2018-2019 NASA I^2 Project List

NASA Center	Project Title	Mentor	Project Description	Requirements
Ames Research Center Moffett Field, California	Advanced Life Support	Michael Flynn	Advanced life support systems include all systems and technologies required to keep astronauts alive in space: water recycling, air recycling and waste treatment. This Internship is primarily focused on water recycling but is cognizant that an optimized system will include integration with air and waste systems. Our research areas include: • Systems that can recover energy from waste. • In situ resource utilization in spacecraft and on planetary surfaces • Application of space flight systems technologies to sustainable terrestrial development.	Innovation a required skill. Our group focuses on training the next generation of NASA scientists on how to innovate and to develop the next generation of water recycling space flight systems that will enable the human exploration and colonization of the Solar System. The ideal candidate is an undergraduate or graduate student in the fields of: Engineering (Chemical, Environmental, Electrical, Industrial, Civil, Computer), Mathematics, Chemistry, Biology, Physics, and Environmental Science and must have at least completed their freshman year of college and a GPA of 3.00 (out of 4). Professional Working Proficiency (ILR level 3) of the English language is the minimum level required. The participant must be a team player and comfortable working with professionals of different cultural and scientific background. At the end of the internship the participant will be required to submit a white paper.
Ames Research Center Moffett Field, California	Biosensor Development	Jessica Koehne	Development of biosensors is an active field due to a wide range of applications in lab-on-a-chip, diagnostics of infectious diseases, cancer diagnostics, environment monitoring, biodetection and others. One of the strategies used for selective identification of a target is to /preselect/ a probe that has a unique affinity for the target or can uniquely interact or hybridize with the target: sort of a "lock and key" approach. In this approach, one then needs a platform to support the probe and a recognizing element that can recognize the said interaction between the probe and the target. The interaction result can manifest optically (by using dyes, quantum dots for example) or electrically. The platform design and configuration may vary depending on whether optical or electrical readout is used and what environment the sensor will be utilized. Recently, printed biosensors on paper substrates have gained much attention for their low cost of manufacture. Within NASA, such printed devices are being investigated because of our potential ability to manufacture in an in-space environment. Such a biosensor would be a print-on-demand device. The current project involves fabricating and validating a printed, electrical biosensor for cardiac health monitoring from a whole blood sample. The intended NASA application is point of care diagnostics for astronaut health monitoring.	
Ames Research Center Moffett Field, California	Closed-Loop Life Support	Jonathan Trent	The project is related to closed-loop life-support and is focused on building a nexus between water, food, and energy. More specifically, in the laboratory there are two projects: 1) developing a monitoring system for microalgae cultivation and 2) testing a combined forward/reverse osmosis system for purifying wastewater to potable standards. Both of these systems have automation/monitoring issues. Samples are non-toxic and utilize standard scientific equipment.	
Ames Research Center Moffett Field, California	Control Internship Position	Nhan Nguyen	Advances in material technologies have led to a new class of ultra-efficient transport aircraft that incorporate advanced high-aspect ratio flexible wing designs with novel control effectors. The NASA Performance Adaptive Aeroelastic Wing (PAAW) research element under the NASA Advanced Air Transport Technology (AATT) project seeks to develop control technologies and analysis capabilities to enable the implementation of these advanced future wing designs. Development of control systems for highly flexible wings is a critical component of this relevant and challenging field. This internship opportunity will support the NASA research team in developing disturbance estimation techniques for use in both adaptive and non-adaptive control designs for gust load alleviation. The intern will also help formulate design requirements for future hardware that facilitate successful estimation and control. Specific applications for the techniques developed include flight control, wing shaping, and load alleviation of flexible wing aircraft.	Final deliverables for this internship include any research results such as report, presentation, or conference publication as well as simulations demonstrating operation of the disturbance observer in use with the control system. The intern should have theoretical and practical knowledge of control and estimation including adaptive control, as well as extensive experience simulating dynamic models within MATLAB/Simulink.
Ames Research Center Moffett Field, California	Design a Pump Control System with Flow Feedback for the Cell Science Project	Terry Lusby	1. Re-design a charge pre-amplifier to custom fit a Far West proportional counter (a gas-based sensor). 2. Assist with the build-up of an engineering design unit (EDU) for the Cell Science Project. This is a cell growth module that will be flown to the ISS.	

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Ames Research Center Moffett Field, California	Evaluation of a Variable Density Approach to Modeling Cryogenic Jets	Cetin Kiris	The intern will assist ARC researchers in extending user defined equation of state routines to include Real Gas effects and analyze the difference between mass fraction and volume fraction formulations for modeling variable density flows. The intern will evaluate the models on existing cryogenic jets and compare with existing experimental and numerical data. Outline for 6 months: - Discuss and analyze differences between mass fraction and volume fraction formulations of the variable density formulation - Begin interaction with the ARC researchers using the user-based source routines which can be linked into the existing libraries - Apply the implemented user routines to existing cryogenic jet problems - Compare current results with existing experimental and numerical results in the literature	
Ames Research Center Moffett Field, California	Evaluation of Biomedical Devices for Exploration Missions	Tianna Shaw	The primary responsibility for this intern position is to support the development and testing of biosensor monitoring systems in support of the Human Research Program (HRP) Exploration Medical Capability (ExMC) Element. The Ames Research Center (ARC) team focuses on the integration of biomedical devices into a prototype medical data architecture (MDA), that will receive, store and display a wide variety of physiological parameters which include; electrocardiogram (ECG), heart rate, blood pressure, pulse oximetry, respiratory rate, and body temperature. The intern will work under the guidance of an ExMC project engineer and will also work with ExMC project system engineer. The intern will support human in the loop laboratory testing of biomedical devices and development of the medical data architecture system. The intern will also participate in data collection, processing and analysis of biosensor data and assist in report writing. He/She will support MDA operations in collaboration with CSA prototype wearable biosensor system and other systems.	
Ames Research Center Moffett Field, California	Experimental Aero-Physics Engineering Intern	Rabi Mehta	The intern will help with a variety of experimental projects which investigate the fluid mechanic, aerodynamic, and/or aeroacoustic characteristics of manned and unmanned spacecraft, aircraft, rotorcraft, ground vehicles, ships, structures, sports balls, and other objects. The experimental projects will be conducted in conjunction with on-site research mentors, using NASA Ames wind tunnel, water channel, lab, and/or computer facilities. The intern will assist with many different phases of one or more test programs; these phases may include prior data review and test planning, test logistics, experimental design and setup, model construction and installation, instrumentation calibration, installation, and operation, test video/photo documentation, post-test data plotting and analysis, and report development. The intern may also assist with the development and execution of various computer programs used to analyze or simulate the results of experimental test programs. The main outcome of this internship will be experience with a variety of disciplines related to fluid mechanics, aerodynamics, and/or aeroacoustics	Physics, Science, Math, Engineering backgrounds preferred
Ames Research Center Moffett Field, California	Intelligence for Choosing Icy Landing and Exploration Sites (ICICLES)	Terrence Fong	Landers for icy moons will want to land at regions that are both safe and scientifically interesting. Communications restrictions that result from these remote operations mean that humans cannot be involved in updating landing site selection during descent, just when the most reliable data becomes available. The objective of ICICLES is to automatically select candidate landing sites from orbit and to contiunally update the EDL plan while descending. The intern will assist the Intelligent Robotics Group (IRG) in designing orbits which observe scientifically interesting candidate landing sites, as well as attempting to inform the geometry of the surface at those sites. In particular, the intern will help develop optimal control methods to design orbit trajectories that provide optimal views of the surface. Very strong emphasis will be placed on incorporating and integrating the intern's research into IRG's on-going projects.	
Ames Research Center Moffett Field, California	Lunar Topographic Products from Orbital Images	Terrence Fong	Digital terrain models are essential for cartography, science analysis, mission planning and operations. The NASA Ames Intelligent Robotics Group (IRG) has developed software to automatically generate high-quality topographic and albedo models from satellite images. Our software, the Ames Stereo Pipeline (ASP), uses stereo vision and photoclinometric techniques to produce 3D models of the Earth, Moon, and Mars with very high accuracy and resolution. The intern will assist IRG to improve the quality of topographic products from lunar orbital images. In particular, the intern will help develop multi-stage stereogrammetric methods to exploit the full potential of multiple, overlapping views of a planetary surface. The intern will work closely with NASA researchers and engineers throughout the internship. Very strong emphasis is placed on incorporating and integrating the intern's research into IRG's on-going projects. Research results may be published in one (or more) technical forums: as a NASA technical report, a conference paper, or journal article.	The intern must have a background in Computer Science or Mathematics. Practical experience with computer programming, Linux-based software development and open-source tools (gcc, git, etc) is required. Experience with C++ is strongly encouraged.

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Ames Research Center Moffett Field, California	MADCAT Project	Kenneth Cheung	The Coded Structures Laboratory conducts research across material science, robotics, and algorithms, for application to aeronautics and space systems. The lab's primary current project incorporates a building-block based approach to ultralight lattice-based structures for shape morphing aircraft. Expected activities for this position will be both theoretical and experimental in nature, in support of advanced research using multidisciplinary analyses to understand the mechanics of new structural strategies and to develop predictive analytical models for the design of systems with novel behavior. Experimental work is aimed at testing these analyses with mechanical load testing and a wind tunnel experiment.	
Ames Research Center Moffett Field, California	Metabolic Control for Adaptation to Spaceflight Environment	Yuri Griko	With the growing interest in long haul flights and the colonization of the solar system, it is becoming important to develop organism self-regulatory control systems which would be able to meet the requirements of extraterrestrial environments rather than requiring an Earthly environment in space. A better mechanistic understanding of metabolism offers a means for sustaining astronauts in long-duration missions beyond the low Earth orbit. Recent data obtained from several research reports have shown that metabolic suppression could protect biological organisms from damaging effects of space radiation and microgravity. The ability to drastically reduce and suspend metabolism appears to be closely tied to the unique survival of bacteria and some invertebrates (e.g., tardigrades) after a prolonged exposure to cosmic vacuum and radiation. It is possible that there is a monophyletic origin for this adaptation at the molecular level among a variety of different organisms. Our ultimate goals are to demonstrate proof-of-principle for metabolic suppression as means to reduce the negative effects of spaceflight environmental issues such as radiation and microgravity. In order to demonstrate the potential application of the metabolic control technology the PI's laboratory at NASA Ames Research Center has engineered a hypo-metabolic chamber with a range of life-monitoring equipment for high-throughput testing of hypo-metabolic parameters and conditions that enable reversible induction of a state of suspended animation in non-hibernating animals. This internship opportunity will assist in defining and implementing demonstrations of the metabolic control technology using different animal models. Objectives of this research are: 1 To characterize the hypometabolic state 2 To develop methodology for real time monitoring of respiratory and other physiological parameters and conditions associated with the hypometabolic stasis. In the proposed experiments, the intern will work in collaboration with molecular biologists and engineers to (1) reproduce induction of the reversible suspended animation-like state in selected animal models, and to (2) establish a comprehensive life support system for monitoring physiological parameters of the hypometabolic state.	Intern should be willing to work with animals. He/she should have basic knowledge of life support systems (respiratory parameters, ventilation, and core body temperature control), have basic laboratory skills and technical knowledge for monitoring physical parameter from telemetric devises, and have software management skills. Strong analytical and organizational skills; interest in biology; interest in data analysis. Senior undergraduate at junior/senior level or higher preferred.
Ames Research Center Moffett Field, California	Microbial Factories for Solar System Exploration	John Hogan	Long duration missions to distant bodies within our solar system will require significant resources to support astronauts. Microbial factories could help produce mission relevant products during such missions using *in situ* resources such as carbon dioxide and water. In terrestrial systems, microbial factories are already being used to produce a wide variety of materials, fuels, nutrients, and medicines. Typically, these microbial systems use high-energy carbon substrates such as sugars. In the extremes of space, however, obtaining sugar-like compounds will prove to be problematic, thus alternative low-energy carbon compounds may need to be employed. The main objective of this project is to evaluate the potential combination of substrates, microorganisms, and products in understanding how a microbial production system will function in the constraints of relevant space missions. The work entails performing microbiological studies and conducting an analysis to determine effective solutions for in-space microbial production systems.	
Ames Research Center Moffett Field, California	Monitoring Changes in ASRS Reports using Python and Text Mining	Hamed Valizadegan	We aim to develop tools that can be used to monitor the changes in the aviations safety reports submitted to NASA Aviation Safety Reporting System (ASRS) program. ASRS collects and analysis the voluntarily submitted aviation safety incidents reports in order to reduce the likelihood of aviation accidents. We need tools that can help ASRS to monitor changes in the narratives of the reports over time and can summarize these reports.	

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Ames Research Center Moffett Field, California	Nanotechnology in electronics and sensor development	Meyya Meyyappan	Nanomaterials such as carbon nanotubes (CNTs), graphene and a variety of inorganic nanowires offer tremendous potential for future nanoelectronics, nanosensors and related devices. We have active ongoing programs in these areas. Several examples are given below. Chemical sensors to detect trace amounts of gases and vapors are needed in planetary exploration, crew cabin air quality monitoring and leak detection; there are numerous societal applications as well. We have been working on CNT based sensors amenable for various platforms including smartphones. Flexible electronics on substrates such as textile and paper is of great deal of interest to us. We have fabricated gas/vapor sensors on cotton textile as well as cellulose paper. Other interests in paper electronics and flexible substrates include memory devices, energy storage devices, displays and detectors. Finally, we have also been revisiting vacuum tubes although in the nanoscale, using entirely silicon based technology. These radiation resistant devices offer exceptionally high frequency performance. Our interest here extends to exploring the nano vacuum tubes for THz electronics applications. In all the areas, the projects include material growth, characterization, device fabrication, device testing and evaluation, reliability and lifetime assessment.	For device related aspects, majoring in electrical engineering or physics is preferred. For the remaining aspects of the project, majors in material science, chemistry and other engineering disciplines are welcome. PhD candidates and talented undergraduates will get preference.
Ames Research Center Moffett Field, California	NASA Ames SPHERES/Astrobee Facility	Jose Benavides	NASA Ames SPHERES/Astrobee Facility Brief description of duties: The successful applicant would be involved with software development and general support of the NASA Ames SPHERES/Astrobee Facility. (www. nasa.gov/spheres) Specifically, the successful applicant would initially be validating and developing C software for a SPHERES. Additional work may include ISS flight quality hardware and maintaining SPHERES Facility labs. The applicant should be familiar with Python and C software development and good coding practices. In general, we are looking for someone who is motivated, a self-starter, and capable of working independently on tasks. Other beneficial experience may include; - MATLAB, C/C++, Java, Python, Android Apps, and Linux scripting, Computer Networking - Spacecraft, Small Satellites, CubeSat's - Avionics, Embedded Hardware & Software - Software testing - experience building space flight hardware - Good writing and communications skills, along with the ability to work well both individually and within a multidisciplinary team.	
Ames Research Center Moffett Field, California	Orbit Analysis for LEO CubeSats and Low Lunar Orbits	Marcus Murbach	The intern will fulfill assignments as a member of the orbital dynamics team in the Mission Design Division at NASA Ames Research Center. The Mission Design Division conducts early-stage concept development and technology maturation supporting the Center's space and aircraft mission proposals. Personnel have experience in mission planning, small spacecraft design, and engineering analysis. The Mission Design Division, or MDD, supports the full mission life cycle in the areas of: • Early Concept Development • Mission Design • Rapid Prototyping • Mission Implementation The candidate will work closely with flight dynamics engineers to expand existing innovative approaches to low altitude orbit design. This work includes the effects of differential drag in Low Earth Orbit (LEO), as well as, the effects of mascon perturbations in low lunar orbits. SmallSat and CubeSat missions are a specialty of Ames Research Center and current research addresses practical issues with small spacecraft missions in a LEO and an interplanetary environment. Another orbital mechanics specialty of ARC is low, equatorial lunar orbits and design tools for addressing lunar gravitational perturbations. For lunar orbits, we plan to expand the research on equatorial frozen orbits and the visualization displays for characterizing gravitational perturbations. For LEO, the characterization of the effects of drag in relative satellite disposition is in the scope of this position. The goals of this assignment include documentation and display tools that will reside as part of the Mission Design Division's computational capability. Additional assignments as needed may involve CubeSat low thrust trajectory design, multiple CubeSat swarms, and CubeSat reentry calculations. Candidate's Computer and/or special skills: GMAT or STK/Astrogator, Matlab or Visual Basic. Strong writing skills are expected, both for internal documentation of work accomplished and for publications resulting from this work.	

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Ames Research Center Moffett Field, California	Robotic Sample Transfer Automation	Brian Glass	The Atacama Rover Astrobiology Drilling Studies (ARADS) project is a Science Mission Directorate-sponsored project led at NASA-Ames. ARADS proposes a Mars rover analog mission as a field test of an integrated rover-drill system with prototype life-detection instruments that are flight mission candidates. The essential elements to ARADS are: 1) use of integrated drill and rover at sites in the Atacama Desert in Chile in unprepared "regolith"; 2) field use of instruments with the rover/drill that are flight prototypes comparable to those planned for ExoMars and Icebreaker; 3) acquire drilled cuttings and transfer to instruments onboard the rover; 4) on-board autonomy and monitoring to support drilling; mission and demonstrate science support (operations and control) for the rover/drill/instrument operations. This intern project will address the third element above: automated sample transfer between a drill (on one side of the KREX2 rover) and instrument intakes (on the other side of the rover). The ARADS sample transfer arm is mounted on a KREX2 rocker, which rotates relative to the central platform on which both the drill and instruments are mounted. Hence, as the rover moves, the trajectory between the drill and instruments will rotate relative to the sample arm's origin point. The arm is powered by servo motors which respond to pulse width modulation signals from the arm interface – two extra servo control channels support the testing of end effectors with up to two actuators. The intern will assist an existing ARADS staff member in developing a dynamic transformation for arm trajectories that will automatically compensate for rocker rotation and for vertical drill movements. This will be coded and tested with the actual arm, drill and rover mechanisms.	
Ames Research Center Moffett Field, California	Rotorcraft Aeromechanics	William Warmbrodt	The Aeromechanics Branch is responsible for aeromechanics research activities that directly support the civil competitiveness of the U.S. helicopter industry and the Department of Defense. Branch programs address all aspects of the rotorcraft which directly influence the vehicle's performance, structural, and dynamic response, external acoustics, vibration, and aeroelastic stability. The span of research also includes unmanned aerial vehicle (UAV) platforms, including quadcopters and other advanced, small remotely piloted vertical takeoff and landing (VTOL) aircraft. 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. 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.	Broad background in science and math classes typical of an upper division undergraduate in mechanical, aeronautical or aerospace engineering. Knowledge of MatLab, Simulink, CREO ProE/SolidWorks/AutoCad,, VSP, Rhino, C++, python, or other programming/software languages is desired, but not mandatory.
Ames Research Center Moffett Field, California	Small Satellite Swarm Interactions	Matthew Sorgenfrei	Very small spacecraft (also known as CubeSats or Nanosatellites) have not yet realized their full potential regarding swarm operations in low Earth orbit or beyond. The relatively low Technology Readiness Level (TRL) is due in part to a lack of sufficient testbeds with which to test the enabling technologies. The Generalized Nanosatellite Avionics Testbed (G-NAT) lab at NASA Ames seeks an intern to research foundational technologies associated with CubeSat swarm operations. Over the course of the internship period the intern will investigate the use of commercially available sensors and actuators for sensing the state of individual members of a satellite swarm and sharing that state information to enable distributed science operations. The successful candidate should possess strong MATLAB/Simulink programming skills, and also be proficient in C and Python. Familiarity with Linux operating systems and embedded systems/single board computers is also desired. The intern will be given access to two separate CubeSat-scale hardware testbeds, each of which utilize commercially available sensors and actuators to enable attitude determination and control. Desired outcomes of the research period include: • Develop real-time MATLAB (or other) visualizations of spacecraft attitude state for both CubeSat testbeds during air bearing operations • Study the efficacy of demonstrating swarm communications by way of Xbee wireless transponders • Study/develop operational modes that are relevant to possible swarm science operations, such as GPS Radio Occulation	

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Ames Research Center Moffett Field, California	Synthetic Biomaterials: A Multi-Scale Approach	Diana Gentry	A small group of interns with backgrounds in bioscience, materials chemistry and science, and bioengineering will, with the guidance of senior researchers, design and fabricate a proof-of-concept hybrid biomaterial using the interactions between living and non-living components to control the material structure. The material proof-of-concept will use existing genetic parts, such as binding domains, and established synthetic biology techniques, such as fusion protein design. The fabrication will be done using current techniques such as 3D CAD modeling, microscale gel deposition, and stereolithography. The exact implementation will be chosen jointly by the interns and mentors after a literature survey. The interns will learn about the history and current state of biomaterials, materials science, and synthetic biology, how to perform basic bioengineering techniques, and how to perform basic biomaterials analyses. They will gain real-world experience with literature searches, proposing and defending research implementations, hands-on bioengineering lab work (including synthetic biology, rapid prototyping, and fluidics), preparing documentation of research work, and statistics and data analysis. Interns will have a chance to present their research at a poster symposium and/or workshop. Depending on the breadth of work covered by the interns, participation in writing a published research paper is a possibility.	
Ames Research Center Moffett Field, California	The Influence of Mechanical Unloading on Biological Function	Elizabeth Blaber	The spaceflight environment, including microgravity and space radiation, is known to negatively impact mammalian physiology, including somatic stem cell-based tissue regeneration. The degenerative effects of spaceflight that we understand best include rapid microgravity-adaptive bone and muscle loss, loss of cardiovascular capacity, defects in wound and bone fracture healing and impaired immune function. These implications pose a significant risk for long-term human space exploration. Our work focuses on the influence of mechanical unloading on stem cell proliferation, differentiation and regeneration and how alterations in stem cell function may be the cause of widespread tissue degeneration in space. In this opportunity, the selected candidate will work with research scientists to analyze the response of mouse bone and bone marrow stem cells to mechanical unloading using both spaceflight samples and mouse hindlimb unloading experiments. The intern will investigate stem cell responses to microgravity and mechanical unloading using gene expression and protein analysis and furthermore, will investigate the influence of stem cell function on whole bone tissue properties - including structural and molecular analysis. Furthermore, the intern will also work with scientists on optimizing conditions for an upcoming spaceflight experiment where we aim to identify key molecular mechanisms that cause degenerative effects in bone tissue through impaired differentiation of mesenchymal stem cells. The intern will conduct cell culture and gene expression/protein assays to characterize wildtype stem cells compared to the transgenic model. The intern will then work with research scientists to determine the optimal cell culture parameters to conduct the experiment in spaceflight hardware.	Laboratory experience is preferred
Ames Research Center Moffett Field, California	Unmanned Aircraft System	Marcus Johnson	Many applications of small Unmanned Aircraft System (UAS) have been envisioned. These include surveillance of key assets such as pipelines, rail, or electric wires, deliveries, search and rescue, traffic monitoring, videography, and precision agriculture. These operations are likely to occur in the same airspace in the presence of many static and dynamic constraints such as airports, and high wind areas. Therefore, operations of small UAS need to be managed to ensure safety and operation efficiency is maintained. NASA has advanced a concept for UAS Traffic Management (UTM) and has initiated a research effort to refine that concept and develop operational and system requirements. A UTM research platform is in development and flight test activities to evaluate core functions and key assumptions focusing exclusively on UAS operations in different environments are underway. This internship will help support the development, planning, support and data analysis for UAS field test activities by: - Preparing documentation and conducting analysis to gain approval to fly; - Planning flight test activities, including developing testing methodologies for determining the effectiveness of detect and avoid systems and other separation mechanisms. - Working flight test logistics such as support, transportation, storage, and procurement of equipment needed at the test site; - Providing on-site support during flight test activities; - Providing post-flight analysis of data collected from the experiment.	

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Ames Research Center Moffett Field, California	Worldwind Application Development	Patrick Hogan	Interns will build an open source app that serves beneficial interests of society, using the EAR99 certified NASA World Wind Open Source technology, virtual globe technology and applications in Java, C++, iOS and Android using NASA World Wind technology. Typical project examples from last year NASA Interns: The wikis that describe these NASA apps (with a video!): https://github.com/NASAWorldWindResearch/SpaceBirds/wiki https://github.com/NASAWorldWindResearch/WorldWeather/wiki https://github.com/NASAWorldWindResearch/Quake-Hunter/wiki The web apps: http://worldwind.arc.nasa.gov/spacebirds/ (Satellite Data) http://worldwind.arc.nasa.gov/worldweather/ (Weather & Climate Data) http://worldwind.arc.nasa.gov/quakehunter/ (Seismic Data)	
Ames Research Center Moffett Field, California	Robotic 3D Mapping for Exploration of Planetary Caves	Uland Wong, Ara Nefian	BRAILLE (Biologic and Resource Analog Investigations in Low Light Environments) is a new astrobiology project at NASA Ames which is investigating technologies and developing a concept robotic mission for exploration of planetary caves on Mars. Martian caves may be hospitable environments for microbial life due to temperate conditions, radiation shielding, and presence of water. BRAILLE will conduct terrestrial testing in an analog environment (at Lava Beds National Monument) in order to learn what sensors, samples and operational strategies are best suited for Martian missions to detect and characterize life. To this end, we are developing a robotic platform that will carry science sensors, perform high resolution 3D mapping of cave interiors, and return this information to scientists for analysis. Creating 3D maps is a challenge because planetary caves are GPS-denied, so any position estimates from the robot must be strictly local and incremental. Increment drift in maps can be further compounded by the irregular nature of cave features. Lastly, lack of natural illumination presents an issue with producing quality images and sensing at range. Solutions to this problem have far-reaching impact to future missions which will venture to such extreme locales.We are looking for a student intern to help with software development and research on the BRAILLE project. The student will have the ability to work on a self-contained, but impactful problem at the forefront of planetary exploration research at NASA. Projects will be tailored to areas of interest and experience. Examples include multi-view stereo mapping with active flash illumination, sensor fusion (LIDAR, imaging, multispectral), or machine learning for detecting interesting science features.	The applicant should, at a minimum, have experience with Linux (Ubuntu) and be able to program well in C or C++. Independent problem solving under guidance of the mentor is expected. Ideally, you will have taken some upper division computer science and introductory robotics classes. Be familiar with data structures applicable to autonomous systems, like voxel grids, point clouds, octrees, range images, and triangulated meshes. Be familiar with the research process: literature survey, problem formulation, hypothesis, implementation, experimentation and statistical analysis. Priority will be given to those who have some prior field experience with caves and other underground environments, or high enthusiasm for such. Any significant experience with one or more areas of robotics research, particularly perception, localization or machine learning is also a plus.
Ames Research Center Moffett Field, California	Software for Autonomous Robotic Landing on Icy Moons	Uland Wong, Michael Dille	Do you want to help NASA land in extreme icy environments? Icy moons, such as Europa, Enceladus and Titan, are the among the most likely locations for finding life elsewhere in the solar system. NASA is developing future missions to explore Europa in particular, beginning with orbital assets in the next decade and eventually leading to robotic surface probes. A leap in autonomous capability is necessary for robotic landers to aerially explore and touch down in environments as remote and unknown as icy moons. Uncharacterized features on these worlds such as fractures, crevasses, plumes, jagged penitente fields, and textureless surfaces will push the limits of current entry, descent and landing (EDL) approaches. ICICLES (Intelligent for Choosing Icy Candidate Landing and Exploration Sites) is a new funded project at NASA Ames that will look at autonomy approaches for assisting landing in safe-but-scientifically interesting locales on icy bodies. We are looking for a student intern to help with software development and research on the ICICLES project. The student will have the ability to work on a self-contained, but impactful problem at the forefront of science autonomy research at NASA. Projects will be tailored to areas of interest and experience. Examples include hazard avoidance algorithms for landing near icy features, trajectory planning for exploring vapor plumes, or 3D thermal mapping in cryogenic environments. The intention is to push hard for results to set the stage for publication by the end of the internship period.	The applicant should, at a minimum, have experience with Linux (Ubuntu) and be able to program well in C or C++. Independent problem solving under guidance of the mentor is anticipated. Ideally, you will have taken some upper division computer science and introductory robotics classes. Be familiar with data structures applicable to autonomous systems, such as voxel grids, point clouds, octrees, range images, and triangulated meshes. Be familiar with the research process: literature survey, problem formulation, hypothesis, implementation, experimentation and statistical analysis. Any significant experience with one or more areas of robotics research, particularly computer vision, path planning and semi-supervised learning, is a major plus.

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Ames Research Center Moffett Field, California	Novel Planetary Robotic Sensor Development	Michael Dille	Recent confirmations of water flow on Mars has refreshed interest in exploration ofcaves and lava tubes on planetary bodies, where temperate conditions present a uniqueenvironment that may harbor trapped liquid water, exotic geologies, and possible life.However, current robotics technology lacks the ability to negotiate such precarious terrains that include very tight operating spaces and partial collapses. Only by reachingthese areas with onboard sensors can astrobiologists and geologists hope to completecomprehensive mapping of cave conditions and sample biofilm candidates. To providesuch reach, we are investigating projectile sensing methodologies in which expendable sensors are lobbed from a mortar-like delivery mechanism and anchored into floors,walls, and ceilings. These sensors can work in cooperation with mobile robots to extendtheir reach, provide situational awareness, and long-duration monitoring capabilities.Constellations of deployed sensors can cooperate, communicating wirelessly duringflight and once anchored, to provide radio or illuminated landmarks aiding photography, mapping, and mobility operations. The exploratory SPEARS (Smart Projectiles forEnvironmental Assessment, Reconnaissance, and Sensing) project here at AmesResearch Center has proven the viability of the projectile sensor concept by developinga rover-mounted platform and evaluating several sensor types.We are now seeking a student intern to develop new and miniaturized sensing payloads.Currently, high priority payload plans include either microscopic imagers for terrainsurface study or fluorescence and spectroscopic instruments for geological compositionsurveys and signs of life detection, closely followed by radio transceivers for selfreorganizingmesh networks. Additional mechanism development is also planned,including refining sensor launcher design, building a micro soil sample collector, andevaluating concepts for projectile self-stabilization in flight. Another particularlyinteresting avenue is actuated or flexible payloads that unfurl or expand a soil collector,solar panel, antenna, or small mobility mechanism such as a wheel or foot.	The ideal intern is a well-rounded student with an interest in sensing instrumentdevelopment and the ability to work well independently on open-ended problems.Depending on the student's interests, valuable skills and experience could lie in optics,RF, electronics, or mechanical design. A self-contained implementation project wouldinclude the design and testing of a useful payload in one of these areas.
Ames Research Center Moffett Field, California	SUPERball 2.0 Tensegrity Robot	Terrence Fong	We are looking for a student intern to help with electronics design and integration for our SUPERball 2.0 tensegrity robot. The participant will conduct basic research in mobile robotics in the Intelligent Robotics Group (IRG) at the NASA Ames Research Center. Research will involve development of advanced mobile robots, including design and testing of novel mechatronic systems with SUPERball 2.0. Developing advanced mobile robots is critical to improving the performance and productivity of future NASA exploration missions. In particular, methods that enable dynamic tensegrity system to function robustly and autonomously under a wide range of environmental and operational conditions will enable robots to be used for a broader set of missions than is currently possible.	The applicant should be enrolled in a master level engineering program and have previous experience in electronics development. Good knowledge of C and Matlab and a Linux environment is preferred. Ability to work independently and effectively as part of a multidisciplinary team, prioritize tasks, coordinate tasks with others, and meet deadlines are a major plus.
Ames Research Center Moffett Field, California	Small Satellite Swarm Mission Design and Implementation	Belcagem Jaroux	Recent advances in small spacecraft capabilities (particularly in CubeSats, NanoSats, and PicoSats) hold the promise that swarms or constellations of small satellites could perform NASA science, exploration, and technology demonstration missions that traditionally were the realm of large, expensive, and complex platforms. As a result, NASA Ames is embarking on a number of small satellite demonstration missions aimed at validating new approaches and processes needed to design, build, test, launch, and operate a large number of identical satellites in a cost-effective manner. Several internship positions are open to engineering students in all areas of SmallSat swarm and constellation mission design and implementation. Particularly needed skills and mentoring opportunities include: • Avionics and embedded systems hardware and software design, simulation and test. • Laboratory simulation and validation of network system architectures of various swarm and constellation mission concepts based on low-cost, commercial-off-the-shelf (COTS) components and systems. • Computer-aided spacecraft thermal analysis, simulation, and test procedures, using commercial software products such as Thermal Desktop. Selected candidates will join small teams of NASA Ames engineers and on-site contractors, with ample opportunities for mentorship as well as independent learning and technical development.	
Ames Research Center Moffett Field, California	Astrobee Robot Software	Marion Smith	The Astrobee robot will launch to the International Space Station in May 2018. It will fly freely and autonomously throughout the space station, where it will assist astronauts, provide a mobile telepresence platform for ground controllers, and be used as a research platform for a variety of experiments. See https://www.nasa.gov/astrobee for more information.	Students of all levels are encouraged to apply to join the Astrobee Flight Software Team. Experience with C++, Linux, and git is preferred. The internship project will depend both on need and the student's interests. Ideally, the project will result in a research publication. Past student projects have included diverse topics such as path planning, obstacle mapping, depth camera calibration, simulator development, sensing and filtering, fault recovery, video streaming, mapping under changing light levels, and more.

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Ames Research Center Moffett Field, California	Experimental Visualization of Shock Structure in a Miniature Arc Jet	Megan Macdonald/Mark McGlaughlin	The Thermophysics Facilities Branch is upgrading its 30 kW miniature arc jet (mARC). These upgrades will result in a high-speed, high-temperature jet with a new shock structure. Visualization of this new shock structure will allow the mARC operators and any future investigators to carry out testing in the regions of the jet with the most uniform conditions. The intern will be responsible for studying the shock structure of this plasma jet with experimental flow visualization techniques. Specifically of interest is the Background Oriented Schlieren (BOS) technique. It is expected that the intern will review prior similar work and seek input from Ames researchers who are experts in flow visualization methods to guide the experimental strategy. The intern will work closely with the team that operates and maintains the mARC. Student will give a final presentation and compile a final report documenting the work completed at ARC. If the results support it, the work will be considered for submission to a conference or journal publication.	Student should be a graduate student with a solid background in aerospace or mechanical engineering and familiarity with fluid flow, optical diagnostics, and experimental research. Student should have experience with flow visualization techniques, particularly the BOS technique. The student should be able to work as part of a team. It would also be desirable (though not mandatory) for the student to have experience writing conference and/or journal publications. Pursuing Masters Pursuing Doctorate Pursuing Post Doctorate Engineering - Aerospace Eng. Engineering - General Engineering - Instrumentation Eng. Engineering - Materials Eng. Engineering - Mechanical Eng. Engineering - Optical Eng.
Ames Research Center Moffett Field, California	Space Structure Assembly Robotics - The Automated Reconfigurable Mission Adaptive Digital Assembly System (ARMADAS) Project	Kenny Cheung	Opportunity Description/Objective (specific student assignment): The Coded Structures Laboratory at NASA Ames Research Center conducts research across material science, robotics, and algorithms, for application to aeronautics and space systems. The lab's primary project is titled Automated Reconfigurable Mission Adaptive Digital Assembly System (ARMADAS), and it incorporates a building-block based approach to automated assembly of ultralight lattice-based structures for space infrastructure. Expected activities for this position can be both theoretical and experimental in nature. Advanced research using multidisciplinary analyses seeks to understand the mechanics of new mechatronic and structural strategies and to develop predictive analytical models for the design of systems with novel behavior. Experimental work seeks to obtain accurate data to validate these analyses. Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): At the conclusion of the internship, the intern will prepare a final report and either make a final presentation or participate in a poster day. The results of the research, if appropriate, can be considered for abstract submittal to a national conference in the appropriate subject area for publication.	
Ames Research Center Moffett Field, California	Machine Learning classification of transit-like signals	Hamed Valizadegan	Kepler and the upcoming TESS are critical missions to increase our understanding of how common earth-like planets and the chances of alien life are. These telescopes work based on transit photometry and their piplines return a list of threshold crossing events (TCEs) whose light signature resemble a planet. However, not all TCEs are planet orbiting a star and they could be due instrument noise or other astrophysical phenomena. Thus, the TCEs are subject to a vetting process in which they are classified into three categories: Planetary Candidate (PC), Astrophusical False Positibe (AFP), and Non-transiting phenomena (NTP). This classification is currently being done manually and we need machine learning tools to automate it. The kepler teams responsible for this vetting process released multiple data release over time as they have learned how to obtain better diagnostics (features) from the light curve and how to classify the TCEs. However, the values of these diagnostics might not be perfect or representative enough and we are developing deep learning methodology (e.g. LSTM) that work directly on the raw light curves to classify these TCEs automatically. The intern is expected to help us developing parts of this project in Python! Tools we use for this project are scikit-learn and Keras! Specific Tasks and Responsibilities: Python Coding, Research on appropriate deep learning architectures for time series classification	AI general knowledge, Masters or PhD, Python programming
Ames Research Center Moffett Field, California	Deep Learning Binarization of Vascular images	Hamed Valizadegan	The Space Bioscience Research Branch (SCR) of NASA Ames has developed VESGEN, a software package for analyses and study of vascular images. A bottleneck in efficient application of VESGEN is the fact that it needs binary images as input in order to analyze the vascular images and provides insight about them. Currently, a VESGEN user needs to semi-manually binarize a vascular image using CAD software packages such as Adobe Photoshop before giving the image as input to VESGEN for analysis. Binarization aims to categorize the pixels of a vascular image into two categories, foreground or Vessel pixels and background pixels. We are investigating deep learning technologies to automate the binarization of vascular image. Our results with deep learning have been very encouraging and we are looking to hire an intern to help us further improve the existing technology! Specific Tasks and Responsibilities: Python Coding, Research on appropriate deep learning architectures for image segmentation	AI general knowledge, Senior Masters or PhD, Python programming

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Ames Research Center Moffett Field, California	Modeling Moderate-to-High Ionization in Hypersonic Flows	Michael Barnhardt	Current practices for modeling hypersonic shock layers assume that the degree of ionization is low, which is a reasonable assumption in most instances. However, this assumption becomes questionable for freestream velocities in excess of 14-15 km/s. The low-ionization assumption has led the state-of-the-art to a number of simplifications regarding the thermochemical state of the shock layer, most notably restricting the interplay between free electrons, energy transfer processes, non-equilibrium chemistry, and transport. This task seeks to develop new models and methods, starting with non-equilibrium treatment of free electron energy, to enable the basic understanding of very high-speed flows. The respondent is expected to develop models in a practical CFD framework and will work closely with other NASA researchers on evaluating the impact of free-electron modeling on shock layer radiation predictions.	PhD candidate with knowledge of plasmadynamics and Computational Fluid Dynamics.
Ames Research Center Moffett Field, California	Shockwave Radiation Testing	Brett Cruden	The Electric Arc Shock Tube (EAST) Facility is NASA's only remaining shock tube capable of obtaining hyperorbital velocities (Mach 10-50, velocities up to ~15 km/s). The EAST data is the primary source of data for informing NASA's radiation modeling practices and associated uncertainties. The intern will participate in planning and conducting tests in the EAST facility, operating the diagnostics, performing calibrations, and analyzing data. The exact tests being performed in EAST will depend on the term of the intern's residency. Current plans for 2018 are to study radiation from expanding flows in the newly refurbished 20º expansion nozzle.	Experience with spectroscopic techniques and/or hypersonic testing facility, esp. shock tubes/tunnels desired. Graduate level (MS or PhD) strongly preferred.
Ames Research Center Moffett Field, California	Aerothermodynamics Modeling	Khalil Bensassi	The Aerothermodynamics Branch at NASA Ames Research Center focuses on advancing the understanding of the fundamental aspects of hypersonic flows for multiple planetary atmospheres including Mars, Venus, Titan, and Earth. Computational Fluid Dynamics solvers, coupled with non-equilibrium radiation codes, are employed for this purpose. Interns will collaborate with engineers and scientists to enhance the capabilities of the current software to better capture the fundamental aspects of the basic physical phenomena in hypersonic flows. They will have access to a world class HPC machine and will be using state-of-the-art physical models and numerical methods. Multiple openings are available in the following areas: "Develop an accurate and efficient radiation-flow solver coupling strategy. "Support the development of a robust and scalable adaptive mesh refinement algorithm. "Assess the performance of the shockwave radiation solver, NEQAIR, on hybrid nodes (CPU/GPU) and investigate optimization strategies.	Experience with Fortran and shell scripting. Experience with computational modeling and parallel simulations.
Ames Research Center Moffett Field, California	Validating Non-Equilibrium Chemistry Models for Entry Flows	Richard Jaffe	Hypersonic shock layers are characterized by chemical and thermal non-equilibrium. The chemical non-equilibrium condition is due to chemical reactions occurring on the time-scale of the flow and the thermal non-equilibrium is due to insufficient collisions for maintaining Boltzmann distributions within ro-vibrational and electronic state manifolds. In the past, models to describe this condition were based on results of contemporaneous shock tube experiments. These models are still widely used today. However, they are being supplanted by "physics-based models" that use results of accurate quantum mechanical calculations to determine collision cross sections and reaction rate coefficients. Results of these calculations must be validated against new shock tube data using Master Equation and CFD calculations. Recent work in this area has been focused on air at velocities of 10-14 km/s and CO_2/N_2 atmospheres for Mars and Venus at velocities of 7-10 km/s. The respondent will learn about all aspects of non-equilibrium for these cases and may be required to compute additional collision cross sections for specific flow conditions.	PhD candidate with interest in understanding non-equilibrium chemistry.
Ames Research Center Moffett Field, California	Mobile Robot for Education and Outreach	George Gorospe	NASA's robotic missions to Mars continue to inspire students across the country. However many of these students have no access to the components or the facilities to produce a robotic vehicle. We are interested in the development of a robotic vehicle for the demonstration of control and navigation algorithms. The student will participate in the development of mobile rover for education and outreach. This includes a study of current NASA rovers and science objectives, and the development of analog activities which the educational rover could perform. The student would participate in the design, fabrication, programming, and testing of such a rover. Research report outlining educational capabilities of the rover, technical report on the design and fabrication of the rover. All code written for the rover.	C++, Arduino, ROS experience preferred but not required. Student should be a capable communicator and willing to learn and apply knowledge to difficult problems.

2018-2019 NASA I^2 Project List

NASA Center	Project Title	Mentor	Project Description	Requirements
Ames Research Center Moffett Field, California	Slip Estimation for Planetary Rovers	Arno Rogg/Terry Fong	IRG is developing technologies for planetary rover exploration that will enable future NASA missions to access new places in the solar system in a safer and more reliable way. Planetary environments such as Mars and the Moon are challenging terrains to rove on. In multiple sites, the terrain has shown to be very loose and this represents a significant risk of entrapment for mobile platforms and for the mission success. Previous rover missions had issues. The Lunar Roving Vehicle (LRV) spun its wheels until the rover got embedded and one astronaut had to lift it up to get it out of this situation. The two Mars Exploration Rovers (MER) rovers had similar issues on Mars: Opportunity encountered some deep wheel sinking issues that took weeks to resolve and Spirit's embedding was so severe it brought an end to the rover's mission. To prevent future rover entrapment from happening, it is important to develop new and more reliable slip estimation techniques. Different approaches can be used, such a visual odometry, inertial units, current threshold and others. The goal of this project is to investigate some of these techniques and find the most suited one that will then be implemented. The existing data coming from the Resource Prospector mission as well as the K-Rex II rover will provide first data to test with. Some new tests could be achieved on the K-Rex II rover that is currently at NASA Ames Research Center.	
Ames Research Center Moffett Field, California	Rover-Instrument Automation and Data Integration	Brian Glass	The Atacama Rover Astrobiology Drilling Studies (ARADS) project is a Science Mission Directorate-sponsored project led at NASA-Ames. ARADS proposes a Mars rover analog mission as a field test of an integrated rover-drill system with prototype life-detection instruments that are flight mission candidates. The essential elements to ARADS are: 1) use of integrated drill and rover at sites in the Atacama Desert in Chile in unprepared "regolith"; 2) field use of instruments with the rover/drill that are flight prototypes comparable to those planned for ExoMars and Icebreaker; 3) acquire drilled cuttings and transfer to instruments onboard the rover; 4) on-board autonomy and monitoring to support drilling; mission and demonstrate science support (operations and control) for the rover/drill/instrument operations. This student project will address the fourth element above: integrated remote rover and instrument control in science operations. The current ARADS rover (KREX-2) hosts three instruments, plus a drill and robot arm. The drill and arm are already partially integrated and hosted on the rover CPU. The instruments are controlled and return their data to two auxiliary laptops strapped to the rover. These communicate by wifi and trunk network connections with instrument team members. Intern will assist ARADS developers in developing system operating procedures, drill and arm control software, drilling system diagnosis and executive controls. The student with work with both the KREX2 rover team and the instrument leads and existing ARADS team members (Thomas Stucky, Antoine Tardy) to define the internal interfaces for commands and data to be relayed from the rover. A "data suitcase" of instrument results and images will be defined and a mechanism developed with the rover team to capture the "suitcase" and then forward it intact to a remote science server for offline parallel analysis by the science team. Likewise, a command dictionary to each instrument will be defined.	

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Ames Research Center Moffett Field, California	Image analysis software based on neural nets and "deep learning"	James Bell	Image analysis software based on neural nets and "deep learning" has been successfully used to find and classify objects in images. This project investigates whether such software can be used to determine the orientation of an object. For example, it is commonly claimed that image recognition software can use deep learning to recognize the presence of some feature, such as a cat, in an image or video. (http://www.nec.com/en/global/ad/insite/article/bigdata07.html) This is done by providing the software with a large training set of images in which a particular feature has been identified, and allowing the software to learn to recognize that feature in new images. The idea of this project is that if such software is trained with images of a wind tunnel model at different orientations, along with independent information about orientation of the model in each image, the software will be able to recognize the orientation of the model in new images. Currently, wind tunnel model orientation is found with a combination of onboard accelerometers to detect orientation with respect to the gravity vector, and encoders on the model support to detect rotations around the gravity vector (yaw). These methods are less accurate when the principle motion of the model is in yaw (eg wings-vertical orientation of the model in the wind tunnel) or the model is too small to accommodate an accelerometer package. Conventional photogrammetry can be used to measure model orientation but requires time-consuming setup and calibration, and is vulnerable to changes in illumination. The project would consist of these parts 1) Set up a simple test apparatus consisting of a rigid body resembling a wind tunnel model, a multi-axis accelerometer, and a yaw meter, on a multi-axis rotation stage. Set up a camera to view the model. Take images at a variety of model orientations while recording the orientation measurements. 2) Feed the images and orientation data into open source deep learning software such as Keras. 3) Compare the accuracy of the resulting software against conventional sensors for determining model orientation.	
Ames Research Center Moffett Field, California	Visualizing the flow field around the SLS and MPCV vehicles in a low-speed water tunnel	Jayanta Panda	These vehicles have gone through many tests in high-speed wind tunnels where the global flow features such as the generation of vortices, and the interaction with plumes are difficult to see. We have small-scale (around 1.5% scale) models of these vehicles which need to be modified and placed in a water-channel facility, and the flow around them will be visualized by placing streaks of dye. The student is expected to perform some modifications of these models and then work with Hannah & I to perform the test. If time permits then we may take the models in a low speed wind tunnel for some more visualization study.	
Ames Research Center Moffett Field, California	VESsel GENeration Analysis (VESGEN)	David Kao	Students of relevant disciplines, such as computer science, and biomedical engineering and imaging, and mathematics, are welcome to consider our multidisciplinary research on NASA's innovative research and discovery software tool, the VESsel GENeration Analysis (VESGEN). For this biomedical data visualization and analysis research, the intern will investigate existing data analysis techniques and apply the results to 3D microvascular data from clinical and research microscopic imaging. The intern will gain a good understanding of existing data analysis techniques (which are implemented in JAVA and C) and then develop an ImageJ plugin based on these pioneering methods. ImageJ, a public domain JAVA image processing program. The plugins will be used for designing new, globally requested 3D visualization and analysis software capabilities. VESGEN is requested by scientists, engineers and physicians around the world for biomedical research on vascular-dependent diseases such as inflammation, cancer, heart disease and reproductive disorders. Request specific expertise in 3D image reconstruction/3D medical image analysis, JAVA programming, and/or extensive computer programming experience. Expected outcome: development of ImageJ plugins, research experience, and co-authorships on conference presentations. A poster/paper presentation of the internship work.	Required Skills: Graduate majors in computer science, biomedical engineering, and mathematics are welcome to consider this multidisciplinary research. Relevant skills include C, Java, openGL, NIH ImageJ, and image and signal processing.
Ames Research Center Moffett Field, California	Analyzing satellite and drone imagery from the Atacama Desert, a Mars analog environment in Chile	Mary Beth Wilhelm Kim Warren-Rhodes (SETI)	The project goal is to understand the impact of an extreme and rare rainfall event on the modification of soil and unltimately on the generation and preservation of molecular biosignatures from the largely inactive microbial community in the driest soils in the Atacama Desert, Chile. This work has implications for predicting if rapid shifts in water availability could impact a putative microbial population sufficiently to generate measurable biomarkers in modern Martian near-surface environments (e.g. RSL, gullies, northern plains ice-cemented soil), and inform where future missions should search for biomarkers that could have been preferentially preserved. More specifically, we would like to have a student (1) analyze nano-climate sensor data from hyperarid Atacama soils and map data onto regional gravimetric moisture data; (2) integrate and analyze historical satellite data, drone, and field imagery to understand the extant, patterns, and history of the water regime in the driest parts of the Atacama Desert; and (3) develop a fluvial map and construct a simple model of water transport and accumulation across surfaces and infiltration into the soil column at different spatial scales.	

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Ames Research Center Moffett Field, California	Exploration of piloting for eVTOL urban operations	Michael Feary	The Aerospace Cognitive Engineering (ACE) group is working on several Human-Automation Interaction flight deck research topics for the NASA Aeronautics Research Mission Directorate (ARMD) and the FAA. While Dr. McMahon is at Ames the group is hoping to work with him to utilize his expertise in simulation of low speed and low altitude electric Vertical Takeoff and Landing (eVTOL) operations in support of the Airspace Operations and Safety Program (AOSP) System Wide Safety and ATM-X projects. The focus of these projects will be to identify automaiton development and training needs for urban eVTOL operations. Specifically these tasks will include: -evaluation of flight controls and displays for eVTOL concept vehicles -development and evaluation of eVTOL simulation environments -support in the development of research issues for implementation of eVTOL operations in the United States -Subject Matter Expertise for VTOL airline operations -Support for simulation and VR research development	
Ames Research Center Moffett Field, California		Scott Murman	This project extends simulations of rotating machinery in atmospheric boundary layers using an advanced high-order discontinuous-Galerkin fluid solver. The eddy solver is a novel code suite for scale-resolving simulations developed at NASA as part of the CFD Vision 2030 study. This tool has previously been used for turbomachinery, fluid-structure interaction, and fundamental benchmark studies, including transition, inflow turbulence, and wall roughness. During this project, eddy will be extended and validated for atmospheric boundary layers, and then applied to relevant rotating machinery problems. The simulations will be used to investigate the detailed flow physics and develop a multi-fidelity design capability. Potential applicaitons include wind farms, trans-oceanic autonomous vehicles, and urban VTOL aircraft. Final application will be determined in collaboration with the student and their advisor.	
Ames Research Center Moffett Field, California	Analysis and Modeling of Meteoroid Ablation	Eric Stern	Student will support analysis and modeling of recent novel experiments to investigate meteoroid ablation. Activities may include utilizing numerical material response modeling tools to simulate the experiments, analysis and reduction of data products from prior experiments, and support the design and execution of diagnostic approaches for future ground test campaigns.	
Ames Research Center Moffett Field, California	Nanotechnology based sensors for chemical and biological detection – wearable sensors and medical diagnostic sensors	Jing Li	NASA ARC is continuing develop sensors using nanostructures for chemical and biological detection. Nanostructures, such as carbon nanotubes, metal oxides nanowires and gold nanoparticles offer high sensitivity with good selectivity. These sensors are low power, small size and low cost. We are using these sensors for making wearable sensors for environmental monitoring and for making portable device for medical diagnosis in space and terrestrial applications. The interns will learn how to make sensors, test sensors and process the sensor data.	
Ames Research Center Moffett Field, California	Genomics of Single Cell Mechanostransduction in Mouse Embryonic Stem Cells	Eduardo Almeida	Forces generated by gravity have a profound impact on the behavior of cells in tissues and can affect the course of the cell cycle and differentiation fate of progenitors in mammalian tissues, potentially impacting the course of normal tissue regenerative health and disease. In this context, to enable Human space exploration, it is increasingly important to understand the gene expression patterns associated with regenerative health and disease as they relate to space travel in microgravity. Until recently changes in gene expression of stem cell progenitors exposed to spaceflight factors have been difficult to interpret, primarily because cellular responses are often not homogeneous in tissue populations, and may occur only in a subset of those cells. In stem cells in particular, "cell decisions" made in response to stimulation may include proliferative self-renewal, progression to differentiation, or entry into a state of replicative quiescence, however the gene expression programs associated with each are not readily knowable in a mixed cell population. Recent developments however now allow us to isolate and separately barcode mRNAs from thousands of single cells and to sequence their expressomes, opening a new field of "quantum genomics" in which regulatory gene networks and stimulus responses are studied and understood with greater clarity at the single cell level. In this project the fellow will specifically culture mouse embryonic stem cells and model gravity by either mechanostimulating them with axial stretch and compression, or not, as they initiate development in vitro, then conduct single cell isolation and barcoding of mRNAs using the 10XGenomics Chromium Controller, followed by reverse transcription into cDNAs and preparation of sequencing libraries for Illumina NGS or Oxford Nanopore long read sequencing. The fellow will also utilize bioinformatic tools including Cell Ranger, Loupe, and GeneSpring to analyze results and attempt to identify common patterns of gravity mechanoresponses in stem cells. If conducted successfully, this research may enable the development of novel tissue regenerative approaches to tissue degeneration such as that induced by spaceflight in microgravity.	

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Ames Research Center Moffett Field, California	Prognostics and Health Management for Aeronautics Applications	Kai Goebel	This project investigates the use of Prognostics techniques for components critical for use in emerging aeronautics applications. Components of interest include in particular batteries, motors, and inertial navigation units. Deterioration or faults of these components leads to potentially serious adversial consequences in the operation of aerial vehicles. Therefore, it is important to understand how these components fail and to what degree the failure point can be predicted. To that end, the components will be modeled both for nominal operations as well as when subject to operational and environmental stresses. Suitable algorithms will be explored that will aid in the prediction of the failure threshold. Experimental data (where available) will be used to assess the efficacy of the algorithmic solutions.	
Ames Research Center Moffett Field, California	Geological Context for the Search for Life on Mars in Polar Ground Ice: Support for the Icebreaker mission	Chris McKay/Carol Stoker	A team at NASA Ames is currently working toward the development of a Discovery mission to search for evidence of life on Mars. The working framework for this mission is to focus on amino acids and lipid biomarkers. In this student project we will consider two cases for the detection of amino acids and lipids. First an “abiotic” case in which only meteoritic infall of organic material is the source of amino acids and lipids. The sink is thermal degradation over time. The second case we will consider is the “biotic” case. Here we will review the recent geological data from Mars to determine the best site on Mars for biotic amino acids and lipids and use analog environments on Earth as a guide for the possible concentrations expected. The student needs a background and interest in planetary sciences, geology, and astrobiology.	
Ames Research Center Moffett Field, California	Next Generation Animal Tracking Project	Andres Martinez	We will have the intern working on the Next Generation Animal Tracking Project that is under Andres Martinez (cc’d). This is an inter-agency project with the Bureau of Ocean Energy Management (BOEM), trying find possible solutions for the next generation of worldwide animal tracking. The intern will work on analyzing the data obtained from our Range Tests on the awarded High Altitude Balloon Flights. This will require the intern to provide us with reports regarding the viability of the hardware tested.	
Ames Research Center Moffett Field, California	Hybrid Rocket Modeling and Experiments	Laura Simurda	This internship will have two primary focuses. The first will be using ANSYS Fluent to model a small-scale hybrid rocket motor that will be used in upcoming experiments. This problem is challenging as it involves using deforming meshes to model the regression of the solid fuel grain over time and the continued combustion as oxidizer is added. It should be noted that the only part of the motor that is ITAR restricted is the rocket injector. This part will not be modeled by the student and the student will not have access to any designs or models including the injector. The second will be aiding in physical experiments. This may include completing tests using an oxyacetylene torch with an optical setup to prove that the sodium line reversal technique works or helping to setup and run small-scale rocket motor tests. Again, the only component in these tests that is ITAR restricted is the injector and the student will not have access to this part.	
Ames Research Center Moffett Field, California	Erosional Studies of Mars and Earth Using Digital Terrain Models	Virginia Gulick	Fluvial and hydrothermal studies using HiRISE images and Digital (Terrain) Elevation Models, combined with CTX, HRSC, CRISM, and other Mars or terrestrial data sets. These studies are focused mainly on the formation of gullies, channels, valleys and other fluvial landforms on Mars and Earth. Terrestrial analog sites or hydrologic or landform models will be used to illuminate the importance of various processes as well as understanding the implications for paleoclimatic change. Additional opportunities may also be available in assisting with HiRISE science planning and targeting support, submitting image requests, and analysing acquired image data. Geology, geography, or planetary science background is desired.	Experience working with ENVI, Matlab, Photoshop, USGS Integrated Software for Imagers and Spectrometers (ISIS), Geographic Information Systems GIS (e. g., ArcGIS, GRASS), SOCET SET, Ames Stereo Pipeline, and Python programming is helpful. Excellent communication and writing skills are desired. Enjoys working both individually and in teams, with creativity, positive energy, and determination.