NASA International Internship Project List 2019-2020

Project Number	NASA Center	Project Title	Mentor	Project Description	Requirements
1	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 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.
2	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 tes of an integrated rover-drill system with prototype life-detection instruments that are flight missi candidates. The essential elements to ARADS are: 1) use of integrated drill and rover at sites in th 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 contro for the rover/drill/instrument operations. This intern project will address the third element above: automated sample transfer between a (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 actuators. The intern will assist an existing ARADS staff member in developing a dynamic transformation fo 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.	
3	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 tes of an integrated rover-drill system with prototype life-detection instruments that are flight missi candidates. The essential elements to ARADS are: 1) use of integrated drill and rover at sites in th 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 contro 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 hos 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 instrume team members. Intern will assist ARADS developers in developing system operating procedures, drill and arm	
4	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, suc binding domains, and established synthetic biology techniques, such as fusion protein design. Th 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 interr 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 a defending research implementations, hands-on bioengineering lab work (including synthetic biology, rapid prototyping, and fluidics), preparing documentation of research work, and statistic 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.	

5	Ames Research Center Moffett Field, California	Genomics of Single Cell Mechanostransduction in Mouse Embryonic Stem Cells	Eduardo Almeida, Cassandra Juran	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 contex to enable Human space exploration, it is increasingly important to understand the gene expressi 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 ofter not homogeneous in tissue populations, and may occur only in a subset of those cells. In stem c 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 t 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 mRN from thousands of single cells and to sequence their expressomes, opening a new field of	
6	Ames Research Center Moffett Field, California	The Influence of Mechanical Unloading on Biological Function	Eduardo Almeida, Cassandra Juran	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 healin 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 cause of widespread tissue degeneration in space. In this opportunity, the selected candidate wi work with research scientists to analyze the response of mouse bone and bone marrow stem cel 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 molecu 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 caus 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 determine the optimal cell culture parameters to conduct the experiment in spaceflight hardwar	Laboratory experience is preferred
7	Ames Research Center Moffett Field, California	Machine learning classification of transit-like signals	Hamed Valizadegan	Kepler and TESS are critical missions to increase our understanding of how common earth-like planets (in habitable zone) are. These telescopes work based on transit photometry and their pipelines return a list of threshold crossing events (TCEs) whose light signature resemble a plane However, not all TCEs are planet orbiting a star and they could be due instrument noise or other astrophysical phenomena. We have been exploring deep learning technology for automatic classification of TCEs and finding planets from non-TCEs. Using our in house tools, we have been able to identify new planets (subject to confirmation). We also have identified multiple ways to improve the existing classifiers and we are looking for interns who can explore these new ways. This internship opportunity is very rewarding because the result will lead to the discovery of new exo-planets. We will also publish the results in prestigious journals. This is a great opportunity to get some visibility. A potential interns needs to know how to program in python and write deep learning codes. 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 (and TensorFlow).	AI General knowledge, Bachelor (Masters or PhD is preferred). Python programming
8	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 VESGE is the fact that it needs binary images as input in order to analyze the vascular images and provid 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 learnin 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 existi technology! Specific Tasks and Responsibilities: Python Coding, Research on appropriate deep learning architectures for image segmentation	AI General knowledge. Bachelor (Masters or PhD is preferred). Python programming

9	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 t determine the orientation of an object. For example, it is commonly claimed that image recognit 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 be identified, and allowing the software to learn to recognize that feature in new images. The idea o 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, 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 accelerometer detect orientation with respect to the gravity vector, and encoders on the model support to dete 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 t 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, a is vulnerable to changes in illumination. The project would consist of three parts: 1) Set up a simple test apparatus consisting of a rigid body resembling a wind tunnel model, a mu 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.	Computer science with a focus on data science/neural nets. Aerospace engineering with a strong background in software would also be acceptable.
10	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 a "lock and key" approach. In this approach, one then needs a platform to support the probe and recognizing element that can recognize the said interaction between the probe and the target. T 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 read 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 fr a whole blood sample. The intended NASA application is point of care diagnostics for astronaut health monitoring.	
11	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 resource support astronauts. Microbial factories could help produce mission relevant products during suc 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.	

12	Ames Research Center Moffett Field, California	NASA Ames Astrobee Facility	Jose Benavides	NASA Ames Astrobee Facility Brief description of duties: The successful applicant would be involved with software development and general support of the NASA Ames Astrobee Facility. (www.nasa.gov/astrobee) Specifically, the successful applicant would initially be validating and developing C++ and Java software for a Astrobee. Additional work may include ISS flight quality hardware and maintaining Astrobee Facility labs. The applicant should be familiar with C++ and Java 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 beneficia 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.	C++ and Java; Good writing and communications skills, along with the ability to work well both individually and within a multidisciplinary team. 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
13	Ames Research Center Moffett Field, California	Space Structure Assembly Robotics - The Automated Reconfigurable Mission Adaptive Digital Assembly System (ARMADAS) Project	Kenny Cheung	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 current 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 conference in the appropriate subject area for publication. Graduate students may consider more focused investigations leading to preparation of a technical journal article.	
14	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 atmospher including Mars, Venus, Titan, and Earth. Computational Fluid Dynamics solvers, coupled with nor equilibrium radiation codes, are employed for this purpose. Interns will collaborate with enginee and scientists to enhance the capabilities of the current software to better capture the fundame 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 computationa modeling and parallel simulations.
15	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 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 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 helping to setup and run small-scale rocket motor tests. Again, the only component in these test that is ITAR restricted is the injector and the student will not have access to this part.	

16	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 Desig 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 ar CubeSat missions are a specialty of Ames Research Center and current research addresses practi issues with small spacecraft missions in a LEO and an interplanetary environment. Another orbit 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 effect 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 t 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.
17	Ames Research Center Moffett Field, California	Astrobee Robot Software	Marion Smith/ Brian Coltin	The Astrobee robot will launch to the International Space Station in May 2018. It will fly freely ar 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 th Astrobee Flight Software Team. Experience with C++, Linux, and git is preferred. The internship project will depend both on need and the student' 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.
18	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 biosignatur from the largely inactive microbial community in the driest soils in the Atacama Desert, Chile. Th 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 fut 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 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 in the soil column at different spatial scales.	

19	Ames Research Center Moffett Field, California	Experimental Visualization of Shock Structure in a Miniature Arc Jet	Megan Macdonald/ Mark McGlaughlin	The Thermophysics Facilities Branch has recently upgraded its 30 kW miniature arc jet (mARC II). These upgrades have resulted in a high-speed, high-temperature jet with a new shock structure. The intern will be integral in implementing and analyzing experimental diagnostics aimed at characterizing the flow physics and operational health of the upgraded facility. This may include visualization of the shock structure within the jet, measurements of the magnetic field around th arc heater, spectroscopic studies of the plasma within the column, and both standard and non-intrusive methods of measuring jet quantities such as heat flux, stagnation pressure, or electron density. 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 complete 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. The student should be able to work as part of a team. Pursuing Masters Pursuing Doctorate Pursuing Post Doctorate Engineering - Aerospace Eng. Engineering - General Engineering - Instrumentation Eng. Engineering - Materials Eng. Engineering - Mechanical Eng. Engineering - Optical Eng.
20	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 hav 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, displa and detectors. Finally, we have also been revisiting vacuum tubes although in the nanoscale, usi 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.
21	Ames Research Center Moffett Field, California	Novel Planetary Robotic Sensor Development	Michael Dille	Long-term wide-area measurement of dynamic environmental surface-level phenomena in hard-to-reach areas is of growing interest for atmospheric research in both planetary exploration and Earth science contexts. These may include flows or variations in moisture, gas composition or concentration, particulate density, or even simply temperature. Improved knowledge of these processes delivers a deeper understanding of exotic geologies and distributions or correlating indicators of trapped water or biological activity. However, such measurements must frequently be taken in unsafe areas such as caves, lava tubes, or steep ravines where neither human field teams nor robotic vehicles can easily reach. To provide such a capability, we have developed small expendable sensors which may be hand-placed, lobbed from a robotic vehicle, or dropped from aircraft. Deployed sensors form a mesh network, communicating wirelessly during flight and once anchored, to provide radio or optical beacons and monitoring using cameras, environmental sensors, and miniature chemical detecto We seek students interested in refining the existing prototype system, developing new sensor payloads, and evaluating new deployment mechanisms.	The ideal intern is a well-rounded student with interest in sensing instrument development. Depending on area of interest, relevant skills include electronics, mechanica design, embedded software development, RF, or optics. Opportunities in sensor data visualization and prediction of dynamic phenomena are also open. Project Area of Research: Sensors, embedded systems, electronics, mechanisms, RF, data visualization

22	Ames Research Center Moffett Field, California	Advanced Life Support	Michael Flynn	Innovation a required skill. Our group focuses on training the next generation of NASA scientists 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. 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 recycli but is cognizant that an optimized system will include integration with air and waste systems. Ou 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.	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 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.
23	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 tha 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 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 hardwar that facilitate successful estimation and control. Specific applications for the techniques develop include flight control, wing shaping, and load alleviation of flexible wing aircraft. Final deliverable 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 w 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.
24	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-t 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 resul 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
25	Ames Research Center Moffett Field, California		Scott Murman	This project develops new methods for high-order finite-element schemes. Work involves all aspects of the simulation pipeline, from mesh generation, to flow visualization. Tasks are part of the eddy framework, and coordinated with other members of the eddy development group. The eddy solver is a novel code suite for scale-resolving simulations developed at NASA a part of the CFD Vision 2030 study. eddy is a public-domain software project, so there are no restrictions on access. Applications span many domains, from turbomachinery, to parachute flui structure interaction, to hypersonics. Software environments include c/c++, python, parallel processing, and GPU.	

26	Ames Research Center Moffett Field, California	Lunar Topographic Products from Orbital Images	Terry 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.
27	Ames Research Center Moffett Field, California	SUPERball 2.0 Tensegrity Robot	Terry Fong, Michael Furlong	We are looking for a student intern to help with electronics design and integration for our SUPER 2.0 tensegrity robot. The participant will conduct basic research in mobile robotics in the Intellig 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 SUPERb 2.0. Developing advanced mobile robots is critical to improving the performance and productivit of future NASA exploration missions. In particular, methods that enable dynamic tensegrity syste 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
28	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 inte will also participate in data collection, processing and analysis of biosensor data and assist in rep writing. He/She will support MDA operations in collaboration with CSA prototype wearable biosensor system and other systems.	
29	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 th 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

30	Ames Research Center Moffett Field, California	Rotorcraft Aeromechanics	William Warmbrodt	The Aeromechanics Branch has numerous intern projects for aeromechanics technology solution that will enable the development of vertical flight vehicles, both piloted and uninhabited, provid unlimited mobility in three dimensions for terrestrial and planetary science applications. Innovative and revolutionary ideas for vertical-flight vehicle technologies are developed, enhanced, analyzed, demonstrated, and assessed using advanced modeling, ground-based facilities, simulation, and flight as appropriate. Intern projects address all aspects of vertical lift aircraft and operations which directly influence the vehicle's performance, structural, and dynan response, external acoustics, vibration, and aeroelastic stability. The span of research projects include civilian transport rotorcraft (helicopters, tilt rotors, and advance designs), urban air mob personal air taxis, and unmanned aerial vehicle (UAV) platforms, including quadcopters and othe advanced, small remotely piloted or autonomous vertical takeoff and landing (VTOL) aircraft, an planetary science vertical lift aircraft such as the Mars Helicopter. The programs are both theoretical and experimental in nature. Advanced computational methodology research using computational fluid dynamics and multidisciplinary comprehensive analyses seek to understand the complete aerial vehicle's operating environment and to develop analytical models to predict aerodynamic, aeroacoustic, and dynamic behavior. Experimental research seeks to obtain accura data to validate these analyses, investigate phenomena currently beyond predictive capability, and to achieve rapid solutions to flight vehicle problems. Interdisciplinary technology projects fo vertical flight vehicles span all aspects of atmospheric flight from vehicle synthesis, conceptual design, aerodynamic and dynamic verification, flight control, handling qualities and human integration (crewed and uncrewed platforms), ride quality investigations, and planetary science mission development. Specific attention is given to identifying and pursuing novel vertical flight vehicle concepts and technologies for emerging urban air mobility markets and planetary exploration.	Broad background in science and math classes typical of an upper division undergraduate/graduate in mechanical, aeronautical, aerospace, electrical engineering, and computer science. Knowledge of MatLab, CAD, Simulink, CREO ProE/SolidWorks/AutoCad, VSP, Rhino, C++, python, or other programming/software languages is desired, but not mandatory.
31	Ames Research Center Moffett Field, California	Deep Learning for Satellite Imagery (DELTA)	Brian Coltin/ Terry Fong	NASA Ames is partnering with the USGS and NGA to develop DELTA, an open source toolkit for deep learning on satellite imagery. DELTA will empower Earth scientists to achieve state of the a classification results with little to no knowledge of machine learning or computer programming. Initially, DELTA will be trained and evaluated on mapping floods for disaster response and recovery. Potential later uses include studying other natural disasters, changing land use pattern climate change, and more. Specific Tasks and Responsibilities: The intern will contribute a feature to the DELTA toolkit whic will ideally result in a research publication. Potential projects include: incorporating various metadata into the learning algorithm; experimenting with new neural network architectures or training methods; incorporating multi-satellite sensor fusion; and more, depending on student interest.	Experience with C++ and/or Python, Linux development, and machine learning are preferred.
32	Ames Research Center Moffett Field, California	Robotic 3D Mapping of Lunar Skylights	Uland Wong	NASA is investigating new ways to explore Lunar skylights with robots. Skylights are giant, recent discovered sinkholes that may lead to intact lava tubes and other caves. Exploration of these skylights and caves is necessary for Lunar science, resource development, and understanding of natural infrastructure. We are developing a proposed mission to drive around the rim of a skylig using small, commercial rovers and to map the walls in 3D using a miniature optical payload. Ou project seeks motivated interns who will assist with design, development and testing of a prototype mapping payload suitable for lightweight planetary rovers. Interns will also use computer vision approaches to process, stitch, and create 3D models from image data for scient analysis.	Interns should have prior robotics and sensing experience. Exposure to 3D computer vision techniques such as image warping, stereo vision, structure from motion, and bundle adjustment is desired. We will be using libraries such as OpenCV and PCL. Ability to prototype mechatronic payloads using nVidia, PC104, Arduino, or Odroid-type embedded systems is a plus.
33	Ames Research Center Moffett Field, California	Thermal Mapping for River Measurement from a UAV	Uland Wong, Michael Dille	The Intelligent Robotics Group at Ames is designing a tightly-integrated UAV payload containing thermal and visible-light cameras to estimate flow rates in streams and rivers using novel optical techniques. In addition to cameras, onboard computing will perform real-time processing to provide live data streaming and vehicle path planning to deliver a complete survey across the water surface. The purpose of this payload is to automate and supplement a sparse and strained network of so-called stream gaging stations that provide the input dataset for US watershed monitoring. This data is critical to track water supplies, predict flood risks, preserve aquatic systems, and respond to natural disasters. This project is collaborative work with the United States Geological Survey (USGS) and presents a chance to engage in cross-cutting research and meet with a variety of scientists.	Interns should be familiar with Robot Operating System (ROS) and capable of developing functionality for a ROS system using C++ or Python programming. Familiarity with camera sensors and image processing (such as with OpenCV) is also desired. Skills for mechanism design (e.g. CAD), payload integration (e.g. electrical or shop skills), and testing are a plus.

34	Ames Research Center Moffett Field, California	3D Microscopy and Novel Optical Sensing for Planetary Exploration	Michael Dille, Uland Wong	We have recently developed a new type of miniaturized 3D microscope that uses just a single optical path (a single camera) and a solid-state means of controlling a moving aperture that allov imaging from multiple viewpoints. In conjunction with carefully controlled multi-directional illumination, this multi-view stereo imagery permits extraordinarily high fidelity 3D reconstructic at microscopic scale. This has incredible value in planetary exploration and terrestrial field applications to study surface composition and geometry, generating immersive graphical display detecting faint bio-signatures, and analyzing soil structure. Results with the device so far have been excellent, and we now seek to mature the design in eith of two ways. First, we wish to further miniaturize and ruggedize the device, produce a compact fully self-contained version, and demonstrate its value for micro-rover or remote sensor pod applications. This includes work in optics design, CAD, and electronics. Second, we want to bett characterize its performance under different conditions, extend and refine the 3D reconstructior algorithms, and implement new algorithmic techniques for material segmentation and bulk material property computation using reflectance modeling. This portion is primarily a software-side computer vision problem. We have unique access to a large array of planetary soil simulants to provide an immediately relevant dataset and a strong interest in publishing results in both the machine vision / optics an planetary applications communities.	Some combination of experience is needed with theoretical optics design and/or optical design software such as Zemax, image processing concepts and algorithms, and 3D reconstruction algorithms. Reasonable programming experience is expected to support the task (e.g. matlab, python, or C++). For the interested student, this could provide an excellent senior project, a substantial portion o a Master's thesis, or an interesting direction and application for PhD thesis worl in a related area. Project Area of Research: Microscopy, computer vision, optics, sensors, planetary science
35	Ames Research Center Moffett Field, California	Novel Media Visualization	Michael Dille, Uland Wong	Robotic planetary exploration is rapidly moving beyond simply taking pictures and detecting basi chemicals, instead now providing ever-larger bodies of data. At the small scale, advanced detectors and imagers now capture fine details of the structure of rocks, soils, dust, while at the larger scale seismographs and climate-scale weather monitoring offer insight into complex wide-area geology and atmospheric processes. The sheer volume of this data and the translation of ra numerical values into representations intuitive for human scientists create great difficulty. Presenting such data to the public in interesting, easily-understood ways is an even greater challenge. Recently developed forms of media including immersive virtual or augmented reality, multi-material 3D printing, and holographic displays offer new and powerful means to meet thes challenges by expressing raw and derived data for clear and rapid interpretation. They also provide promise for enabling physically disabled individuals to experience and appreciate environments they could not otherwise reach. We invite a student interested in any or all of these technologies to explore with us such presentation concepts, to produce interactive graphic displays and/or 3D printed artifacts from remotely collected data. We can provide the student with access to our existing array of 3D printers, a rare and extensive collection of planetary soil simulants, low cost 3D displays, and sor of the leading experts in planetary robotic sensing and geology.	Some combination of experience in computer vision, computer graphics, display technologies, programming, human-computer interaction, or media arts is needed. Giver the complex and high open-ended nature of this work, self directed senior level students with strong algorithmic and linear algebra backgrounds are suggested. Project Area of Research: Data visualization, computer graphics, media arts, planetary science
36	Ames Research Center Moffett Field, California	Mini Hyperspectral Camera for Planetary Surface Study	Michael Dille, Uland Wong	Determining material composition or biological presence is an important task in remote robotic planetary missions and Earth science field studies. Point spectrometers and filter imagers are popular instruments to collect such data, however they are often bulky devices that provide eith poor spatial or spectral resolution. Future mission concepts demand small, inexpensive, and rugged sensors that can be applied to micro-rovers, small unmanned aircraft, and distributed me networks. The Intelligent Robotics Group at NASA Ames has developed a concept for a focal plane imager (camera) built upon Micro Electro Mechanical (MEMS) and Liquid Crystal Display (LCD) technologies that is effectively solid state but can produce multi-spectral images in a small devic Crucially, using concepts of compressive sensing theory, the effective resolution of the image car be varied with the number of samples taken, allowing a trade-off between sampling time, desire data quality, computational demand, and data volume. We now seek to build, characterize, and demonstrate a bench prototype of this camera and explore directions for further ruggedization, miniaturization, and increased science applicability.	Relevant research interest as a master's/PhD thesis or mature undergraduate thesis. Mainly, some combination of specific experience optics design theory and/or optical design software such as Zemax, and image processing in software. Electronics and/or mechanical experience would be helpful. Project Area of Research: Computer vision, optics, sensors, planetary exploration
37	Goodard Space Flight Center, Greenbelt, Maryland	Lunar and Planetary Sample Science	Barbara Cohen	The history of each planet is told through its rocks- how the minerals are put together, what the minerals are made of, and when the rocks were formed. We use multiple analysis techniques to understand the formation, modification, and age of planetary materials to learn about their pare planets. We invite interns to participate in research projects using the Mid-Atlantic Noble Gas Research Laboratory (MNGRL.)	Geology, Chemistry, Planetary Science

38	Ames Research Center Moffett Field, California	Automated Planning for in-Vehicle Robotics	Jeremy Frank	In-vehicle robotics are robots that operate inside large spacecraft such as the International Spac Station and future vehicles such as the Gatway. For example, the Astrobee robot will launch to t International Space Station in May 2018. It will fly freely and autonomously throughout the spac 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. The internship pro will be to conduct research and development of automated planning for such robots. The intern will work with ROSPlan, the automated planning technology plugin to the Robotic Operating System (ROS). The intern will develop enhancements to ROSPlan to perform robust planning an replanning in the presence of unexpected events, uncertain activity duration, and possibly faults The intern will use robotics simulators written in Gazebo to evaluate different enhancements. T intern may also require familiarity with other technologies such as FlexBE (to implement lower le robot behaviors). The intern should have a good working knowledge of artificial intelligence planning techniques, have good software development skills, and be interested in research in th applications of AI technology to robotics.	
39	Goddard Space Flight Center, Greenbelt, Maryland	The role of ionospheri oxygen ions in magnetic reconnectior in Earth's magnetosphere: Fully kinetic simulations and MMS observations	Li Jen Chen	During the internship, the intern will work with Li-Jen Chen to investigate the role of ionospheri oxygen ions on magnetic reconnection by employing a combination of fully kinetic simulations a satellite measurements. The measurements will be taken from NASA's flagship mission: the magnetospheric Multiscale (MMS). Existing magnetic reconnection events in Earth's magnetotai and magnetopause will be analyzed to compare with results from the simulations. A publication will be prepared to disseminate the research findings at the end of the internship period.	
40	Ames Research Center, Moffett Field, California	Architecture Analysis tool for the Lunar Autonomous Positioning System	Kelley Hashemi	The Lunar Autonomous Positioning System (LAPS) concerns construction of an orbital and groun resource network that provides Position, Navigation, and Timing (PNT) services for lunar surface operations. While functionally similar to the Global Positioning System (GPS) for Earth, this syste will instead build an automated PNT framework using a combination of participating lunar missi and supplementary PNT assets. The goal is to use distributed algorithms to autonomously achiev orbit determination and time synchronization of accuracy sufficient for lunar surface end-user localization. The focus of the intern's effort will be to enhance a simulation-based tool that facilitates exploration of the many LAPS architecture choices and relate them to user localization accuracy. Tasks could include a portion of the following: 1. Implement functionality to generate realistic measurements among PNT assets including considerations such as line of sight, satellite attitude, noise, signal variation due to selected hardware or operational mode. 2. Implement localization algorithms for an end user on the lunar surface using position and time estimates fro visible PNT assets, gauge accuracy for variable system design choices. 3. Develop new or implement other existing automated, distributed orbit determination and time synchronization algorithms that are usable within the confines of the system architecture. 4. Execute localization accuracy trade study using the tool considering hardware selection and operational choices, asse locations, algorithm choice, access to ground truth measurements; separately consider the impa of asset failure	Computer/Software Skills Required: MATLAB. Desired: GMAT or similar. Scientific and Technical Skills: Familiarity with topics such as Kalman filters, GPS, orbital dynamics, and numerical integration is desirable. Academic Level: College Seniors through PhD
41	Ames Research Center, Moffett Field, California	Computational Aerosciences Research	Cetin Kiris	The Computational Aerosciences branch (TNA) at the NASA Ames Research Center develops, enhances, and applies physics-based predictive capabilities in computational aerosciences, and performs large-scale simulations that advance the goals of the NASA Aeronautics Research and Human Exploration and Operations Mission Directorates. Team members utilize these simulatior tools on the NAS High End Computing (HEC) systems to help design and analyze next-generation aircraft and spacecraft. Projects focused on design include adjoint-based aerodynamic shape optimization of concept aircraft and of propulsion-airframe integration strategies. Projects focus on analysis range from generating aero-databases for next generation of airplanes and space vehicles to performing detailed scale-resolving simulations of these vehicles. TNA also continues advance its contributions to computational aero-acoustics by developing and using high fidelity tools to predict near-field noise of various aerospace vehicles ranging from small quadcopter drones to urban air vehicles, and then propagate it out to the far-field to predict noise in the surrounding communities. Areas of current applied research activity include; wall-modeled large eddy simulation (WMLES), aero-elasticity, fluid-structure interaction, multi-physics and multi-ph modeling, high-resolution low-dissipation numerical schemes, algorithmic changes to exploit nev computing hardware architectures, and exploring Lattice-Boltzmann method.	