fast Plasma Instrumentation (FPI) research group, which is integral to the Magnetospheric Multiscale mission (MMS). The MMS mission has the goal of understanding the physics of magnetic reconnection in space. A variety of other research topics in space physics also can be addressed with MMS mission data. Students associated with the group have opportunities to contribute to the mission science through analysis of data, participation in instrument/mission operations, and through theory, modeling, or simulation-based research. | Master's Degree or Doctoral Degree | William Paterson | william.r.paterson@nasa.gov | 301.286.2922 | Barbara Giles | barbara.giles@nasa.gov | 301.286.5574 |
| **GFSC-032** | Life Finder Detectors: Detector Technology for Future NASA Missions | The search for life on other worlds looms large in NASA strategic planning. Even using 10 meter space telescopes coupled with coronagraphs and starshades, better detectors than exist today are needed. Within our group at Goddard, it is possible to work on emerging detectors for space astrophysics including near-infrared array detectors (Teledyne H4RG, H2RG, etc.), superconducting transition edge sensor microcalorimeter arrays, CMOS arrays, CCDs, EMCCDs, and other potential single photon detector technologies. | Master's Degree or Doctoral Degree | Bernard Rauscher | bernard.j.rauscher@nasa.gov | 301.286.4871 | Samuel Moseley | samuel.h.moseley@nasa.gov | 301.286.2347 |

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| **GFSC-033** | Massively parallel ad hoc communications based upon cellular signalling | In molecular biology cells organize and communicate on an ad hoc basis without the use of centralized computing. Both intercelluar and intracellular communications take place on a massively parallel basis. The student will develop communications models of massively parallel networks based upon an analysis of intercellular and intracellular signalling. The student will develop a communications concept of operations applicable to NASA using these models. The student will develop a mission concept that would benefit from using this communications concept | Master's Degree or Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | George Bussey | george.d.bussey@nasa.gov | 301.286.6904 |
| **GFSC-034** | Modeling and simulation of complex Cubesat communications problems | The number of Cubesats and Smallsats planned for operation in the next 10 years will place tremendous demands on the ground infrastructure and available spectrum for communications. This opportunity is focused on developing models for large numbers of Cubesats communicating via ground stations and spacebased relays. These models will include link analyses, RFI analyses, resource analyses and others as required | Master's Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | George Bussey | george.d.bussey@nasa.gov | 301.286.6904 |
| **GFSC-035** | Narrowband spacebased relay beacon services for CubeSats | Simulation and development of narrowband communications services with lightweight protocols that could be used by CubeSats for tracking, navigation and low level communications. | Master's Degree or Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | Gregory Heckler | gregory.w.heckler@nasa.gov | 301.286.6565 |
| **GFSC-036** | Novel Diffractive Optics with Applications to Solar Physics | Key physical processes in the solar atmosphere, such as magnetic reconnection, occur on characteristic length scales that require very high angular resolution to be observed from the vicinity of Earth. This is an opportunity to explore new types of optics and analysis methods that have the potential to provide 1 milliarcsecond (5 nanoradian) imaging of the Sun or other celestial objects in narrow wavelength bands. Diffractive optics such as photon sieves are diffraction limited at extreme ultraviolet wavelengths while conventional optics cannot approach the diffraction limit with existing fabrication techniques. Depending on the fellow's interest, the opportunity can emphasize analytical work on diffractive or nano-structured optics, or laboratory work on a prototype sounding rocket instrument to validate this approach to solar imaging. | Master's Degree or Doctoral Degree | Douglas Rabin | douglas.rabin@nasa.gov | 301.286.5682 | Adrian Daw | adrian.daw@nasa.gov | 301.286.2278 |
| **GFSC-037** | Novel forms of optical communications | The student will work on developing novel forms of optical communications such as Chaotic communications. The student will work on developing hardware, software and mathematical algorithms required for implementing a demonstration of the communications technology. | Doctoral Degree | Harry Shaw | harry.c.shaw@nasa.gov | 301.286.8680 | Haleh Safavi | haleh.safavi@nasa.gov | 301.614.5610 |
| **GFSC-038** | Physics of galaxy clusters | Galaxy clusters can be sensitive tools for cosmology. However, to realize their full potential for constraining cosmological parameters, we need a much better understanding of their physics -- especially the physics of the hot intracluster gas. It includes pressure balance, radiative cooling, mergers, shock heating, turbulence, magnetic fields, ultrarelativistic particles, energy injection from the central AGN and various plasma effects. Many of these and other phenomena can be observed in the X-ray, radio and microwave bands. The research under this opportunity will involve analysis of Chandra and other archival X-ray data on clusters, possibly in conjunction with data from other wavelengths and/or results from numeric simulations, in order to elucidate the physical properties of the intracluster plasma. | Doctoral Degree | Maxim Markevitch | maxim.markevitch@nasa.gov | 301.286.5947 | Robert Petre | robert.petre-1@nasa.gov | 301.286.3844 |
| **GFSC-039** | Planetary Magnetic Fields | Magnetic fields inform us about many aspects of planetary systems. Using observations from magnetometers onboard spacecraft we can learn about an object's core, whether it has oceans or aquifers, and how its atmosphere interacts with the solar wind. For example we can use MAVEN data to examine how the solar wind might have eroded away the martian atmosphere over billions of years or Juno data to probe the origin of Jupiter's internal magnetic field and powerful magnetosphere. The candidate would have the opportunity to work with existing spacecraft data to conduct data analysis of these topics and to use science to better understand how planets work. | Doctoral Degree | Jared Espley | jared.r.espley@nasa.gov | 301.286.0445 | Ronald Oliversen | ronald.j.oliversen@nasa.gov | 301.286.6290 |

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| **GFSC-040** | Remote Sensing of Vegetation Structure, Coastal Geomorphology and biodiversity | This research opportunity is for students interested in forest ecology, coastal ecosystem ecology, coastal geomorphology or biodiversity with a focus on remote sensing. The project includes the analysis of optical, radar and lidar data over forested and coastal ecosystems. The student will help analyze lidar, radar and optical data and have the opportunity to participate in field campaigns. Personal interest and projects in this research area are welcome and encouraged. | Master's Degree or Doctoral Degree | Temilola Fatoyinbo Agueh | lola.fatoyinbo@nasa.gov | 301.614.6660 | David Lagomasino | david.lagomasino@nasa.gov | 301.614.6666 |
| **GFSC-041** | Research augmenting experience in Heliophysics | This is for highly motivated graduate student(s) to take advantage of the modeling capabilities, databases and tools available at the Community Coordinated Modeling Center and to conduct research from a systems approach, with emphasis on investigating the interconnected magnetosphere and ionosphere system and their dynamics. Research topics include but not limited to radiation belt, ring current, aurora and other ionospheric dynamics. The CCMC's Space Weather DONKI (Database of Notification, Knowledge, Information) will facilitate in putting event studies in a global perspective by connecting to the driver/source directly from the sun and also facilitate in interdisciplinary studies by studying event chains across different domains. | Master's Degree or Doctoral Degree | Yihua Zheng | yihua.zheng@nasa.gov | 301.286.0111 | Maria Kuznetsova | maria.m.kuznetsova@nasa.gov | 301.286.9571 |
| **GFSC-042** | Research Opportunities for Space-based Gravitational-wave Observatories | Gravitational Waves have opened the first new window for observing the Universe in nearly a century. Observations by ground-based observatories have already discovered merging binary black holes that cannot be seen any other way. Spacebased observatories will offer a complementary view at frequencies from 0.1 to 100 mHz where we expect many other high energy sources, including supermassive black hole mergers that track the formation of large scale structure in the Universe. Observation of gravitational waves will provide a powerful new tool for understanding these objects, their environments, and the underlying physics of gravity itself. The group has two main efforts: Numerical Relativity and Data Analysis, and technology development. The Numerical Relativity effort has achieved breakthroughs in the study of merging black holes, as well as developing data analysis methods for gravitational wave detectors that incorporate numerical waveforms. There is currently a small team working on data analysis for the LISA Pathfinder mission, an ESA-led mission that is operating until March 2017. | Master's Degree or Doctoral Degree | Jeffrey Livas | jeffrey.livas-1@nasa.gov | 301.286.7289 | John Baker | john.g.baker@nasa.gov | 301.286.3663 |
| **GFSC-043** | Solar X-ray and gamma-ray instrument design and development | The Sun is the most energetic particle accelerator in the solar system; large solar flares and fast CMEs accelerate ions up to 10s of GeV and electrons up to 100s of MeV. We study the mechanisms responsible for this impulsive release of magnetic energy by observing the X-ray and gamma-ray signatures of accelerated particles. The student will analyze solar high-energy observations by missions including RHESSI and Fermi. The student will also test and calibrate high-energy detectors in a laboratory setting to understand how these observations and made. These tasks in combination enable the student to contribute significantly to the design of future instruments for balloons, sounding rockets, ISS, or spacecraft. Depending on student's interests and the timing of projects, the student may even be able analyze new observations from an instrument that he/she helped design. | Doctoral Degree | Albert Shih | albert.y.shih@nasa.gov | 301.286.1843 | Steven Christe | steven.d.christe@nasa.gov | 301.286.7999 |
| **GFSC-044** | Study of Ring Current and Radiation Belt Dynamics | Energetic particles in the radiation belts and ring current are hazardous to spacecraft systems and humans in space. Understanding the processes which control the buildup and decay of these energetic particles is important for predicting and forecasting the development of the radiation belts and ring current. To examine these processes, both theoretical studies and computer simulations are carried out. Computer simulations include global MHD models, kinetic models, and single particle trajectory tracing. Theories and models are validated using extensive comparisons with observations of energetic particles and fields. Opportunities exist to develop new theories, improve existing models, and analyze available data. | Doctoral Degree | Mei-Ching Fok | mei-ching.h.fok@nasa.gov | 301.286.1083 | Alex Glocer | alex.glocer-1@nasa.gov | 301.286.9475 |
| **GFSC-045** | The Nature of Star-forming Galaxies at High Redshift | We are characterizing the nature of star-forming galaxies at the epoch when most stars formed (redshift 1-3). We do this by studying spatially resolved spectroscopy and narrow-band imaging of galaxies that have been dramatically magnified by gravitational lensing. Research involves in-hand optical, near- IR, and mid-IR spectra from Magellan, Keck, and Spitzer, as well as broad and narrow-band imaging from Hubble and Spitzer. Such work is pathfinding for the science that JWST will be able to conduct for large samples of unlensed galaxies. | Master's Degree or Doctoral Degree | Jane Rigby | jane.r.rigby@nasa.gov | 301.286.1507 | Jonathan Gardner | jonathan.p.gardner@nasa.gov | 301.286.3938 |

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| **GFSC-046** | The Swift Mission Galactic Plane Survey | The objective of this opportunity is to discover new sources along the plane of our Milky Way galaxy using X-ray and optical data from the Swift satellite. The Fellow will analyze data from Swift and combine it with data from other observatories to perform the first-ever sensitive survey of the Galaxy. | Master's Degree | Cornelis Gehrels | neil.gehrels@nasa.gov | 301.286.6546 | Stephen Cenko | brad.cenko@nasa.gov | 301.286.4678 |

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| **JPL-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |

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| **JSC-001** | Energy Systems Research and Development | Soliciting independently conceived research proposals in the area of advanced energy storage and generation systems for application to human space exploration. | Pursuing Master's Degree or Pursuing Doctoral Degree | Bryan Dansberry | bryan.e.dansberry@nasa.gov | 281.483.0707 | | | |
| **JSC-002** | Human Extra-Vehicular Activities (EVA) Systems Design | Soliciting independently conceived research proposals in the area of human EVA and EMU. Areas can include EMU and EVA tools & hardware design; EVA surface mobility systems design; EVA/robotic systems integration; EVA systems lunar and Mars habitat-related advanced technology development. | Pursuing Master's Degree or Pursuing Doctoral Degree | Bryan Dansberry | bryan.e.dansberry@nasa.gov | 281.483.0707 | | | |
| **JSC-003** | Human health and performance research and development | Soliciting independently conceived research proposals investigating the mechanisms by which space flight affects human physiology at the cellular level. | Pursuing Master's Degree or Pursuing Doctoral Degree | Bryan Dansberry | bryan.e.dansberry@nasa.gov | 281.483.0707 | | | |
| **JSC-004** | Human Robotic Interface Research and Design | Soliciting independently conceived research proposals in the area of human-robotic interface as applied to human space exploration. Areas can include human/robot interface design, telepresence and automated control system design and advanced technology development. | Pursuing Master's Degree or Pursuing Doctoral Degree | Bryan Dansberry | bryan.e.dansberry@nasa.gov | 281.483.0707 | | | |
| **JSC-005** | Inference Algorithms for Complex Event Processing Systems | A Complex Event Processing system that conducts inference on RFID data streams is being developed to aid Astronauts and Inventory Stowage Officers managing inventory on the International Space Station (ISS). As part of this effort, algorithms that conduct inference or are trained to detect events from lower level RFID tag reads are sought. Data sources comprise both the on-orbit and analog based RFID systems. Challenges include the highly reflective environments imposed by space vehicles and habitats, limited number of readers, and the constraints imposed by the EPCglobal Class 1 Gen 2 UHF protocol. | Pursuing Master's Degree or Pursuing Doctoral Degree | Bryan Dansberry | bryan.e.dansberry@nasa.gov | 281.483.0707 | | | |
| **JSC-006** | Life Support, health monitoring and habitation research and development | Soliciting independently conceived research proposals in the area of human life support and habitation systems design as well as human health and performance monitoring. Areas including closed loop regenerative life support systems, habitation systems design, exercise countermeasures equipment design, environmental monitoring systems design, and biomedical systems design. | Pursuing Master's Degree or Pursuing Doctoral Degree | Bryan Dansberry | bryan.e.dansberry@nasa.gov | 281.483.0707 | | | |

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| **KSC-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |
| **KSC-001** | Data Mining and Analysis | Data mining uses pattern based queries, searches, or other analyses of one or more electronic databases in order to discover or locate a predictive pattern or anomaly indicative of lessons learned, or system failures. Throughout NASA, hundreds of data systems are designed and tailored to serve specific engineering and business needs. Many of these systems use relational algebra with structured query language to categorize and retrieve data. In these systems, data analyses are limited and require prior explicit knowledge of metadata and database relations;lacking exploratory data mining and discoveries. The purpose of this project is to infuse data mining techniques, methods and algorithms to improve data evaluations and analyses in NASA Data Systems. | Pursuing Master's Degree or Pursuing Doctoral Degree | Ali Shaykhian | ali.shaykhian@nasa.gov | 321.861.2336 | | | |

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| **LaRC-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |
| **LaRC-001** | Additively Manufactured Multifunctional Parts with Embedded Sensing | Advances have been made in the ability to 3D print materials such as nanotubes and graphene so that multifunctionality can be achieved in aerospace parts when these materials provide functionalities such as reinforcement, conductive paths and sensing. However, much still needs to be developed to realize the full potential of embedded functionalities. This project provides an opportunity to investigate how the ability to embed functional materials by 3D printing can enable the design and fabrication of lightweight intelligent systems. Among the challenges that need to be addressed are design and fabrication of a functional part and meaningful data acquistion. Skills that will be useful span materials design and processing, signal processing, programming and device design. | Pursuing Master's Degree | Mia Siochi | emilie.j.siochi@nasa.gov | 757.864.4279 | Godfrey Sauti | godfrey.sauti-1@nasa.gov | 757.864.8174 |
| **LaRC-002** | Aeronautics Conceptual Design Methods | Develop innovative, multi-disciplinary, multi-fidelity analysis and design methodologies for advanced aircraft concepts and technologies that improve the fuel efficiency and environmental impact of future aircraft. Analysis methods and design processes intelligently balance the desire for accuracy and detail with the need to quickly evaluate many different design options during conceptual design. New methods replace traditional empirical correlations of existing aircraft with more physics-based analysis, improving the validity for unconventional aircraft concepts and technologies. Example research areas currently being pursued by NASA include: hybrid wing-bodies, truss-braced wings, hybrid-electric propulsion, structural batteries, dynamic aeroelastic optimization, non-traditional and/or autonomous missions, and design of aircraft using active control systems. Innovative ideas in other aspects of aircraft analysis and design are welcome, as well. | Pursuing Master's Degree or Pursuing Doctoral Degree | Erik D. Olson | erik.d.olson@nasa.gov | 757.864.7628 | | | |
| **LaRC-003** | Controlled Assembly of Micrometer-sized materials into Meso-scaled Architectures | Polystyrene microspheres (PSL)s are a great platform for an array of both fundamental and highly applied research endeavors. Similarly, they represent a "middle ground" between macroscopic properties and nanometer (or quantum) behaviors. As such, there is a wealth of information and opportunity to conduct research using these materials. PSLs can be readily generated and modified for a variety of applications. A candidate for this research would need to investigate novel routes for controlling interactions between these particles including: modification of PSL chemistry or surface composition, particle-solvent interactions, utilization of external energetic stimulus, deposition processes. These novel micrometer-scaled materials and resultant assemblies can be envisioned to be applied toward microfluidics, logic computing, hydrophobicity-hydrophilicity, optics, etc. These materials can be applied to answer aeronautics and space exploration needs. | Pursuing Master's Degree or Pursuing Doctoral Degree | Chris Wohl | c.j.wohl@nasa.gov | 757.864.8074 | Pacita Tiemsin | pacita.i.tiemsin@nasa.gov | 757.864.5310 |
| **LaRC-004** | Doped Chiral Polymer Metamaterials (DCPM) | Metamaterials are a new class of materials with exotic electromagnetic properties not found in any naturally occurring material. Doped Chiral Polymer Metamaterials (DCPM) with tunable resonance frequencies are developed by adding plasmonic inclusions into chiral polymers with variable orientations. Amplifying the chiral parameter while lowering the real part of the permittivity (e') can achieve a DCPM without having a negative permeability (μ') and complex architecture. Lightweight, flexible DCPM offers a wireless antenna suit, radio astronomy spectroscopy, non-destructive testing of spacecraft, security detection of chemicals, EM cloaking devices, reduction of energy/power beam dispersion, sub- wavelength high resolution imaging, compact optics systems for sensors, novel beam steering control for lasers and novel space telescopes. A gifted student is sought to research and develop new doped chiral polymer metamateirals that will be used for real-world aerospace applications. | Pursuing Master's Degree or Pursuing Doctoral Degree | Cheol Park | cheol.park-1@nasa.gov | 757.864.8360 | Sang-hyon Chu | sang-hyon.chu-1@nasa.gov | 757.864.8215 |
| **LaRC-005** | Grid Generation Automation and Improvement | One of the most difficult tasks in generating computational fluid dynamics results is the grid generation step. Issues include a lack of automation (i.e. process a CAD file to create a viscous grid with minimal user intervention), the quality of the grid that is generated, and the continued need to update the grid generation software to handle increasingly complex configurations. The objective is for the student to use this research opportunity to work on the grid generation software VGrid to improve the automation, robustness, and flexibility of the system or, if appropriate, work on the improvement of other grid generation tools. The configurations the student will work with include the most complex configurations being analyzed at NASA. Experience with CFD, grid generation, computer programming (Fortran would be preferred) and Unix. The task requires significant ability in mathematical manipulations.<br>Comments: Must be US Citizen since will be working on ITAR restricted software. | Pursuing Master's Degree or Pursuing Doctoral Degree | Melissa Carter | melissa.b.carter@nasa.gov | 757-864-8606 | | | |

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| **LaRC-006** | Latent Curing Epoxy Resin Systems for Unitized Composites Manufacturing | One component (1K) prepolymers with latent curing chemistries may provide an economical, certifiable means of manufacturing large-scale, composite airframes. Latent curing resin could be applied to joining surfaces in the lay-up of airframe components and activated to cure during the final assembly process. The focus of this project is on thermosetting epoxy resins used by commercial transport aircraft manufacturers. The resins systems must be compatible with current manufacturing technologies and consider current manufacturing certification criteria. This task will focus on the design of latent curing epoxy resin systems, synthesis of monomers/reagents as needed, characterization of resin and polymer properties, and demonstration of latent curing function including testing of ultimate mechanical properties. Applicants should have a degree in chemistry or chemical engineering with some experience in synthesis and polymer science. The student must be experienced with Microsoft Office products. Experience with programing, scripting, and typesetting software is an advantage. Experience with organic synthesis, composites, mechanical testing and/or fracture mechanics is a plus. | Pursuing Master's Degree or Pursuing Doctoral Degree | Frank Palmieri | frank.l.palmieri@nasa.gov | 757.864.8802 | Christopher Wohl | C.j.wohl@nasa.gov | 757.864.8074 |
| **LaRC-007** | Nanostructured Membrane System for Molecular Transport and Control | The goal of this work is to study transport phenomena of various molecules through nanostructured membranes and develop a hierarchical structure and transport system with high selectivity and high efficiency. The current life support system used in the International Space Station heavily relies on a combination of expendable and limited regenerative technologies. In this research, boron nitride nanotubes are assembled to build a nanostructured membrane for molecular transport and control of various chemical species including water molecules. The membrane morphology and surface properties are characterized and tailored for maximum performance by understanding material structures-properties-processing relationships. Successful development of this nanostructured membrane system would benefit future human space exploration beyond low earth orbit, and offer many opportunities for other applications such as carbon capture, sensors, desalination, drug delivery, DNA sequencing, waste treatment, chemical separations, and energy storage and delivery that require fast transport of small molecules. This internship opportunity will enable the student to gain experiences of fabrication of nanostructured materials and characterization of their material properties. | Pursuing Master's Degree or Pursuing Doctoral Degree | Sang-hyon Chu | sang-hyon.chu-1@nasa.gov | 757.864.8215 | | | |
| **LaRC-008** | Advanced nano-composites: discovering novel lightweight multifunction materials | Boron Nitride Nanotubes (BNNTs) are uniquely well suited for ceramic or metal matrix nano-composites. The focus of this work will be to explore the interaction between the BNNTs and metals or ceramics for materials for lightweight structures that will be used in aerospace and spacecraft applications. An advanced nano-composite can crosscut the advancement of both science and structure to facilitate architecture and systems for long duration human extraterrestrial exploration. An advanced material nanocomposite has the potential for greater than 20% mass reduction with improved radiation shielding and mechanical properties, and serve the immediate need for lightweight multifunctional materials that are stronger and more reliable than the current state of the art. The student will gain experience using: Atomic force, optical, and scanning electron microscopy; infrared, raman, and electron dispersive spectroscopy; nanoparticles and metals processing to fabricate samples; and laboratory practices for materials engineering research. | Pursuing Master's Degree or Pursuing Doctoral Degree | Samuel Hocker | john-andrew.s.hocker@nasa.gov | 757.864.9649 | Cheol Park | cheol.park-1@nasa.gov | 757.864.8360 |
| **LaRC-009** | Multifunctional Structural Boron Nitride Nanotube Composites for Aerospace Applications | Boron Nitride Nanotube (BNNT) is a structural analogue of carbon nanotube. Having extraordinary mechanical properties, BNNTs also offer unique high thermal stability (> 900°C in air), chemical stability, high dielectric strength, neutron radiation shielding, piezoelectricity (sensing/actuation), and a dyeable white color. Developed at NASA, our novel high pressure, high temperature BNNT synthesis produces clean white, highly crystalline, small diameter, long BNNTs without using a catalyst. To explore BNNTs, new BNNT composites, fibers, and yarns will be developed using polymers, metals, and ceramics to study heir mechanical, thermal, electrical, sensing/actuation, and radiation shielding properties systematically for aerospace applications. A gifted student is sought to research and develop new multifunctional BNNT-fibers, and BNNT-nanocomposite materials that will be used for real-world aerospace applications. | Pursuing Master's Degree or Pursuing Doctoral Degree | Cheol Park | cheol.park-1@nasa.gov | 757.864.8360 | Sang-hyon Chu | sang-hyon.chu-1@nasa.gov | 757.864.8215 |

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| **MSFC-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |
| **MSFC-001** | Additive Manufacture In-Situ Process Monitoring (ISPM) Development | The proposed task is for design, development, and implementation of an In-Situ Process Monitoring (ISPM) system to aid in quality control of full-scale additively manufactured metal builds. This task involves autonomous optical image capture during the build process followed by image processing to identify potential flaws. Virtual build models are generated and compared to design models to evaluate critical flaws to determine whether to scrap a build or continue with subsequent post-processing steps (e.g. stress relieve, scanning, HIP, surface modification, machining, etc). Preliminary efforts are to develop a prototype system to undergo verification using a mock-up build platform then integrated into an AM machine. Additional efforts could include gathering real-time IR thermography data to aid model developers in prediction of microstructure and properties. | Pursuing Master's Degree or Pursuing Doctoral Degree | Omar Mireles | omar.r.mireles@nasa.gov | 256.544.6327 | Cooper, Kenneth | kenneth.g.cooper@nasa.gov | 256.544.8591 |
| **MSFC-002** | Analyzing clouds, precipitation, and winds with an airborne microwave radiometer | The Advanced Microwave Precipitation Radiometer (AMPR) is an airborne instrument that uses dual-polarimetric passive measurements at four separate frequencies to retrieve information about clouds and precipitation, as well as land and ocean surface properties (including near-surface ocean wind speeds). A wealth of AMPR data has been collected in recent field campaigns - including observations of deep convection and severe storms, maritime cumulus congestus and stratocumulus clouds, and precipitation systems associated with landfalling extratropical cyclones. This provides an opportunity to study microphysical and dynamical processes in a variety of precipitation systems, by leveraging airborne passive microwave observations in concert with other surface-based and airborne assets (e.g., radar). The objective of the graduate fellowship would be to focus on a particular type of precipitation system, and then analyze AMPR and other data to study physical processes controlling the structure and evolution of clouds and precipitation. The student also would be able to assist with hands-on instrument testing and calibration, and may be able to participate in future flight campaigns. This is a unique opportunity to both work directly with a flight instrument's hardware as well as use its data to study scientific problems. It is envisioned that this fellowship could become the student's thesis research project. | Pursuing Master's Degree or Pursuing Doctoral Degree | Timothy Lang | timothy.j.lang@nasa.gov | 256.961.7861 | | | |
| **MSFC-003** | Application of Aeroelastic Techniques for the Determination of Non-Structural Damping in Turbomachinery | Of the three parameters required for the prediction of forced response of flow-path components in turbomachinery, structural dynamic characteristics, fluid dynamic forcing function, and damping, the third is the least well-defined. The proposed research intends to apply well-developed aeroelastic techniques that are used to determine damping in jet-engine turbines and compressors to the different conditions of rocket engine turbomachinery. The techniques will be applied to both the hot-gas side of the turbopumps, where the aerodamping values may be very low but yet still necessary, especially for integrally-bladed disks (blisks), where the structural damping is negligible, and to the liquid-pump side, where the damping is much higher but where the typical viscous damping assumption has been shown to be substantially inaccurate. This research project will build upon initial numerical studies performed on inducer blades, coupled with water-flow test data, to determine the hydroelastic damping parameters, and will use significant literature and expertise in the turbine field to develop the aerodamping values. The resulting capability to make more educated estimations of these parameters will be essential for operation of pumps with highly-energetic dynamic sources like Higher Order Cavitation, such as the RS-25, and for turbines in new Oxygen Rich Staged Combustion engines presently in development by American industry. | Pursuing Master's Degree or Pursuing Doctoral Degree | Andy Brown | Andy.brown@nasa.gov | 256.544.1584 | | | |
| **MSFC-004** | Bridging the Physics of Clouds, Precipitation and Lightning | The student candidate will use satellitebased lightning, cloud and precipitation remote sensing datasets in combination with groundbased radar, lightning, and related ancillary airborne or groundbased cloud and precipitation microphysics information to bridge our understanding of processes that physically connect cloud kinematic, microphysical, precipitation, and electrical processes in deep convective cloud systems. The research spans scales from individual severe thunderstorms to global weather and climate variability. A portion of the research may also be dedicated to the improved identification and global monitoring of regional severe storms, satellitebased estimation of heavy/extreme precipitation, and provision of new information to weather decision support systems. | Pursuing Master's Degree or Pursuing Doctoral Degree | Walt Petersen | walt.petersen@nasa.gov | 256.961.7408 | Christopher Schultz | christopher.j.schultz@nasa.gov | 256.961.7856 |

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| **MSFC-005** | Cloud Detection with Satellite Data | The presence of clouds over a region have a controlling effect on many atmospheric and climate processes. A "cloud mask 11 which delineates cloudy from clear regions is an important component in the process of deriving important land, ocean, and atmospheric parameters to study these processes.Scientists inthe Earth Science Office at MSFC have refined a two-channel technique (see reference below) for the detection of clouds from a variety of satellite sensors for the generation of products supporting the Short-term Prediction Research and Transition (SPoRT) program (http: /weather.msfc.nasa.gov/sport). The Bispectral Composite Threshold (BCT) approach uses spatially and temporally varying thresholds with two infrared channels to create a yes I no cloud mask. Preliminary comparisons of BCT algorithm show good agreement with a more complex NOAA operation cloud mask algorithm for a limited case study period. The objective of the graduate fellowship would be to extend the comparison to a large number of case studies during different periods of time and over different regions in order to more fully understand the algorithms performance as compared to the NESDIS operational approach. It is envisioned that this fellowship could become the students thesis research project. Reference: Jedlovec, G J., S. L. Haines, and F. J. Lafontaine, 2008: Spatial and temporal varying thresholds for cloud detection in GOES imagery. IEEE Trans. Geosci. Rem. Sensing, 46, 6, 1705-1717. | Pursuing Master's Degree | Gary Jedlovec | gary.jedlovec@nasa.gov | 256.961.7966 | Lafontaine, Frank | frank.j.lafontaine@nasa.gov | 256.961.7796 |
| **MSFC-006** | Combustion Dynamics Prediction Development for In-Space Methane Propulsion | In-space methane propulsion systems need high combustion efficiency, proper thermal management, and acceptable combustion dynamics within the combustion device(s). Acceptable combustion dynamics includes considerations for both stable combustion as well as low combustion roughness as to not lower component fatigue life. The objective of this opportunity is to investigate prediction techniques for use in evaluating combustion dynamics of methane combustors. The student will use both finite element-based predictive -software results and measured methane-oxygen hot fire data to validate the software's ability to predict combustion dynamics for in-space methane/oxygen combustors. | Pursuing Master's Degree or Pursuing Doctoral Degree | Robert Kenny | robert.j.kenny@nasa.gov | 256.544.3563 | Matthew J. Casiano | matthew.j.casiano@nasa.gov | 256.544.6057 |
| **MSFC-007** | Developing Applications of Land Surface Model Data for Wildfire Threat and Drought Monitoring | NASA missions focused on remote sensing of the land surface and hydrological cycle provide unique vantage points for the mapping of soil moisture, detection of crop and vegetation stress, changes in the land surface that result from wildfire burn areas, and other information useful for incorporation in land surface modeling. In turn, the resulting land surface outputs can be used in a variety of applications to improve weather analysis and forecasting through integration in numerical weather prediction models, or fused with other current and upcoming mission data (e.g. lightning from ISS-Lightning Imaging Sensor and Geostationary Lightning Mapper on GOES-R) to aid in the detection of areas sensitive to the ignition of wildfires. Research activities will focus on the validation and improvement of land surface models and output data sets, incorporation of output into fused data approaches for monitoring wildfire threats and drought monitoring, and application of these outcomes to support the prediction of wildfire risk areas and impacts or extent of meteorological drought conditions | Master’s Degree | Andrew Molthan | andrew.molthan@nasa.gov | 256.961.7474 | Bradley T.Zavodsky | brad.zavodsky@nasa.gov | 256.961.7914 |
| **MSFC-008** | Development of Conceptual Models of the Friction Stir Welding Process | In the friction stir welding process a rotating threaded pin seized in a weld seam is moved along the seam stirring the sides of the seam together into a weld as it goes. Friction stir welds are strong and reliable and are increasingly used in the aerospace industry in general and by NASA in particular. The process was invented in 1991 at The Welding Institute in the United Kingdom. The solid-state process was taken up by NASA in 1995 as a means to circumvent fusion-welding problems with a new alloy. The process seems to have been conceived originally as chaotic mixing. Subsequently process models incorporating a liquid layer at the tool-weld metal surface or conceiving the process as an extrusion of heat-softened metal past a friction-heating pin were put forward. Fluid finite element analysis models seem to be popular today, although they miss important flow aspects like the discontinuous structural change at the "shear surface". Studies undertaken at NASA have decomposed the friction stir flow field into simpler components and produced a model reproducing microstructural features and relating features to boundary conditions at the tool surface. The object of this study is to document the progression of concepts of the friction stir welding process, to make better understood the concept of friction stir welding developed at NASA, which would seem to have advantages over previous and some extant concepts, and to see if somewhere we have missed a still more useful model. A publication of the results in a widely read journal is to be aimed at. | Pursuing Master's Degree | Arthur Nunes | arthur.c.nunes@nasa.gov | 256.544.2699 | Carolyn K. Russell | carolyn.k.russell@nasa.gov | 256.544.2705 |
| **MSFC-009** | Enivronmental Control and Life Support Technology for Space and/or Earth Applications | Environmental Control and Life Support (ECLS) is an essential function of long-duration manned space flight. Technology development to identify the best technologies to ensure crew survival is ongoing. These technologies can occasionally be modified and implemented on Earth to solve terrestrial challenges. This opportunity will involve support in the development of one or more of these technologies for Space application, Earth application, or a combination of both. | Pursuing Master's Degree or Pursuing Doctoral Degree | Morgan B. Abne | morgan.b.abney@nasa.gov | 256.961.4758 | | | |

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| **MSFC-010** | High Temperature Thermoelectrics | Student will follow a design of experiments approach to fabricate high temperature thermoelectrics using a direct current sintering furnace. Analysis of the thermoelectrics will include measuring Seebeck Coefficient and thermal conductivity as well as SEMIEDS analysis of the samples. It is expected that this research will lead to a refereed journal paper and it is possible for a Master's Thesis to be obtained using this work. | Pursuing Master's Degree | Dennis Tucker | dr.dennis.tucker@nasa.gov | 256.544.7022 | Carolyn K. Russell | carolyn.k.russell@nasa.gov | 256.544.2705 |
| **MSFC-011** | Integration of NASA Earth Remote Sensing for Improved Land Surface and Hydrological Predictions | NASA's constellation of Earth remote sensing instruments provide a comprehensive suite of observations focused on the land surface, including measurement of vegetation extent and health, soil moisture, and groundwater, and future planned missions will continue to build upon these capabilities. In addition, NASA research teams have developed land surface modeling and data assimilation capabilities to integrate this information into regional weather forecasting and hydrologic (i.e. streamflow) predictions, including the NASA Land Information System, the community and open-source Weather Research and Forecasting (WRF) model as a contribution to a NASA-Unified WRF that focuses on NASA's specific contributions of physics parameterizations, and linkages to NOAA's National Water Model via WRF's recently developed WRF-Hydro component.<br>The research project will focus on the integration of NASA land surface data sets through data assimilation or other approaches within the aforementioned models to improve their use and adoption within these systems, targeting improvements in regional weather forecasting and climate or dynamic downscaling simulations. The project will also explore the feasibility of incorporating future NASA mission data to improve the mapping and simulation of water resources and various components of the water budget over land, such as precipitation, regional streamflows, ground water recharge, and related physical processes. | Doctoral | Andrew Molthan | andrew.molthan@nasa.gov | 256.961.7474 | Bradley T.Zavodsky | brad.zavodsky@nasa.gov | 256.961.7914 |
| **MSFC-012** | Machine Learning and Data Fusion Approaches to Identifying Hazardous Weather from Geostationary and Polar-Orbiting Platforms | NASA polar-orbiting missions including land surface and cloud remote sensing from MODIS and NASA/NOAA joint missions that include VIIRS provide opportunities to identify weather phenomena such as severe thunderstorms, turbulence hazards for aircraft, low cloud ceilings and visibility restrictions, lightning, smoke, flood water, and other hazards, and with increased temporal resolution with many of these capabilities continued through upcoming launch of the NASA/NOAA Geostationary Operational Environmental Satellite (GOES) –R Series (GOES-R), which will also provide a Geostationary Lightning Mapper (GLM) to provide near real-time observations of lightning data frequently coinciding with severe weather events throughout the United States. In addition, NASA and partnering sensors also provide three-dimensional remote sensing of temperature and moisture relevant to improving weather analysis and forecasting applications.<br>The proposed research activity will apply multispectral satellite image analysis techniques through machine learning and data fusion or assimilation approaches that identify current or future, likely hazards. Research will analyze past events to identify patterns commonly observed in satellite imagery and modeling outputs towards a goal of rapidly identifying these hazards from satellite imagery and algorithm outputs, improving lead time for their prediction, avoidance, or mitigation. | Pursuing Master's Degree | Andrew Molthan | andrew.molthan@nasa.gov | 256.961.7474 | Bradley T.Zavodsky | brad.zavodsky@nasa.gov | 256.961.7914 |
| **MSFC-013** | Modeling Investigation of cryogenic propellant receiver tank cooling/transfer physics and operations | Cryogenic propellants are essential to NASA's mission for in-space exploration, providing higher overall propulsion system performance. Typical propellants are hydrogen, oxygen and methane which are stored as sub-critical liquids at high density in large low pressure propellant tanks. For long duration missions, and in the case of landers and nuclear thermal propulsion systems, the ability to refill these systems is attractive, as it allows the vehicle to be reused.<br>The in-space transfer of cryogenic propellants is problematic and hardware/operations would need to be devised to minimize losses due to venting, chill-down and tanking while maintaining a simple operational scheme. The focus of this research would involve a combination of system level fluid and computation fluid dynamics modeling and analyses to address the chill-down and injection of cryogenic fluid into a propellant tank. The approaches must consider minimal/strategic venting while cooling the tank system followed by no-vent fill scenarios to move the bulk fluid into the propellant tank; the cool down of the transfer lines can also be examined. Investigations would include modeling of spray condensation/evaporation coupled with tank thermodynamic interactions and heat transfer for normal<br>gravity and low gravity conditions. Packages such as MSFC's Generalized Fluid Systems Simulation Program (GFSSP) and CFD programs would be used to develop system algorithms that could be used to assess the chill/fill process on a range of propellant tank sizes. Liquid nitrogen provides an excellent surrogate to experimentally evaluate numerical models and simulations, anchoring the physics which can then be extended to other cryogenic propellants. MSFC has a small hardware setup that has been used to generate liquid nitrogen vented chill/no-vent fill data that can be used to validate models and be operated to produce specific conditions under investigation. | Pursuing Master's Degree or Pursuing Doctoral Degree | Adam Martin | adam.k.martin@nasa.gov | 256.544.5296 | Jonathan Stephens | jonathan.r.stephens@nasa.gov | 256.544.3769 |
| **MSFC-014** | Remote Sensing of Energy and Water Cycle Variability | The objective of supported research is to use satellite-based datasets to better understand the Earth's hydrologic and energy cycles. Particular emphasis is placed on measurement and analysis of integrated hydrologic variability in the earth system from global to regional scales to include interannual to subseasonal spatial and temporal variability of water and energy cycle components. | Pursuing Master's Degree or Pursuing Doctoral Degree | Jason Roberts | Jason.b.roberts@nasa.gov | 256.961.7477 | Pete Robertson | pete.robertson@nasa.gov | 256.961.7836 |

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| **MSFC-015** | Urban Heat Wave Hazard and Risk Mapping | Heat waves are one of the largest causes of environmentally- related deaths globally. While elevated summertime temperatures are the main driver for this hazard, the amplification of heat waves by the heat island in urban areas and elevated humidity (apparent temperature), combined with urban demographics, are key elements leading to these potential disasters. The most recent Intergovernmental Panel on Climate Change (IPCC) report indicates that temperature extremes are likely to increase under a global warming scenario. This project uses moderate resolution thermal data from NASA satellites to derive apparent temperature (heat index) over urban regions to produce a heat wave hazard map. The hazard map is combined with urban demographic information to produce a daily heat wave risk assessment for selected cities. The product is being developed in a research mode with the prototype product being initially delivered via mobile "app" for the summer of 2016. Validation of the products will be supported through citizen scientist reports of local temperature variations. The objective of the graduate fellowship would be participate in the development of the remote sensing products, their delivery to end users, data collection and validation. It is envisioned that this fellowship could become the student's thesis research project. | Pursuing Master's Degree | Gary Jedlovec | gary.jedlovec@nasa.gov | 256.961.7966 | Jason Burks | | |
| **MSFC-016** | Weld Seam Trace Defects in Friction Stir Welds | In the friction stir welding process a rotating threaded pin seized in a weld seam is moved along the seam stirring the sides of the seam together into a weld as it goes. Friction stir welds are strong and reliable and are increasingly used in the aerospace industry in general and by NASA in particular.<br>The friction stir welding action takes place along the weld seam, the trace of which is a suspect source for defects that reduce the strength of a weld. A number of concepts that clarify the processes taking place within a friction stir weld have been developed at this laboratory. The condition of the weld seam trace is affected by weld parameter settings, tool geometry, weld material, and seam surface preparation. The intermediary between weld process and weld properties is structure. The objective of this study is to observe weld structures resulting from varied weld processes, focusing on seam trace defects, to observe the effects of defects on strength, and to interpret defect formation and strength consequences in terms of fundamental physical models. The results of this study will have consequences for design of friction stir tools, optimization of parameter choices and joint preparation techniques, and diagnosis and correction of weld problems. | Pursuing Master's Degree or Pursuing Doctoral Degree | Arthur Nunes | arthur.c.nunes@nasa.gov | 256.544.2699 | Carolyn K. Russell | carolyn.k.russell@nasa.gov | 256.544.2705 |

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| **SSC-000** | Student Proposed with Concurrence of NASA Technical Mentor | The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor. | Pursuing Master's Degree or Pursuing Doctoral Degree | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | Student idenified NASA Technical Advisor | | | |
| **SSC-001** | Ground Test Facilities Technology | A wide range of rocket propulsion test work occurs at NASA SSC including full-scale engine test activities at test facilities A-1, A-2, B-1 and B-2 as well as combustion device research and development activities at the E-Complex (E-1, E-2, E-3 and E-4) test facilities. Rigorous test campaigns are pursued to ensure rocket engine and rocket engine component systems satisfy their design requirements and to allow for an understanding of the system/component operational envelope. The testing also allows for the development and validation of accurate simulation models.<br><br>SSC is interested in new, innovative ground-test techniques to conduct a variety of required developmental and certification tests for space systems, stages/vehicles, subsystems, and components. Examples include better coupling and integration of computational fluid dynamics and heat transfer modeling tools focused on cryogenic fluids at high flow and high pressure conditions and on rocket exhaust plumes; advanced control strategies for non-linear multi-variable systems; structural modeling tools for ground-test programs; low-cost, variable altitude simulation techniques; and uncertainty analysis modeling of test systems. | Pursuing Master's Degree or Pursuing Doctoral Degree | Harry M. Ryan | harry.m.ryan@nasa.gov | 228.688.2757 | | | |