# Lista de Oportunidades de Estágios na NASA - 2017

| Oportunidade | Project Title | Project Description | Specific requirements | NASA Center |
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| 1 | *Small Satellite Swarm Interactions* | 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.<br>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:<br>• Develop real-time MATLAB (or other) visualizations of spacecraft attitude state for both CubeSat testbeds during air bearing operations<br>• Study the efficacy of demonstrating swarm communications by way of Xbee wireless transponders<br>• Study/develop operational modes that are relevant to possible swarm science operations, such as GPS Radio Occulation | | Ames Research Center Moffett Field California |
| 2 | *CubeSat Mission Team* | The interns will be joining a CubeSat mission team working on the last phases of development of the mission.<br>The mission spacecraft is a three-unit (3U) CubeSat that will synchronize an on-board atomic clock with one on the ground to an accuracy of 200 ps by exchanging short laser pulses between the two.<br>The internship technical activities will include:<br>• Completion of spacecraft communications and operations software and preparation of hardware and software test plans and procedures<br>• Functional testing of the FlatSat configuration of the satellite (Bus + Payload) in the lab, including spacecraft software Verification and Validation.<br>• Documentation of test results in a report, to support the Flight Readiness Review. | | Ames Research Center Moffett Field California |

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| **3** | *Robotic Sample Transfer Automation* | 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.<br>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.<br>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.<br>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 |
| **4** | *Microbial Factories for Solar System Exploration* | 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 |

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| 5 | *Orbit Analysis for LEO CubeSats and Low Lunar Orbits* | The intern will fulfill assignments as a member of the orbital dynamics team in the Mission Design Division at NASA Ames Research Center.<br>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.<br>The Mission Design Division, or MDD, supports the full mission life cycle in the areas of:<br>• Early Concept Development<br>• Mission Design<br>• Rapid Prototyping<br>• Mission Implementation<br>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.<br>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.<br>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.<br>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. | | Ames Research Center<br>Moffett Field California |
| 6 | *Evaluation of Biomedical Devices for Exploration Missions* | 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<br>Moffett Field California |

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| **7** | *Evaluation of a Variable Density Approach to Modeling Cryogenic Jets* | 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.<br><br>Outline for 6 months:<br>- Discuss and analyze differences between mass fraction and volume fraction formulations of the variable density formulation<br>- Begin interaction with the ARC researchers using the user-based source routines which can be linked into the existing libraries<br>- Apply the implemented user routines to existing cryogenic jet problems<br>- Compare current results with existing experimental and numerical results in the literature | | Ames Research Center<br>Moffett Field California |
| **8** | *Synthetic Biomaterials: A Multi-Scale Approach* | 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.<br><br>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.<br><br>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<br>Moffett Field California |

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| **9** | *Control Internship Position* | 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.<br><br>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.<br><br>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<br>Moffett Field California |
| **10** | *Biosensor Development* | 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<br>Moffett Field California |

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| **11** | *Experimental Aero-Physics Engineering Intern* | 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.<br>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 |
| **12** | *CubeSat Cluster Test-Bed* | Team members will use available off-the-shelf or spare laboratory hardware to develop laboratory test bed of at least two "Cubesats" and one ground station that will be used for on-going software and communications architecture development. The "Cubesats" may be complete units with all subsystems, flat-sats, or development units consisting of just a processor and RF subsystem. The team will develop ground software as necessary to demonstrate operation of the units including simulated intersatellite communications and simulated downlink. | Intern should have an Aerospace Engineering, Mechanical Engineering or Mechatronics, Electrical Engineering, Systems Engineering or other related engineering major. | Ames Research Center Moffett Field California |

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| 13 | *Data Mining and Analysis for Sustainability Base* | The Intelligent Systems Division at NASA Ames Research Center will be integrating advanced technologies into a new "Green" building known as "Sustainability Base" at the Ames campus. Sustainability Base is high-performance, LEED Platinum certified building that will incorporate NASA innovations and technologies to improve energy efficiency, reduce carbon footprint, and lower operating and maintenance expenses compared to traditional buildings. It will function as a living experimental platform, integrating the latest technologies as they evolve. This internship opportunity will assist in defining and implementing demonstrations of NASA technology in Sustainability Base. In particular, the intern will employ advanced data mining algorithms on data acquired from Sustainability Base to learn how the building operates and then monitor how it is performing over time. This could include measurements of energy use, mechanical system performance, environmental parameters, and other key performance indicators. For example, correlations between environmental control system settings and temperature ranges in workspaces can be established and then monitored to give early indication of performance degradation or unexpected changes to the building configuration. However, basic data analysis and gaining an intuitive understanding of data from various building systems (BACnet data, lighting, shade, photovoltaic sensor data, etc.) will also be an important precursor to any application of the advanced data mining algorithms. In addition to global building performance, the algorithms can also be used to detect changes in individual energy use as well. In either case, the algorithms will provide early indications of off-nominal performance to building operators or occupants, enabling corrective actions to maximize building performance and efficiency. Additional information on Sustainability Base can be found at http://www.nasa.gov/sustainability-base/. Additional information on data mining algorithms can be found at http://ti.arc.nasa.gov/tech/dash/intelligent-data-understanding/. | The focus of this effort may relate more to automated tracking and consolidation of energy data and plug load management and analysis, so the ideal candidate will have experience in scripting or application development to extract real-time data from APIs and websites for logging into a PostgreSQL database. Experience with MATLAB; Familiarity with Linux OS is preferred; Strong analytical and organizational skills; Interest in sustainability; Interest in data mining algorithms for health management. Senior undergraduate at junior/senior level or higher preferred. | Ames Research Center Moffett Field California |
| 14 | *Lunar Topographic Products from Orbital Images* | 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. | Ames Research Center Moffett Field California |

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| **15** | *Metabolic Control for Adaptation to Spaceflight Environment* | 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.<br>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.<br>This internship opportunity will assist in defining and implementing demonstrations of the metabolic control technology using different animal models.<br>Objectives of this research are:<br>1 To characterize the hypometabolic state<br>2 To develop methodology for real time monitoring of respiratory and other physiological parameters and conditions associated with the hypometabolic stasis.<br>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 |
| **16** | *Studies of the Aqueous History of Mars* | Intern will analyze data from a variety of spacecraft to understand the geologic history of sites of interest, in order to better understand the role of water in the history of Mars. This opportunity may include computer modeling, data analysis, and laboratory work. If times allows, preparation of a manuscript. Potentially, the sites will be proposed as landing sites for the 2020 Mars Rover. Intern will also develop software for the analysis of CRISM data. | Experience in Unix or equivalent fluency in IDL preferred. | Ames Research Center Moffett Field California |

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| **17** | *The Influence of Mechanical Unloading on Biological Function* | 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 |
| **18** | *Intelligence for Choosing Icy Landing and Exploration Sites (ICICLES)* | 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.<br><br>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 |