NASA Education Aeronautics Scholarship and Advanced STEM Training and Research (AS&ASTAR) Fellowship Activity

NASA Research Announcement (NRA)

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I. OVERVIEW INFORMATION
This National Aeronautics and Space Administration (NASA) Research Announcement (NRA), titled the NASA Education Aeronautics Scholarship and Advanced STEM Training and Research (AS&ASTAR) Fellowship activity, solicits proposal applications for the academic year 2016 – 2017. NASA may elect to support some of the proposals submitted under this NRA through the use of internal funding sources. The sources of NASA financing include but are not limited to Minority University Research Education Projects (MUREP); STEM Education and Accountability Projects (SEAP); and the following NASA Mission Directorates: Aeronautics Research, Human Exploration and Operations, Science; and NASA Centers.

Our nation's and its citizen's future prosperity depend on how well we educate today's students. The needs of our nation’s future workforce demand that we have workers with advanced thinking, reasoning, and problem-solving skills. The development of a skilled workforce is essential to the future economic success of the nation and is a priority mission for the NASA Education; to advance high-quality STEM education by supporting institutions and learners financially and by providing access to NASA-unique assets. Through this solicitation, NASA is strengthening involvement with higher education institutions to ensure that NASA can meet future workforce needs in STEM fields. Participation in NASA projects and research stimulates increasing numbers of students to continue their studies at all levels of the higher education continuum and earn advanced degrees in these critical fields.

The NASA Education AS&ASTAR opportunity is conducted in conjunction with the Aeronautics Research Mission Directorate (ARMD) and the Human Exploration and Operations Mission Directorate (HEOMD). All NASA investments in postdoctoral fellows are excluded from this announcement. Graduate researchers interested in conducting earth and space science research shall submit their applications directly to the Science Mission Directorate’s (SMD) NASA Earth and Space Science Fellowship (NESSF): https://astrobiology.nasa.gov/careers-employment/nasa-earth-and-space-science-fellowship-nessf-prog/. Graduate researchers interested in conducting space technology research must submit their applications directly to the NASA Space Technology Research Fellowship (NSTRF), https://www.nasa.gov/directorates/spacetech/strg/archives_nstrf.html.

II. EXECUTIVE SUMMARY
NASA’s Office of Education (NASA Education) collaborates with NASA Headquarters, NASA Mission Directorates, NASA Centers and external STEM partners to implement STEM education. NASA Education provides unique opportunities to learners, educators, and institutions by providing access to NASA’s mission content, people, resources, and facilities. NASA Education’s investments include 1) Federal (financial) domestic assistance to the nation’s colleges and universities (including minority-serving institutions and community colleges), museums, and other non-profits; and, 2) Intra- and Inter-Agency coordination.

During Fiscal Year (FY) 2016, NASA will continue to consolidate and prioritize activities that support the Agency’s education goals across Lines of Business (LOB):
NASA Internships, Fellowships, and Scholarships (NIFS): Utilize NASA facilities and assets to provide work experiences and research and educational opportunities to improve retention in STEM and prepare students for employment in STEM jobs;

STEM Engagement (SE): Provide opportunities for participatory and experiential learning activities to connect learners to NASA-unique resources;

Educator Professional Development (EPD): Prepare STEM educators and leaders to deliver quality STEM instruction utilizing unique NASA assets and content; and,

Institutional Engagement (IE): Improve the capacity of U.S. institutions to deliver effective STEM education.

NASA Education’s LOBs reflect a transformative, scalable education portfolio that effectively leverages resources and partners from all sectors to enhance STEM Education, inspire and captivate learners, educators, and institutions. The NIFS LOB seeks to leverage NASA’s unique mission activities to enhance and increase the capabilities, diversity, and size of the nation’s next generation workforce needed to enable future NASA discoveries. NIFS goals and objectives align with those of the Committee on Science, Technology, Engineering and Mathematics (CoSTEM) Federal STEM Education 5-year Strategic Plan and the FY 2014 NASA Strategic Plan. This announcement requests research proposals from interested applicants to support the Fellowships component in the NIFS LOB.

Graduate Research Fellowships provide financial support to graduate students pursuing a Master’s or Doctoral degree in STEM while partaking in graduate unique research projects under the guidance of an institutional Principal Investigator in collaboration with NASA Technical Advisers.

This 2016 NRA is designed to consolidate many of NASA’s previous fellowship programs/projects into one activity, and provide a mechanism to develop an expansive and diverse pool of graduate researcher proposals from which NASA funding sources can select. The NRA builds in flexibility so that each funding source may have its unique expectations and selection requirements. This NRA demonstrates NASA’s commitment to streamlining and consolidating activities. Funding will continue for established NASA Education Fellowships until closeout, thereby fulfilling NASA responsibilities to NASA Fellows. However, this is contingent on available federal funding.

NOTE: *This NRA only covers new fellowship proposals/applications. Renewal applications are handled differently, based on the original agreement terms.

A. **Title:**

NASA Education Aeronautics Scholarship and Advanced STEM Training and Research (AS&ASTAR) Fellowship

B. **Purpose:**

The purpose of the NASA Education AS&ASTAR Fellowship activity supports the vitality and diversity of the STEM workforce of NASA and the United States by training and funding
graduate students during their STEM academic endeavors and providing access to NASA, its content, unique facilities, and STEM experts. The NASA Education AS&ASTAR Fellowship activity expands the reach of NASA Education budget by leveraging funding sources and collaborating with other Federal Agencies to support graduate student research and the education development of selected individuals.

C. Objectives:

1. Improve the nation’s future STEM workforce by developing the skills and competencies of graduates pursuing degrees in STEM disciplines, one student at a time;
2. Provide opportunities for a diverse population to participate and contribute to NASA’s missions and projects;
3. Use NASA’s unique mission content, workforce, and facilities in order to enhance and increase the capabilities, diversity, and size of the nation’s next generation workforce needed to enable future NASA discoveries;
4. Improve the rates at which students, who have historically been underrepresented in NASA-related fields, are awarded graduate degrees at their respective universities in the STEM fields.
5. To build an intellectual network between NASA and higher education institutions by allowing faculty greater access and knowledge of NASA’s research opportunities.

To achieve maximum impact and success, NASA Education AS&ASTAR Fellowship activity applicants should focus on one or more of the above goals and objectives.

D. National and Agency-Wide Priorities:

NASA’s works in collaboration with other Federal agencies to improve the quality of STEM education in the United States, which supports both the NASA 2014 Strategic Plan and the Administration’s STEM policy. The NASA Education AS&ASTAR Fellowship activity will address the following long-term NASA Education goals and objectives that are outlined in the 2014 NASA Strategic Plan. These measures determined by the agency’s short-term Annual Performance Indicators (API), which set quantifiable targets for NASA’s offices, programs, and projects. NASA’s goals and objectives are subject to change to adapt to national and agency-wide priorities.


The NASA Education AS&ASTAR Fellowship activity is designed to increase retention and completion rates of underserved, and underrepresented graduate students in STEM fields. To achieve this goal, this solicitation focuses on the following NASA Strategic Objective:

**Goal 2:** Advance understanding of Earth and develop technologies to improve the quality of life on our home planet.

*Objective 2.4: Advance the nation’s STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers and faculty in NASA’s mission and unique assets.*
The NASA Education AS&ASTAR Fellowship activity provides financial support to individuals who are early in their graduate education and have demonstrated the potential to contribute to NASA’s mission and future STEM workforce. The use of innovative professional development activities motivates learners leading to increases in the number of historically underrepresented and underserved populations, such as women, minorities, persons with disabilities, and veterans, who are pursuing advanced degrees in STEM disciplines. This activity develops a supportive Professional Learning Community (PLC) consisting of the fellowship cohorts, institutional faculty advisers (PIs), NASA researchers, NASA scientists and NASA Education program managers. The PLC intent is to support the graduate’s experience leading to an increase graduation rate.

NASA’s APIs are outlined in the NASA FY 2015 Complete Management and Performance (http://www.nasa.gov/sites/default/files/files/NASA_FY15_MP.pdf). The NASA Education AS&ASTAR activity supports the following NASA Education multi-year performance goal and API:

E. Multi-year Performance Goal:

- 2.4.1: Assure that students participating in NASA higher education projects are representative of the diversity of the nation.

F. Annual Performance Indicator:

- ED-16-1: Provide significant, direct student awards in higher education to (1) students across all institutional categories and levels (as defined by the U.S. Department of Education), (2) racially or ethnically underrepresented students, (3) women, and (4) persons with disabilities at percentages that meet or exceed the national enrolled percentages for these populations, as determined by the most recent, publicly available data from the U.S. Department of Education’s National Center for Education Statistics for a minimum of two of the four categories.

G. National Science and Technology Council (NSTC) Committee on STEM Education (CoSTEM):

The NASA Education AS&ASTAR Fellowship activity is consistent with national priorities for STEM education established by the CoSTEM http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf. Specifically, the NASA Education AS&ASTAR Fellowship activity addresses the following CoSTEM priorities:

a. Design graduate education for tomorrow’s STEM workforce: Provide graduate-level trained STEM professionals with basic and applied research expertise, options to acquire specialized skills in areas of national importance and mission agency’s needs, and ancillary skills needed for success in a broad range of careers.

b. Better serve groups historically underrepresented in STEM fields: Increase the number of students from groups that have been underrepresented in STEM fields that graduate with STEM degrees in the next 10 years and improve women’s participation in areas of STEM where they are significantly underrepresented.
H. NASA Relevance:
Each proposed research project is developed in response to one of the NASA Fellowship Research Opportunities and each proposal shall include a letter of support from a NASA Center researcher stating their concurrence with the proposal and their willingness to serve as a NASA Technical Adviser. Coordination with the potential NASA Technical Adviser is mandatory. If an applicant has questions about a research opportunity, they should contact the NASA Technical Adviser identified in the opportunity. The NASA Technical Adviser associated with the opportunity will provide review and guidance on the activities in his or her lab. Also, proposals shall clearly and concisely describe:

- The relevance of the proposed work to NASA’s currently funded research priorities as described in the funding opportunity.
- The relevance of the proposed work to the interests and abilities of the fellowship candidate, and how the work will increase the capacity and integrity of executing cutting-edge research at the University.

If the proposer needs further assistance, they can contact the NASA Center POC listed in the opportunity.

III. FUNDING OPPORTUNITY DESCRIPTION

The NASA Education AS&ASTAR Fellowship activity provides funding for fellowship candidates to perform graduate research at their respective campuses during the academic year under the guidance of their Faculty Adviser, who will serve as the Principal Investigator (PI) on the award. In addition to his or her Faculty Adviser, each selected fellow will be paired with a NASA Researcher (based on the proposal or the suggestion of a NASA supporting researcher), who will serve as the fellow’s NASA Technical Adviser. Graduate research requires an educational collaboration between the fellow’s faculty members and a NASA Technical Adviser.

The fellowship candidate independently develops the research proposal in response to the NASA Graduate Research Opportunity solicited in the NRA. The fellowship candidate develops the proposal in collaboration with the Faculty Adviser and the NASA Technical Adviser to ensure relevance, institution’s capability, and NASA capacity. The PI submits the proposal on behalf of the fellowship candidate. The fellowship candidate’s Faculty Adviser serves as the candidate’s PI if a NASA Training Grant is awarded.

If the proposal is awarded a grant, the NASA Technical Adviser becomes an integral part of the team by becoming an additional member to the research cohort. The NASA Technical Adviser promotes NASA’s innovation-oriented culture and provides entry into NASA-unique facilities. NASA Fellows will work with their designated NASA Technical Adviser at a host NASA center during an annual 10-week Center-Based Research Experience (CBRE), which typically occurs in the summer months. The CBRE is a mandatory requirement. NASA Education funded participants are selected in part, because of their proposed use of the NASA facilities, content, and people as identified in the proposal. It is critical for the technical and professional development of NASA Fellows that they have the opportunity to work in a dynamic real-world environment, which exposes each cohort to
government research culture and norms. Through the CBRE, Fellows will advance their STEM education, gain relevant research experience, expand their professional network, learn best practices, research ethics, and develop their understanding of specific research processes.

IV. AWARD BUDGET and ALLOWABLE EXPENSE INFORMATION

The NASA Education AS&ASTAR Fellowship activity will be awarded as a non-portable training grant to accredited U.S. universities on behalf of fellows selected under this NRA. For each Fellow, the University receives up to a $55,000 annual award, with the following annual maximums per budget category:

- Fellowship Stipend: $25,000 (Master’s) / $30,000 (Doctoral)
- Tuition Offset and Fees: $10,000
- CBRE Allowance: $8,000
- Health Insurance Allowance: $1,000
- Faculty Adviser Allowance: $4,500
- Fellow Professional Development Allowance: $1,500

If a deviation is required for an institution’s indirect costs for a selected proposal, then the deviation language will be specified in the NASA Grant and Cooperative Agreement document under Additional Terms.

A. Allowable Expenses (adjustments may be made with the permission of the Program Manager and Grant’s Officer):

1. Fellowship Stipend: A stipend is assumed to be for a Fellow’s personal expenses. Stipend payments should be prorated evenly across a ten-month academic school year.
2. Tuition Offset and Fees: Provided up to the maximum value to offset the fellow’s tuition and fees.
3. CBRE Allowance: This allowance is to be used to support travel and other expenses associated with the CRBE experience. CBRE funds are to be released from the institution to the NASA Fellow in two incremental payments. The first payment should be released within a month of the planned CBRE with the last payment released after the successful completion of the 5th week of the CBRE. NASA Training Grants reporting process requires institutions to submit receipts for all financial transactions, and organizations should require receipts for travel related expenses.
4. Health Insurance Allowance: Permissible up to maximum value, only to the level of expected actual cost.
5. Faculty Adviser Allowance: This allowance is designated to support and facilitate a collaborative research team. Faculty Advisers are significant contributors to the execution of the NASA Training Grant’s research goals. This allowance supports on-site visit(s) during the NASA Fellow’s CBRE to discuss with the team, various research-related topics and to explore additional research opportunities with NASA. Domestic travel requirements are found in Appendix F.

6. Fellow Professional Development Allowance: This allowance may be used in direct support of training, research, technical, scientific, and publication needs of the Fellow. This stipend can be used in concurrence with the Faculty Adviser Allowance to cover approved Fellowship Fellow domestic travel to technical and scientific meetings. The Fellow is expected to attend at least one technical conference to present the work being conducted under the awarded research proposal. All technical conferences shall follow procedures (Appendix E) for approval by the NASA Fellowships Manager.

- Equipment, including computers, may not be purchased with NASA Education funds. Government furnished equipment will not be provided as part of these awards.

Throughout the duration of this award, Fellows are prohibited from concurrently receiving any other Federal fellowships, scholarships, traineeships, apprenticeships, internships, or any other federal funding.

The NASA Education AS&ASTAR activity is a fellowship to support graduate education and does not provide funding for institutional overhead.

Tax questions should be directed to the Internal Revenue Service. Refer to IRS publications on “Scholarships and Fellowships”. (http://www.irs.gov/)

V. ELIGIBILITY INFORMATION

A. Fellowship Candidate Eligibility:

To be eligible to receive a NASA Education AS&ASTAR Fellowship, the candidate shall meet the following requirements:

- Be a U.S. citizen or naturalized citizen (permanent residents are not eligible) at the time of proposal submission;
- Hold a Bachelor’s degree in a STEM field earned prior to August 31, 2016.
- Have a minimum 3.0 GPA on a 4.0 scale;
- Be enrolled in a Master’s or Doctoral degree program no later than September 2016.
- Intend to pursue a research-based Master’s or Ph.D. program in a NASA relevant field (see Appendix B);
• Have completed no more than twelve months of full-time graduate study (or the equivalent) as of August 1, 2016 *

• Have a projected degree plan length of two years or more;
• Meet all other eligibility requirements as set forth in the current Solicitation.

* The 12-month limit applies to the entire graduate career. All post-baccalaureate, graduate and professional study counts towards this limit, including all Master's and Ph.D. programs, professional programs, graduate-level coursework completed outside a degree program, and both full-time and part-time study.

If a student has completed more than 12-months of graduate study, he or she may be considered eligible if they have an interruption of at least two consecutive years prior to November 1, 2016, and they have not completed any additional graduate study by August 1, 2016

** For example, if a student earned a Master's degree in 2011, has been out of school since then, and is currently applying to Ph.D. programs (with a planned fall 2016 start date), the student would meet the eligibility requirements. However, if the student earned a Master's degree in 2011 and started a Ph.D. program in fall 2015 or spring 2016, he or she would not meet the eligibility requirements, due to having completed additional graduate study after the interruption.

If the fellowship candidate meets the above eligibility requirements and is planning to start a new graduate degree program at an academic institution that is different from his/her current academic institution, he/she is encouraged to work with faculty/or Department Chair at the prospective university in assembling and submitting proposals to this fellowship opportunity.

B. **Degree and Field of Study:**

Fellowships are awarded for graduate study leading to research-based masters and doctoral degrees in an NASA-specific STEM discipline. Please refer to Appendix B.

C. Institutional Eligibility:

1. The institution shall be one of higher education with U.S. accreditation and a physical campus located in the United States or its territories.
2. The institution shall offer graduate level degrees in eligible STEM fields (Appendix B) by fall 2016.

VI. **PROPOSAL and SUBMISSION INFORMATION**

No more than one NASA Education AS&ASTAR Fellowship proposal shall be submitted on behalf of a single fellowship candidate. If more than one proposal is submitted on behalf of a fellowship candidate then, all proposals will be deemed ineligible for that candidate. The proposal shall
address a NASA Education AS&ASTAR Fellowship research opportunity and have a NASA Center researcher’s concurrence.

The NASA Education AS&ASTAR Fellowship proposal submission process may have two phases: Phase I is the proposal submission by the Principal Investigator (PI) and, or the Authorizing Official Representative (AOR) on the behalf of the fellowship candidate. For Phase I, the following is required to be submitted: the proposal cover page (including project abstract), impact statement, project description, degree program schedule, biographical sketch, letters of recommendation, and transcripts. Phase II is only required by the selected proposals who utilized the “NASA OE Fellowship Proposal Submission Office” as the AOR. A proposal application package shall be submitted by the selected fellowship candidate’s institutional AOR. (Directions will be sent with Phase II notification.)

Detailed instructions for proposal submission can be found in NSPIRES in “Other Documents” on the NASA Education AS&ASTAR Fellowship Page.


A listing of available research opportunities throughout NASA is included in this solicitation. Applicants should review the opportunities and discuss with the NASA Technical Adviser the viability and relevance of the applicant’s research concept to the selected opportunity of interest.

*NASA civil servants assigned to Appendix D as the lead technical officers may only provide general information regarding the application guidelines for NASA Education AS&ASTAR, which includes general information about NASA or NASA assets, and may refer proposers to a specific part of Appendix D or page number without interpretation of any kind.

NASA Fellowships are designed to support independently conceived or designed research, or senior designed projects by highly qualified undergraduates, and graduate students, in disciplines needed to help advance NASA’s missions, thus affording students the opportunity to directly contribute to advancements in STEM-related areas of study. NASA Fellowship opportunities are focused on innovation and the generation of measurable research results, which contribute to NASA’s Current and future science and technology goals.

A. Principal Investigator (PI):

All proposals must have a Faculty Adviser identified (who will serve as the PI of the training grant) from the proposing institution. PIs must meet all of the following criteria at the time that the Phase II Application is submitted (See Section VI.D. for more information).

- The PI shall be a tenured or tenure-track faculty member at an eligible institution (if a tenure system is established). Eligible institutions that do not have a tenure track will be required to submit a letter of commitment to comply with the rule that any proposed change to the PI under the agreement is subject to NASA approval. Also, the PI shall have a Ph.D. or equivalent in an engineering, computer science, technology, mathematics, or science discipline that is relevant to NASA’s research needs.
• The Faculty Adviser/PI shall provide a Curriculum Vitae (CV), which includes the following information as part of the proposal package:
  a) Name
  b) Current position
  c) Title
  d) Department
  e) University address
  f) University phone number
  g) Principal publications
  h) Relevant career experience
  i) Research
  j) Awards
  k) Scholarships
  l) Other relevant accomplishments

B. NSPIRES Registration Information:

• The University shall be registered with NSPIRES through the Electronic Business Point of Contact (EBPOC) listed in the System for Award Management (SAM) database (https://www.sam.gov/portal/SAM/#1).
• Each registered university shall have a designated Authorizing Official Representative (AOR) who shall submit the fellowship candidate’s application. (Please see “NOTE” below if you do not have an AOR, or cannot locate your AOR)
• The Faculty Adviser (PI) shall be registered with NSPIRES and affiliated with the registered institution.
  (Please see “NOTE” below if the submitter has not been accepted into the institution of his or her choice yet and thus does not have a PI.)
• The fellowship candidate shall be registered with NSPIRES and activate his/her account.

NOTE: ** Application tip for fellowship candidates not yet accepted into a graduate program and do not have a PI or AOR: If you have not yet been accepted into the university of your choice and thus do not have a PI or AOR associated with the academic institution for your Phase I submission, please select the “NASA OE Fellowship Proposal Submission Office” as your organization. If selected for a Phase II Submission, your application will need to be relinked with the correct institution.
C. Application Procedures – Phase I:
Potential fellowship candidates and their respective PIs (Faculty Advisers) are urged to access the NSPIRES electronic proposal system well in advance of the proposal due date to familiarize themselves with its structure and to enter the requested information. See the submission instructions in NSPIRES for full details.

The fellowship candidate is the principal author of the submitted Phase I research proposal. By submitting the proposal for consideration, the fellowship candidate and the Faculty Adviser (PI) certify that the fellowship candidate is the principal author.

All proposals shall be submitted via NSPIRES in electronic format only. No mailed in materials or hard copies will be accepted. NASA Education AS&ASTAR Fellowship proposals shall be submitted electronically by the AOR of the institution (see Appendix C in this NRA or Step-by-Step Submission Instructions under “Other Documents” in NSPIRES for more information) or using the “NASA OE Fellowship Proposal Submission Office” by the deadline listed. Phase I proposals shall be received by 11:59 p.m. E.T. or 8:89 p.m. P.T. on June 17, 2016. Proposals received after this deadline will not be accepted.

   a) Click on Solicitations
   b) Click on Open Solicitations
   c) Use any keywords to select: NASA Education Aeronautics Scholarship and Advanced STEM Training and Research (AS&ASTAR) Fellowship; and
   d) For submission instructions, select Phase I Proposal Submission Instructions under “Other Documents."

Phase I proposals shall include ALL of the items listed below (a-i), appropriately labeled, in the exact order specified. Proposals should not include extraneous information or materials not specifically requested or outlined in this solicitation. No additional information shall be provided by links to web pages within the proposal, except as part of citations in the References Cited section. Images may be included in the page limits. Review of the proposal is based solely on those materials received by the proposal deadlines. The proposal shall be in writing and shall use the following:

- Standard 8.5" x 11" page size
- 12-point, Times New Roman font, or Computer Modem (LaTeX) font
- 10-point font may be used for references, footnotes, figure captions and text within figures
- 1" margins on all sides; and
- Single spaced or greater line spacing
2. Proposal Application Package:

a) **NSPIRES-generated Proposal Cover Page:** The cover page to be completed online includes a Project Abstract. This proposal section shall be titled “Project Abstract” and shall not total more than one paragraph. The abstract shall be a complete summary of the proposed project description (see below). As such, it is a very concise statement of the major elements of the proposed research project. It states the purpose, methods, and findings of the proposed investigative research on the research opportunity. The abstract shall not exceed 200 words. Abstracts shall be clear, concise, and cohesive. The cover page also includes responses to the Program Specific Data Questions.

**Please Note:** The following elements (b – g) are not part of the NSPIRES Proposal Cover Page form and shall be combined into a single PDF document and uploaded on the NSPIRES site for submission.

b) **Impact Statement:** This proposal section shall be titled “Impact Statement” and shall be jointly written by the fellowship candidate and Faculty Adviser (PI). It should address the impact of such an award on both the fellowship candidate professionally and the institution. It shall not exceed one page, and it shall focus on the NASA Education objectives listed in the Executive Summary.

c) **Faculty Adviser/PI Curriculum Vitae (CV)** with information identified in section: VI. A. Principal Investigator.

d) **Project Description:** This proposal section shall be titled “Project Description” and shall not exceed five (5) single-spaced pages (using a 12-point font with at least 1-inch margins on all sides). The project description shall provide a clear description of the fellowship candidate’s proposed research and should be written in response to the Research Opportunities listed under “Other Documents” and with the concurrence of a NASA researcher. The Project Description shall follow the order below and contain the following technical elements:

i. Statement of the Problem

ii. Hypothesis

iii. Approach

iv. Predicted Outcomes

v. Conclusion

vi. References cited
e) Degree Program Schedule: This proposal section is a schedule stating the proposed start and completion dates, as well as anticipated milestones of the fellowship candidate’s degree program. There is no standard format for this section. This section shall be titled “Degree Program Schedule” and shall not exceed one page.

f) Biographical Sketch for the fellowship candidate. It shall not exceed two pages, and shall include the following information:

i. Name

ii. Current Academic Level

iii. Title

iv. Department

v. University address

vi. University phone number

vii. Relevant career experience

viii. Research

ix. Awards

x. Other relevant accomplishments

g) Transcripts: Transcripts that cover the fellowship candidate’s entire academic career, high school and undergraduate years shall be included. These shall be legible and unaltered. If transcripts are not current or recent, an explanation shall be provided. If all, or part of, the fellowship candidate’s social security number and/or the fellowship candidate’s complete date of birth appear on the transcript, these items shall be blocked out (redacted) prior to submission. These redactions are the only permitted alterations to a transcript.

h) Letters of Recommendation: Each fellowship candidate shall submit three (3) current letters of recommendation as part of the proposal package by the proposal deadline. Recommenders shall not be family members of the fellowship candidate. Each letter shall contain the recommender’s contact information. Since the letters of recommendation constitute a critical component of the proposal, failure to submit these letters may negatively affect the evaluation of the proposal.

i. One letter shall be from (and signed by) the fellowship candidate’s proposed Faculty Adviser (PI) on official letterhead. It shall include the following information: name and title of the letter writer, department, and institution or
organization. It shall include a statement indicating the level of assistance provided to the fellowship candidate during the preparation of the project description. (NOTE: If a fellowship candidate has not yet been accepted into his or her university of choice, then he or she shall submit a letter of recommendation from his or her current academic adviser.)

ii. The other two letters should come from individuals (teachers, professors, STEM professionals, advisers, mentors, work supervisors, etc.) with detailed knowledge of the fellowship candidate’s abilities. Each letter shall contain the recommender’s contact information.

Note: **All letters of recommendations shall be submitted as part of the proposal package by the proposal deadline.

   i) **Letter of Concurrence:** The NASA Center to be utilized as part of the proposal effort shall provide a letter stating its concurrence with the proposal and its willingness to serve as a NASA Technical Adviser for the fellow if the proposal is awarded a training grant. A statement of support shall be included for any research expenses not covered by the training grant and identified as an in-kind contribution from NASA.

Proposals not meeting the requirements as outlined in sections 2.a) through 2.i) above may be eliminated from award consideration.

Phase I Proposal Submission Deadline: 11:59 p.m. E.T. (8:59 p.m. P.T.), currently June 17, 2016. No extensions will be granted to accommodate late proposals or partial proposal submissions. Step by step instructions for Proposal Submission can be found in NSPIRES in “Other Documents” under the NASA Education AS&ASTAR Fellowship.

**D. Application Procedures - Phase II (if required):**

The institution and fellowship candidate may be required to submit a Phase II application if an award offer is extended after Phase I Proposal Evaluation. If the Phase I Proposal Application Package was submitted using “NASA OE Fellowship Proposal Submission Office” as the submitting AOR, a correction will be necessary to replace the fellowship candidate’s institutional AOR. In such cases, Phase II is required to move forward through the process. This section provides an outline of the required Phase II elements. Detailed instructions will be released, via NSPIRES, concurrent with the Phase I selection announcement.

Phase II of this solicitation will require submission of a proposal application package, via NSPIRES, by a university AOR. The PI on the training grant award will be the Faculty Adviser. The Faculty Adviser will also have a role in the submission of the Phase II package. The selected fellowship candidate shall work with the Faculty Adviser and AOR to ensure that all of the following components are submitted by the Phase II deadline (currently August 19, 2016).
1. NSPIRES Proposal Cover Page (with the Faculty Adviser as PI and additional Program Specific Data Questions)

2. Unrevised, except as specified below, components b through g of the Phase I submission:
   a. The Phase I-submitted Impact Statement
   b. The Phase I-submitted Project Description
   c. The Phase I-submitted Degree Program Schedule
   d. The Phase I-submitted Biographical Sketches
   e. The selected fellowship candidate’s transcripts, with updates as available

3. Curriculum Vitae (CV) for the Faculty Adviser, (see Section: VI. A. Principal Investigator).

4. Statement from the Faculty Adviser on the planned use of funds outlined in budget categories funded in section I.V, and a brief description of any ongoing or pending research awards from NASA that are related to the selected fellowship candidate’s proposal.

By submitting the Phase II package, the proposer accepts the Terms and Conditions specified in Phase I. NASA will examine the Phase II packages for completeness (i.e., all components have been submitted and are correct). Training grants will only be awarded when all of the Phase II package components are complete.

E. Pre-proposal Questions and Answers:

A pre-proposal teleconference will be held on Monday, May 23, 2016, at 3:00 p.m. E.T. or 12:00 p.m. P.T. During this teleconference, prospective fellowship candidates may verbally ask questions about this opportunity. Fellowship candidates may also receive technical assistance from project staff at this time, which may include tips and guidance for applying to the opportunity. Refer to the NASA Education AS&ASTAR Fellowships on NSPIRES for connection details.

Prospective fellowship candidates, Faculty Advisers and academic institutions are requested to submit any written questions, as instructed below. Responses to the questions submitted will be posted on NSPIRES. The list will be updated periodically during the open period of the opportunity. Questions submitted after the deadline will not receive a response.

Questions regarding this opportunity shall be submitted in writing to the NASA Fellowship Manager, Brenda Collins (email: NASA.Fellowships@nasaprs.com) by June 7, 2016, in order that answers may be obtained and posted in a timely manner. Questions and responses will be posted in NSPIRES under “Other Documents” associated with this solicitation.

Civil servants listed in Appendix D as either POCs and/or potential technical officers for future awards, shall not assist in the development or any formal pre-submission review of specific proposals. This restriction begins on the release date of this solicitation. Additionally, the civil servants at NASA Headquarters who will serve as internal reviewers for this solicitation shall not “pre-read” proposals or provide letters of support or commitment to an entity that plans to apply. However, proposers may contact the potential NASA Technical Advisers (as identified in the Research Opportunities by Center Document in “Other Documents”) for information regarding a review of the work currently being performed in his or her lab.
VII. APPLICATION REVIEW INFORMATION

A. Proposal Review and Selection:

All eligible Phase I proposals will be reviewed by technical experts using virtual and/or panel reviews. The following two (2) equally weighted criteria will be used to evaluate the fellowship candidate’s proposal application:

1. **Academic Merit and Distinction.** Based upon the review of the fellowship candidate’s transcripts, impact statement, letters of recommendation and biographical sketch, reviewers will analyze the applicant’s potential to conduct NASA relevant research based upon the following criteria:

   a. The applicant’s ability to synthesize and evaluate original thoughts into a clear and concise document;

   b. The applicant’s previous experiences conducting research and/or desire/potential to conduct research in an authentic lab setting; and

   c. The applicant’s intrinsic motivation and determination to complete an advanced degree at the academic institution of choice.

2. **Scientific Merit of the Proposed Research.** Based upon the review of the applicant’s Project Description, reviewers will analyze the quality of the proposed NASA relevant research based upon the following criteria:

   a. The proposal’s ability to address a gap in the scientific literature;

   b. The proposal’s ability to clearly describe a collaborative approach to conducting research within NASA; and

   c. The proposal’s ability to clearly describe the connection between the proposed research area and the academic discipline that the fellowship candidate is pursuing.

After the review of Phase I proposals, NASA technical experts and program managers will review proposals and make selections for participation in this program. Selections will be based on the successful submission of a timely, and complete proposal package that successfully addresses the two (2) evaluation criteria described above in Section VII.A.(1) and (2). For NASA Education AS&ASTAR Fellowship proposals, the stated impact on the fellowship candidate and the university will also be taken into consideration. For any Phase I proposals that need to move on to Phase II, NASA will contact the applicant to discuss next steps.

B. Review of Applicants in the Federal Awardee Performance and Integrity Information System (FAPIIS)
NASA, prior to making a Federal award with a total amount of Federal share over the period of performance greater than the simplified acquisition threshold (currently $150,000), is required to review and consider any information about the applicant that is in the designated integrity and performance system (currently the Federal Awardee Performance and Integrity Information System—FAPIIS) accessible through the System for Award Management (SAM, https://www.sam.gov) (see 41 U.S.C. 2313).

An applicant, at its option, may review information in FAPIIS and comment on any information about itself that NASA previously entered and is currently in FAPIIS.

NASA will consider any comments by the applicant, in addition to the other information in FAPIIS, in making a judgment about the applicant’s integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 2 CFR 200.205 Federal awarding agency review of risk posed by applicants.

VIII. AWARD ADMINISTRATION INFORMATION

A. Anticipated Type of Award:
The NASA Fellowship funding is issued to the awardee’s institution by NASA Shared Services Center (NSSC) in the form of a NASA Training Grant. Cooperative agreements and contracts will not be awarded.

B. Estimated Number of Awards:
Awards are subject to Congressional appropriation in Fiscal Years 2016 and beyond, and also NASA’s receipt of proposals of adequate merit. NASA expects to select a minimum of 13 proposals for award. Individual total award values will range from $50,000 to $55,000 each year for a total award value of $150,000 to $165,000 with a period of performance of up to three (3) years. NASA may elect to support some of the proposals submitted under this NRA through the use of non-NASA funds if funds are available from other NASA programs or federal sources. NASA reserves the right to not make any awards under this NRA and to cancel this NRA at any time. NASA assumes no liability (including proposal preparation costs) for canceling the NRA or for an entity’s failure to receive an actual notice of cancellation.

C. Period of Performance:
All awards are made for one (1) year and are renewed for up to two (2) more years of financial support, pending availability of federal funds and a successful annual review of the effort. Some awards may be eligible for multi-year funding. Renewals are contingent upon NASA’s acceptance of the renewal application, which includes satisfactory progress (as reflected in Fellow’s academic performance and research progress, recommendation by the Faculty Adviser, recommendation by the NASA Technical Adviser, and effective costing of the annual budget). Requests for deferment of awards will not be approved.

Fellows seeking renewal shall submit a Renewal Proposal Applications Package to the NASA Education NRA: Aeronautics Scholarship and Advanced STEM Training and Research (AS&STAR-Renewal) Fellowship Renewal for Academic Year 2017-2018 The NRA shall be posted on NASA NSPIRE in the winter of 2017. Refer to Appendix G.
D. Transfer of Award

1. The PI and the institution’s AOR shall provide a timely statement to NASA Program Management advising of any changes in the fellow’s enrollment status.
2. If a fellow withdraws within the first half of the award year, the institution may request a replacement fellow with similar achievement and research objectives to complete the remaining months of the current award. Since this is a highly competitive program, replacement fellows may be recommended from NASA’s current database of alternative applicants who have passed a review process and met all the requirements for the award. However, replacement fellows are not considered as renewals for subsequent awards. Upon expiration of the replacement award, the replacement fellow shall follow the guidelines for a new fellowship candidate, submit a proposal application and compete for future NASA Education AS&ASTAR awards.
3. This award cannot be transferred to another institution. The fellow shall reapply to the program and follow the guidelines for a new fellowship candidate, submit a proposal application, and compete for any future NASA Education AS&ASTAR awards.

E. Administrative and National Policy Requirements

All administrative and national policy requirements can be found in section: 2 CFR 200, 2 CFR 1800, and the NASA Grant and Cooperative Agreement Manual (GCAM) (https://prod.nais.nasa.gov/pub/pub_library/grantnotices/GrantNotices.html).

F. Access to NASA Facilities

Award recipients that have individuals working under the award who need access to NASA facilities and/or systems must work with NASA program staff to ensure proper credentialing. Such individuals include U.S. citizens, lawful permanent residents (“green card” holders), and foreign nationals (those who are neither U.S. citizens nor permanent residents).

IX. PROGRAMMATIC REQUIREMENTS

A. Fellows shall participate in a minimum of 40 hours per year in programmatic professional development activities such as webinars and conferences.
B. The Center Based Research Experience (CBRE) is a mandatory requirement of the program. If a fellow does not participate in the CBRE, the fellowship will not be renewed.
C. Each Fellow shall publish a peer review paper by the end of the training grant’s performance period.

X. REPORTING REQUIREMENTS

All reports are vital to program management and evaluation. It is the responsibility of the Faculty Adviser (the PI), the fellow, and the institution receiving a NASA Education AS&ASTAR Fellowship award to ensure prompt submission of all required reports. A listing of interim and final reports is included in the official training grant that will be sent to the fellow’s host university upon issuance of
the award (see 2 CFR 1800.902 and Exhibit E of the GCAM). A summary of these reports is provided below:

AGO = ADMINISTRATIVE GRANT OFFICER
IPO = INDUSTRIAL PROPERTY OFFICER
CASI = CENTER FOR AEROSPACE INFORMATION
NTO = NEW TECHNOLOGY OFFICE
CC = CLOSEOUT CONTRACTOR
PO = PATENT COUNSEL OFFICE
FMO = FINANCIAL MANAGEMENT OFFICE

Interim Reports

<table>
<thead>
<tr>
<th>Report</th>
<th>Action Required By:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarterly Federal Cash Transactions Report (SF 425)</td>
<td>HHS/PMS</td>
</tr>
<tr>
<td>This report is submitted by the University Sponsored Research Office and is required within 30 working days following the end of each quarter of the Federal fiscal year for all Grants and Cooperative Agreements (Ref. 2 CFR Part 1800.906). Submit to HHS/PMS. The address will be on the Training Grant.</td>
<td></td>
</tr>
<tr>
<td>Progress Reports (Required for all Grants and Cooperative Agreements.) (Not required if performance period is less than one year.) Submit with annual NASA Education AS&amp;ASTAR Fellowship renewal report. Official transcripts are requested by the fellowship candidate and sent as part of the annual progress report. Submit to Program Manager by the due date on the notice of award document.</td>
<td>TO, GO, NTO</td>
</tr>
<tr>
<td>Report Due: Annually, 60 days prior to the anniversary date of the grant/cooperative agreement (except final year). (Ref. 1800.902) Submit to Program Manager and Grants Officer.</td>
<td></td>
</tr>
<tr>
<td>Notification of Decision to Forego Patent Protection (Required for all Grants and Cooperative Agreements).</td>
<td>PO, TO, GO</td>
</tr>
<tr>
<td>Report Due: As applicable, not less than 30 days before the expiration of the response period required by the relevant patent office. (Ref. 1800.908)</td>
<td></td>
</tr>
<tr>
<td>Election of Title to a Subject Invention: (Required for all Grants and Cooperative Agreements).</td>
<td>PO, TO, GO</td>
</tr>
<tr>
<td>Report Due: Within 2 years of disclosure of a subject invention being elected, except in any case where publication, on sale or public use of the subject invention being elected, has initiated the one year statutory period wherein valid patent protection can still be obtained in the United States, at least, 60 days prior to the end of the statutory period. (Ref. 1800.908) Submit to Program Manager and Grants Officer.</td>
<td></td>
</tr>
<tr>
<td>Annual Inventory Report of Federally-Owned Property in Custody of the Recipient (Required for all Grants and Cooperative Agreements, except grants and agreements with commercial organizations.)</td>
<td>FMO, IPO</td>
</tr>
<tr>
<td>Report Due: No later than October 15 of each year. NOTE: Negative reports are not required. (Ref. 1800.907)</td>
<td></td>
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</tbody>
</table>

Final Reports

<table>
<thead>
<tr>
<th>Report</th>
<th>Action Required By:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properly Certified Final Federal Cash Transaction Report, SF 425 (Required for all Grants and Cooperative Agreements)</td>
<td>FMO, GO</td>
</tr>
<tr>
<td>Report Due: Within 90 days after the expiration date of the grant/cooperative agreement. (Ref. 1800.906) Submit to Project Officer and Grants Officer.</td>
<td></td>
</tr>
</tbody>
</table>
Summary of Research (Required for NASA Education AS&ASTAR Training Grants). Report Due: Within 90 days after the expiration date of the grant/cooperative agreement. (Ref. 1800.902) For research related training program grants, the fellows complete the summary of the research report. Submit to Project Officer and Grants Officer.

*Award recipients may also be subject to reporting requirements under the NASA Plan for Increasing Access to Results of Federally Funded Research. Any such requirements will be identified in the Notice of Award.

XI. INTELLECTUAL PROPERTY

A. Data Rights:

Recipients may copyright any work that is subject to copyright and was developed under a NASA award. NASA reserves a royalty-free, nonexclusive and irrevocable right to reproduce, publish, or otherwise use the work for Federal purposes, and to authorize others to do so.

B. Invention Rights:

Recipients are subject to applicable regulations governing patent and inventions, including government-wide regulations issued by the Department of Commerce at 37 Part 401, “rights to Inventions Made by Nonprofits Organizations and Small Business Firms Under Government Awards, Contract, and Cooperative Agreements.

XII. NASA CONTACTS

(Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact)

A. Cognizant Program Officer(s):

- Elizabeth Cartier
  Deputy Program Manager
  NASA Ames Research Center
  Office of Education and Public Outreach
  Mountain View, CA 94035
  650-604-6958
  elizabeth.a.cartier@nasa.gov

B. Proposal Submission Assistance Contact:

- Beata Kozak
  NASA Research and Education Support Services (NRESS),
  2345 Crystal Drive, Suite 500
  Arlington, VA 22202
C. Program Manager – Technical Officer

- Brenda Collins
  Program Manager
  Ames Research Center
  Office of Education and Public Outreach
  Mountain View, CA 94035
  Email: NASA.Fellowships@nasaprs.com

D. NASA Internships, Fellowships, & Scholarships (NIFS)

- Carolyn Knowles
  Director, NIFS
  NASA Headquarters Washington, DC 20546
  Email: NASA.Fellowships@nasaprs.com

E. NASA Shared Service Center (NSSC)

- NSSC Customer Contact Center
  1-877-677-2123 (1-877-NSSC123)
  E-mail: nssc-contactcenter@nasa.gov
XIII. SUMMARY of KEY INFORMATION

<table>
<thead>
<tr>
<th>Total ESTIMATED annual budget for each NASA Education AS&amp;ASTAR</th>
<th>$50K (Masters)/ $55K (Doctoral)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of new awards</td>
<td>Pending adequate proposals of merit and available funding</td>
</tr>
<tr>
<td>Start date of award (estimated)</td>
<td>September 1, 2016</td>
</tr>
<tr>
<td>Duration of awards</td>
<td>Up to 3 years</td>
</tr>
<tr>
<td>Award type</td>
<td>Training Grant</td>
</tr>
</tbody>
</table>
| Due date for proposals | Phase I Applications: June 17, 2016 at 11:59 p.m. E.T. or 12:00 p.m. P.T.  
Phase II Applications: August 19, 2016 at 11:59 p.m. E.T. or 12:00 p.m. P.T. |
| Pre-proposal teleconference | Monday, May 23, 2016 at 3:00 p.m. E.T. or 12:00 p.m. P.T. |
| Public announcement of awards | Estimate six months after solicitation closes |
| Submission medium | Electronic proposal submission is required via NSPIRES; no hard copy will be accepted. See Chapter 3 of the NASA Guidebook for Proposers (available at http://www.hq.nasa.gov/office/procurement/nraguidebook/). |
| Web site for submission of proposal via NSPIRES | http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376 from 8 am to 6 pm Eastern Time, Monday to Friday (except on federal holidays). |
| Selection Officials | Carolyn Knowles,  
Director NIFS  
Education - NASA Headquarters  
Brenda Collins  
Program Manager – Technical Officer  
NASA Ames Research Center |
| Program Management | Brenda Collins  
Program Manager – Technical Officer  
NASA Ames Research Center  
Office of Education and Public Outreach  
NASA Ames Research Center  
brenda.j.collins@nasa.gov  

Elizabeth Cartier  
Deputy Program Manager  
Mountain View, CA 94035  
650-604-6958  
elizabeth.a.cartier@nasa.gov |
Appendix A: Additional Eligibility Information

Described in detail below are the two eligibility requirements for the NASA Education AS&ASTAR Fellowship activity:

- United States (U.S.) citizenship and
- Degree requirements

A. Citizenship:

B. Be a U.S. citizen or naturalized citizen (permanent residents are not eligible) at the time of proposal submission;
   a. The term "national" designates a native resident of a commonwealth or territory of the United States, such as American Samoa, Guam, Puerto Rico, United States Virgin Islands, or the Northern Mariana Islands. It does not refer to a citizen of another country who has applied for U.S. citizenship and who has not received U.S. citizenship by the application deadline.

B. Degree Requirements:

1. Applicants are eligible to apply who:
   a. Have not enrolled in graduate school and will have adequate preparation to attend graduate school in the Fall of 2016;
   b. Have not completed more than 12-months of a graduate program in a supported field of study (see Appendix B).

2. Below are additional guidelines to determine eligibility:
   a. Not currently enrolled in graduate school:
      - No prior graduate school enrollment
      - Undergraduate students typically apply prior to starting a graduate program that is usually in the fall of their senior year or in the fall of the academic year in which they plan to receive a bachelor's degree.
      - At the time of application, undergraduate student applicants are expected to be on a schedule to receive a bachelor's degree in a science or engineering field prior to the Fall of 2016, and to demonstrate adequate preparation to begin graduate study and research by the Fall of 2016.
      - Bachelor degree holders without any graduate study can apply any time after earning their bachelor’s degree.
   b. With prior graduate school enrollment:
      - As a general rule, applicants shall not have completed more than 12-months of full-time graduate study or the equivalent (as defined by the university/universities attended) as of August 1, 2016.
      - All graduate, post-baccalaureate and professional study is counted towards the allowed 12-months of graduate study, including all full-time and part-time master’s and doctoral degree programs, and non-degree graduate-level and professional coursework. The only exception is for graduate coursework required to establish or maintain credentials in a profession such as teaching, and then coursework is not included in the 12-month limit.
- Applicants who have completed more than 12-months of graduate study or who have earned a previous graduate or professional degree are eligible only if they have had an interruption in graduate study of at least two (2) consecutive years prior to November 1, 2016. To be eligible, applicants shall not have completed any additional graduate study by August 1, 2016. Applicants shall address the reasons for their interruption in graduate study in the Personal, Relevant Background, and Future Goals Statement.
- Applicants in joint BS/MS programs are eligible to apply prior to completion of any further graduate study. Joint baccalaureate master's programs are those in which an institution offers students concurrent admission to both an undergraduate and graduate degree program. Pursuing separate undergraduate and master's degrees at the same institution does not constitute a joint baccalaureate master's program. Completion of any graduate study outside of the joint program disqualifies an applicant unless the graduate coursework is required to establish or maintain credentials in a profession such as teaching, and then coursework is not included in the 12-month limit.
- In four-year joint programs, applicants may apply in the fourth year or after completion of the program.
- In five-year joint programs, applicants may apply in the fourth or fifth year of the program or after completion of the program.

c. Currently enrolled in graduate school:
- Part time – Graduate students who are enrolled in a part-time graduate study (or a combination of part-time and full-time graduate study) may apply before completing 24 semester hours or 36-quarter hours or their equivalent.
- Full time – Applicants shall not have completed more than 12 months of full-time graduate, post-baccalaureate graduate, and professional study by August 1, 2016. Pre-graduate participation in summer activities (e.g., bridge programs, field studies, lab rotations) offered by a graduate program prior to the start of the fall graduate program is not included in this total.
  - There is no credit hour limit for students who have completed full-time graduate study. Eligibility for full-time students is based on the length of time enrolled in the graduate program.
  - All graduate, post-baccalaureate and professional study is counted towards the allowed 12-months of graduate study, including all full-time and part-time master’s and doctoral degree programs, and non-degree graduate-level and professional coursework. The one exception is for graduate coursework required to establish or maintain credentials in a profession such as teaching, and then coursework is not included in the 12-month limit.
Appendix B: Eligible Graduate STEM Disciplines Degrees or Fields of Studies

**CHEMISTRY**
- Chemical Catalysis
- Chemical Measurement and Imaging
- Chemical Structure, Dynamics, and Mechanism
- Chemical Synthesis
- Chemical Theory, Models and Computational Methods
- Chemistry of Life Processes
- Environmental Chemical Systems
- Macromolecular, Supramolecular, and Nanochemistry
- Sustainable Chemistry
- Chemistry, other (specify)

**COMPUTER AND INFORMATION SCIENCE AND ENGINEERING (CISE)**
- Algorithms and Theoretical Foundations
- Bioinformatics and other Informatics
- Communication and Information Theory
- Computational Science and Engineering
- Computer Architecture
- Computer Networks
- Computer Security and Privacy
- Computer Systems and Embedded Systems
- Databases
- Data Mining and Information Retrieval
- Formal Methods, Verification, and Programming Languages
- Graphics and Visualization
- Human Computer Interaction
- Machine Learning
- Natural Language Processing
- Robotics and Computer Vision
- Software Engineering
- CISE, other (specify)

**ENGINEERING**
- Aeronautical and Aerospace Bioengineering
- Biomedical
- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical and Electronic Energy
- Environmental Engineering
- Industrial Engineering & Operations Research
- Materials Engineering
- Mechanical Engineering
- Nuclear Engineering
- Ocean Engineering
- Optical Engineering
- Polymer Engineering
- Systems Engineering
- Engineering, other (specify)

**GEOSCIENCES**
- Atmospheric Chemistry
- Aeronomy
- Biogeochemistry
- Biological Oceanography
- Chemical Oceanography
- Climate and Large-Scale Atmospheric Dynamics
- Geo-biology
- Geochemistry
- Geomorphology
- Geodynamics
- Geophysics
- Glaciology
- Hydrology
- Magnetospheric Physics
- Marine Biology

**GEOSCIENCES**
- Marine Geology and Geophysics
- Paleoclimate
- Paleontology and Paleobiology
- Petrology
- Physical and Dynamic Meteorology
- Physical Oceanography
- Planetary Science
- Sedimentary Geology
- Solar Physics
- Tectonics
- Geosciences, other (specify)

**LIFE SCIENCES**
- Biochemistry
- Bioinformatics and Computational Biology
- Biophysics
- Cell Biology
- Developmental Biology
- Ecology
- Environmental Biology
- Evolutionary Biology
- Genetics
- Genomics
- Microbial Biology
- Neurosciences
- Organismal Biology
- Physiology
- Proteomics
- Structural Biology
- Systematics and Biodiversity
- Systems and Molecular Biology
- Life Sciences, other (specify)

**MATERIALS RESEARCH**
- Biomaterials
- Ceramics
- Chemistry of materials
- Electronic materials
- Materials theory
- Metallic materials
- Photonic materials
- Physics of materials
- Polymers
- Materials Research, other (specify)

**MATHEMATICAL SCIENCES**
- Algebra, Number Theory, and Combinatorics
- Analysis
- Applied Mathematics
- Biostatistics
- Computational and Data-enabled Science
- Computational Mathematics
- Computational Statistics
- Geometric Analysis
- Logic or Foundations of Mathematics
- Mathematical Biology
- Probability
- Statistics
- Topology
- Mathematics, other (specify)

**PHYSICS AND ASTRONOMY**
- Astronomy and Astrophysics
- Atomic, Molecular and Optical Physics
- Condensed Matter Physics
- Nuclear
- Particle Physics
- Physics of Living Systems
- Plasma
- Solid State-Theoretical Physics
- Physics, other (specify)

*Note: These fields of study may include some that are not listed.* The following programs and areas of study are not eligible:

- Practice-oriented, professional degree programs (MBA, MSW, MPH, ED, etc.)
- Joint science-professional degree programs (MD/Ph.D., JD/Ph.D., etc.)
- Business administration or management
- Social work
- History (except for history of science)
- Public health programs
- Medical programs
- Dental programs
- Counseling programs
- Research with disease-related goals, including the etiology, diagnosis or treatment of physical or mental disease, abnormality or malfunction
- Clinical areas of study (including patient-oriented research; epidemiological and behavioral studies; outcomes research; health services,
- Research in pharmacologic, non-pharmacologic, and behavioral interventions for disease prevention, prophylaxis, diagnosis, or therapy; and community and other population-based intervention trials
Appendix C: Step-by-Step Instructions for Proposal Submission

Important Notes to Review Prior to Initiating Proposal Submission:
In NSPIRES, errors indicate problems that will preclude proposal submission to NASA. Errors must be corrected in order to submit a proposal. Warnings are meant to be used as guidelines for checking a proposal prior to submission to NASA. They indicate potential discrepancies, based on typical proposal requirements. Submitters are solely responsible for any actions they take in response to warnings.

Please consult the NASA Education AS&ASTAR Fellowship announcement for specific requirements. In particular, the posted opportunity under “Other Documents” of the solicitation describes the research opportunities available for fellowship candidate proposals. One of these opportunities must be selected during the proposal creation process described below. Please ensure that the correct “Option for Proposal Submission” is selected.

STEP BY STEP SUBMISSION INSTRUCTIONS for Phase I Submission:

Step 1
1. START The University shall be registered with NASA NSPIRES through the Electronic Business Point of Contact (EBPOC) listed in the System for Award Management (SAM) database (https://www.sam.gov/portal/SAM/#1). Each registered university will have a designated Authorizing Official Representative (AOR) who will be responsible for submitting the fellowship candidate’s application. (Please see “NOTE” below if you do not have an AOR or cannot locate your AOR)

2. The Faculty Adviser (Principal Investigator - PI) shall be registered with NSPIRES and affiliated with the registered university. (Please see “NOTE” below if you have not been accepted into the University of your Choice yet and thus do not have a PI)

3. The Fellowship candidate must be registered with NSPIRES and activate his/her account.

NOTES:
*Application tip for fellowship candidates not yet accepted into a graduate program and do not have a PI or AOR: If you have not yet been accepted into the university of your choice and thus do not have a PI or AOR associated with the academic institution for your Phase I submission, please select the “NASA OE Fellowship Proposal Submission Office” as your organization. If selected for a Phase II Submission, your application will need to be relinked with the correct institution. More details will be provided at that time.

**Application tip for fellowship candidates who have been accepted into a graduate program who cannot find their AOR: Ask your Faculty Adviser for assistance first. If your Faculty Adviser does not know, you can contact the NSPIRES helpdesk for assistance in locating the contact information for your university’s designated AOR.

Step 2
1. The Faculty Adviser MUST initiate the proposal in NSPIRES for the Fellowship candidate
a. Faculty Adviser logs into NSPIRES

b. Select “Proposals” link

c. Click “Create Proposal” button on right side
   i. Select “Solicitation” and click “Continue”
   ii. Select “AS&ASTAR” and click “Continue”
   iii. Create “Proposal Title” (Note: The title must be entered at this point, and only the Faculty Adviser should edit the proposal title), and click “Continue”
   iv. Link the proposal to the submitting organization, and click “Continue”
   v. The system will display “Submitting Organization Information” for verification. Click “Continue.”
   vi. Click “Save”

d. On “View Proposal” page (the Faculty Adviser is identified as the PI for the proposal.)
   i. Select “Business Data” link in “Proposal Cover Page”
   ii. Click “Edit” to complete information in each field and click “Save”
   iii. Click “OK”
   iv. On “View Proposal” page, select “Proposal Team” link
   v. Click “Add Team Member”
   vi. Enter Fellowship candidate’s name and click “Search” for the Member (Fellowship candidate) – system will display search results.
   v. Select the correct Fellowship candidate, and click “Continue”
   vi. On “Team Member” page, Assign Role/Privileges
   vii. Select “Graduate/Undergraduate Role” from pull down menu.
   viii. Grant Fellowship candidate “Edit” privileges by selecting
   • “Proposal Summary”
   • “Program Specific Data”
   • “Proposal Attachments”
   ix. Select “No” to the two questions that follow the section entitled “U.S. Government Agency & International Participation”
   x. Click “Save”
   xi. Click “OK”
• Faculty Adviser MUST Logout of NSPIRES

Step 3

Fellowship candidate logs into NSPIRES.
At initial log on, the Fellowship candidate must follow these steps:

• Under “Reminders/Notifications,” click “Need Graduate/Undergraduate Fellowship candidate Confirmation for Proposal: [proposal title] for Solicitation AS&ASTAR Fellowships 2016” link

• On “Team Member: Participation Confirmation” page, Fellowship candidate should read and click “Continue”

• On “Team Member Profile” page, click “Link Relationship”

• On “Team Member: Organizational Relationship” page, go to “Link Proposal to a Non-SAM Organization” – enter your institution name, click button, and click “Save”

• On “Team Member Profile” page, verify information and click “Continue,” which will take you to “View Proposal” page. On “View Proposal” page

  i. Select “Proposal Summary” link

     (a) Select “Edit”

     (b) Type or cut and paste the proposal summary into the “Proposal Summary” text box

     (c) Click “Save,” and click “OK”

  ii. Select “Program Specific Data” link (Note: Required for the proposal to be considered.)

     (a) Select “Edit”

     (b) Respond to the 49 questions listed.

     (c) Click “Confirm” at the end of the questions, and click “OK”

  iii. Proposal Attachments

     (a) Click “Add”

     (b) Select “Proposal Document” as “Attachment Type” from the drop-down list

     (c) Browse and select your proposal document

Note: All required proposal elements that are not part of the NSPIRES cover page must be combined into a single .pdf document and uploaded on the NSPIRES site for submission. Document must include:
### Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Statement</td>
<td>2 pages</td>
</tr>
<tr>
<td>Faculty Adviser/PI Curriculum Vitae (CV)</td>
<td>N/A</td>
</tr>
<tr>
<td>Project Description</td>
<td>5 pages</td>
</tr>
<tr>
<td>Degree Program Schedule</td>
<td>1 page</td>
</tr>
<tr>
<td>Biographical Sketch</td>
<td>2 pages</td>
</tr>
<tr>
<td>Transcripts</td>
<td>2 pages</td>
</tr>
<tr>
<td>Letters of Recommendation</td>
<td>N/A</td>
</tr>
<tr>
<td>Letter of Concurrence – NASA Technical Adviser</td>
<td>1 page</td>
</tr>
</tbody>
</table>

(d) Click “Upload” and click “OK”

**NOTE:** “Complete Proposal” section (“Generate” button enables you to review your proposal in draft prior to submission.) However, this option is independent of the submission process. If the proposal fails to generate, you should still proceed with your submission.

iv. Fellowship candidate MUST Log out of NSPIRES

### Step 4

1. Fellowship candidate MUST now coordinate with his or her Faculty Adviser to RELEASE the full proposal to the organization.

   a. The Faculty Adviser logs into NSPIRES

   b. Select “Proposals” link

   c. On “Current Proposals/NOIs” page

      i. Select the “Proposal Title” to be released

      ii. On “View Proposal” page

      iii. Click “Release to Org” button

      iv. Click “Release”

      v. Click “OK” [If the Faculty Adviser has additional Fellowship proposals to release, repeat process]

      vi. If the Faculty Adviser has no additional Fellowship proposals to release, Log out of NSPIRES

2. The Faculty Adviser MUST now coordinate with the Authorized Organizational Representative (AOR), who will SUBMIT the full proposal through NSPIRES. The Faculty Adviser will know that the proposal has been successfully submitted when he/she receives an E-mail from NSPIRES stating that it has been submitted and includes a proposal number
For assistance, you may contact the NSPIRES Help Desk:
Phone: (202) 479-9376 or
E-mail: nspires-help@nasaprs.com

The Help Desk is staffed Monday through Friday (except for federal holidays) from 8:00 AM to 6:00 PM EST.
Appendix D: NASA Education AS&ASTAR Fellowship Opportunities by Center
Updated 05/11/16

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

If you have questions about any of the following opportunities at Armstrong Flight Research Center, please contact Rebecca (Becky) Flick rebecca.m.flick@nasa.gov or 66-276-3949.

AFRC-000  Student Proposed with Concurrence of NASA Technical Mentor
AFRC-001  Development of structures, structural dynamics, and aeroelastic as well as aeroservoelastic sensitivity analyses tool using NASTRAN and ZAERO codes
AFRC-002  Aeroservoelastic Flutter Tool Validation, Development and Control Feedback Studies
AFRC-003  Modeling and Control of Electric, Turbo-electric, and Hybrid Aircraft

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

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

ARC-000  Student Proposed with Concurrence of NASA Technical Mentor
ARC-001  Studying the effects of nutrition and altered metabolism on cardiovascular function in Drosophila
ARC-002  Research in Microbial Ecology and Space Biology
ARC-003  Mission Design Division – SmallSat Development and Design
ARC-004  Thermal Protection Material Modeling and Testing
ARC-005  Astronaut Autonomous Operations: Complex Planning and Scheduling
ARC-006  Tensegrity Robotics Research
ARC-007  Rotorcraft Aeromechanics
ARC-008  Carbon dioxide electrolysis for oxygen production in Mars
ARC-009  Fabrication of Flexible Biosensors
ARC-010  Scientist or Engineer for Printed Sensors or Electronics Development
ARC-011  Laboratory Investigations of Cloud Formation on Earth and Mars
ARC-012  Investigations of the Current and Past Climates of Mars

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

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

GRC-000  Student Proposed with Concurrence of NASA Technical Mentor
GRC-001  Advance power system control for turbo-electric and hybrid electric propulsion
GRC-002  Corrosion of Turbine Engine Materials by CMAS
GRC-003  Characterization of High Temperature CMCs (Ceramic Matrix Composites) for Turbine Engine Hot Section Component Applications
GRC-004  Energy and Thermal Efficiency of Shape Memory Alloy Actuators
GRC-005  Additive Manufacturing of Materials and Structures for Extreme Environments
If you have questions about any of the following opportunities at Goddard Space Flight Center, please contact Mablelene S. Burrell at Mablelene.S.Burrell@nasa.gov or 301-286-1122.

GSFC-000  Student Proposed with Concurrence of NASA Technical Mentor
GSFC-001  Balloon Experimental Twin Telescope for Infrared Interferometry (BETTII): Graduate Fellowships
GSFC-002  NEN and SN Compatible CubeSat Communication System
GSFC-003  Exoplanets and Gravitational Microlensing
GSFC-004  Effect of atmospheric aerosols on UV radiation measured by satellites
GSFC-005  Archival Investigations of X-ray Binary Stars
GSFC-006  X-ray studies of galaxies near and far (2016)
GSFC-007  Radar remote sensing of planetary surfaces
GSFC-008  High Energy Energetic Particles in the Heliosphere
GSFC-009  Instrument Development for energetic particles on Small Satellite platforms
GSFC-010  Integration of Optically Transparent Printed Antennas with Solar Cells for CubeSat and SmallSat Platforms
GSFC-011  Near-Infrared Window for Studies of Cometary Volatil
GSFC-012  Snow and Ice Research using Satellite Data
GSFC-013  Development of the Next Generation X-ray Polarimeter
GSFC-014  Orbital and Physical studies of meteoroids
GSFC-015  Creating an Air Quality Exposure Picture for Major Urban Regions
GSFC-016  Impulsive Heating and Particle Acceleration in Solar and Stellar Coronae
GSFC-017  Instrumentation for Inflationary Cosmology
GSFC-018  Laser instrument
GSFC-019  Integrated photonics
GSFC-020  Research Opportunities for Space-based Gravitational-wave Observatories
GSFC-021  Modeling of illumination conditions on the Moon, Mercury, and Beyond
GSFC-022  Modeling of Cassini Infrared Spectra of Titan - PHD Fellowship
GSFC-023  X-ray Astrophysics using Astro-H
GSFC-024  Exploring the Heating and Dynamics of the Solar Corona
GSFC-025  Novel Diffractive Optics with Applications to Solar Physics
GSFC-026  Synthetic Aperture Radar
GSFC-027  Planet Formation in the Solar Neighborhood
GSFC-028  Auroral Imaging for studying Magnetosphere-Ionosphere Coupling
GSFC-029  Electromagnetic and Optical Analysis of the Carbon Nanotubes Coated Petal-shaped Masks in the Space-based Telescopes
GSFC-030  Solar Wind Properties and Structures
GSFC-031  Trans-Atlantic Dust Transport, Deposition, and Impacts
GSFC-032  Optimization of SmallSat/CubeSat Constellation Concept for Global Earth Surface Sensing Using GEO-LEO Delay-Doppler Mapping
GSFC-033  Analysis of Polar Deposits on Mercury and the Moon
Jet Propulsion Laboratory (JPL)

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

JPL-000  Student Proposed with Concurrence of NASA Technical Mentor

Johnson Space Center (JSC)

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

JSC-000  Student Proposed with Concurrence of NASA Technical Mentor
JSC-001  Human Robotic Interface Research and Design
JSC-002  Human Extra-Vehicular Activities (EVA) Systems Design
JSC-003  Life Support, health monitoring and habitation research and development
JSC-004  Human health and performance research and development

Kennedy Space Center (KSC)

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

KSC-000  Student Proposed with Concurance of NASA Technical Mentor
KSC-001  Molecular modeling for carbon dioxide to fuel 2- dimensional and multi atomic layer photocatalysts
KSC-002  Analytical Chemistry Method Development for Propellant Handlers Ensemble Suit Materials
KSC-003  Augmented/Virtual Reality
KSC-004  Data Mining and Analysis
KSC-005  Robotic Joints

Langley Research Center (LaRC)

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

LARC-000  Student Proposed with Concurrence of NASA Technical Mentor
LARC-001  Synthesis of Novel Meso-scaled Materials
LARC-002  Next-Generation Computational Methods for Scalable Computing
LARC-003  Modeling sonic boom propagation from supersonic aircraft
LARC-004  Protective Coatings for Carbon-Carbon Composites to 4000°F
LARC-005  Optical Emission Spectroscopy In a Plasma Environment
LARC-006  Experiments and modelling of nitric oxide laser-induced fluorescence
LARC-007  Multidisciplinary topology optimization for improved structural and vibroacoustic performance of aerospace systems
LARC-008  Optimized Coherent Doppler Lidar Signal Processor
LARC-009  Pulsed Single-Mode Fiber Optic Amplifiers
LARC-010  Development of Advanced Optical Diagnostics for NASA Ground Test Facilities
LARC-011  Integrated Adaptive Wing Technology Maturation
LARC-012  Energy Absorber For Passive Earth Entry Vehicles
LARC-013  Complex Adaptive Systems Metrics
LARC-014  Next-Generation Computational Methods for Scalable Computing
LARC-015  Probabilistic Analysis of Crash Conditions for a General Aviation Aircraft
LARC-016  Aeronautics Conceptual Design Methods
LARC-017  Multifunctional Boron Nitride Nanotube Composites for Aerospace Applications
LARC-018  Unmanned Vehicle Systems Research
LARC-019  Human Exploration Capabilities
LARC-020  Aerospace Crew State Monitoring Research
LARC-021  Algorithms and Interaction Rules for Self-Separating and Self-Organizing Air Traffic
LARC-022  Human Exploration Spacecraft Research and Conceptual Design of Spacecraft Operating During Long Duration Dormant Periods
LARC-023  Statistical Engineering for Aerospace Applications
LARC-024  Weather Integration in Airborne Trajectory Management
LARC-025  Multi-axial Stochastic Fatigue Analysis Methods
LaRC-026  Intelligent Sensor Systems
LaRC-027  Computational Aeroelasticity and Aeroviscoelasticity
LaRC-028  Optical Emission Spectroscopy In a Plasma Environment

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

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

MSFC-000  Student Proposed with Concurrence of NASA Technical Mentor
MSFC-001  Cloud Detection with Satellite Data
MSFC-002  Modern Control Techniques for Mitigating Launch Vehicle Bending Modes
MSFC-003  Urban Heat Wave Hazard and Risk Mapping
MSFC-004  Development of Conceptual Models of the Friction Stir Welding Process
MSFC-005  Weld Seam Trace Defects in Friction Stir Welds
MSFC-006  High Temperature Thermoelectrics
MSFC-007  Structural Dynamics of Rocket Engine Turbomachinery
MSFC-008  Additive Manufacture In-Situ Process Monitoring (ISPM) Development

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

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

SSC-000  Student Proposed with Concurrence of NASA Technical Mentor
SSC-001  Rocket Propulsion Test Design and Analysis
SSC-002  Enhanced Development of a Balanced Isolation Valve
SSC-003  Innovative Technology Development to Support Ground Testing Associated with Advanced
Appendix E: NASA Education AS&ASTAR Fellowship Opportunities Descriptions

Updated 05/11/16

Opportunity Number: AFRC-000

Host Center: Armstrong Flight Research Center

Opportunity Title: Student Proposed with Concurrence of NASA Technical Mentor

Opportunity Description/Objective (specific student assignment): The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Student, PI and NASA Technical Advisor

Contact Information: NASA Advisor
Opportunity Title: Development of structures, structural dynamics, and aeroelastic as well as aeroservoelastic sensitivity analyses tool using NASTRAN and ZAERO codes

The major objective of this research is to develop and demonstrate the capability for structures, structural dynamics, and aeroelastic and aeroservoelastic simulations, sensitivity analyses, and optimizations for both static, steady-state, and time-dependent problems. The newly developed computer programs under this research should be incorporated to the in-house object-oriented optimization tool (will be provided during development period) for demonstration of new codes. All the structural simulations and sensitivity analyses should be based on NASTRAN code. On the other hand aeroelastic as well as aeroservoelastic simulations and sensitivity analyses should be based on ZAERO code.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Dr. Chan-gi Pak

Contact Information: chan-gi.pak-1@nasa.gov; phone: 661-276-5698; cell: 661-575-7497
Opportunity Number: AFRC-002

Host Center: Armstrong Flight Research Center

Opportunity Title: Aeroservoelastic Flutter Tool Validation, Development and Control Feedback Studies

Opportunity Description/Objective (specific student assignment): The controls branch is studying control of flexible structures and aerostructural modeling. As part of this research effort, an aeroservoelastic (ASE) modeling tool was created which utilizes plate and beam finite elements, vortex lattice method (VLM) and the doublet lattice method (DLM) to generate state space models in MATLAB. Tutorials are included which makes the understanding of these methods easily graspable. While the tool was created to be used as a learning device for the branch it could also become a software platform for verification of experimental studies. Experimental studies could include: cantilever beam and plate tests, ground vibration tests (GVT), wind tunnel flutter or aeroelastic divergence investigations, and aeroservoelastic feedback control tests. While some effort has already been put into verifying the code through previously published experimental data, only one case study could be found and compared against. Further verification of the code could also come through comparison to commercial codes and other imaginative methods. The tool capabilities are limited in that it only models rectangular wings, when most wings are modeled with sweep. Effort could be put into expanding its capabilities. For theoretical work, the tool could be set up for optimal sensor or control placement as well as for any type of control feedback study in the single input single output (SISO) sense or multiple input multiple output (MIMO) sense.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate
Opportunity By

Rebecca (Becky) Flick

Contact Information

rebecca.m.flick@nasa.gov
661-276-3949
Opportunity Number: AFRC-003

Host Center: Armstrong Flight Research Center

Opportunity Title: Modeling and Control of Electric, Turbo-electric, and Hybrid Aircraft

Opportunity Description/Objective (specific student assignment): Proposals are being considered for work pertaining to modeling and control of electric, turbo-electric, and hybrid aircraft, including but not limited to distributed propulsion configurations. Research proposals should be relevant to one or more challenges and opportunities posed by these configurations. Examples include aerodynamic modeling of propulsor interaction, power management, trajectory and trim optimization, maneuvering and distributed control allocation, FMEA, and health management. Work may be done in simulation, but ideally will culminate in an experiment to be conducted on a subscale vehicle, or on the Hybrid-Electric Integrated Systems Testbed currently in development. HEIST is a hardware-in-the-loop testbed including 6-DOF aircraft simulation and functioning power and propulsion components. Emulation of MW-scale systems with kW scale HEIST components is of interest.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication, technical memo, or test plan. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Rebecca (Becky) Flick

Contact Information: rebecca.m.flick@nasa.gov
                      661-276-3949
Opportunity Number: ARC-000

Host Center: Ames Research Center

Opportunity Title: Student Proposed with Concurrence of NASA Technical Mentor

Opportunity Description/Objective (specific student assignment): The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Student, PI and NASA Technical Advisor

Contact Information: NASA Advisor
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<td>Ames Research Center</td>
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<td>Opportunity Title:</td>
<td>Studying the effects of nutrition and altered metabolism on cardiovascular function in Drosophila</td>
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<td>Description/Objective (specific student assignment):</td>
<td>This project will follow up on spaceflight observations that microgravity can affect various physiological systems in living organisms including in Drosophila melanogaster. Specifically, hypergravity treatments will be used to look at the effects of nutrition and altered metabolism on cardiovascular function in this altered gravity environment.</td>
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<td>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</td>
<td>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</td>
</tr>
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<td>Opportunity By</td>
<td>Sharmila Bhattacharya – Lead for Biomodel Performance and Behavior Laboratory</td>
</tr>
<tr>
<td>Contact Information</td>
<td><a href="mailto:sharmila.bhattacharya@nasa.gov">sharmila.bhattacharya@nasa.gov</a>, 650.604.1531</td>
</tr>
</tbody>
</table>
Opportunity Number: ARC-002

Host Center: Ames Research Center

Opportunity Title: Research in Microbial Ecology and Space Biology

Description/Objective (specific student assignment): Our laboratory is studying the ecology of complex microbial ecosystems. We are conducting research on naturally occurring communities of algae and cyanobacteria known as microbial mats. We are interested in these communities for a number of reasons including: 1) they are modern analogs of some of the earliest ecosystems on Earth, 2) they are informing our search for life elsewhere, and 3) they may be useful microbial ecosystems to study the effects of spaceflight on microbes. We are also conducting a number of projects in our laboratory which are directed at utilizing cyanobacteria and microalgae from extreme environments for NASA applications (bioregenerative life support and biological in situ resource utilization) as well as for “Greentech” applications on Earth (e.g., microalgae for biofuels and higher value co-products). We use a variety of experimental techniques in our research including: photophysiological and biogeochemical measurements as well as molecular ecological tools.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Brad Bebout - Research, Chemical & Biological Evolution

Contact Information: brad.m.bebout@nasa.gov, 650.604.3227
Opportunity Number: ARC-003

Host Center: Ames Research Center

Opportunity Title: Mission Design Division – SmallSat Development and Design

Opportunity Description/Objective (specific student assignment): Research proposals are solicited for the development of mission concepts, instruments, on-board processing algorithms, or necessary technology for science missions that utilize multiple (2 or more) small satellites. Such proposals should detail the applicant’s qualifications to conduct the research, how their institution’s capabilities support the proposed work, and should show evidence of interest and support from NASA centers and/or other Government labs. Successful applicants will work closely with Ames’ Mission Design Division throughout the duration of the fellowship, and intensively during periods of residency at the Center; the proposal should include plans for such residency (which may be at any time of the year, and not restricted to the summer.)

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Chad Frost – Mission Design Division Chief

Contact Information: Chad@nasa.gov, 650.604.1798
Research proposals are solicited for the development of mission concepts thermal protection materials branch of the Entry systems division that is one of the core competency area at NASA Ames in providing the solutions for heatshield and entry vehicles for human and science missions. The arc-jet operations to test materials at extreme environments, modeling and testing of thermal protection materials at both component and systems scale are all performed within this division. The Entry systems division is supporting (and has supported in past) multiple NASA projects including Orion, Asteroid Threat Assessment project, HEEET, Mars 2020, Insight Mars, MSL and MEDLI (Mars Science Lab).

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Pursuing Master’s; Pursuing Doctorate

Parul Agrawal, Ph.D. - Sr. Research Scientist, AMA

parul.agrawal-1@nasa.gov;
650.604.3764
Opportunity Number: ARC-005

Host Center: Ames Research Center

Opportunity Title: Astronaut Autonomous Operations: Complex Planning and Scheduling

Description/Objective (specific student assignment):
Future human spaceflight exploration class missions envision a group of astronauts that work more independently from Earth-bound ground controllers. As astronauts fly further away than low-Earth orbit and/or mission durations become longer, intermittent and time-delayed communications between Earth and crew will compel crew autonomy. However, this concept of operations is a significant shift from current human spaceflight operations. Our research will focus on enabling crew autonomy for future human spaceflight operations. While a variety of research topics are possible in this area, our emphasis will be supporting crew autonomy at the planning and scheduling level. For almost ten years, the NASA Ames Human Computer Interaction (HCI) Group has developed and deployed planning and scheduling software tools for space operations, supporting both human and robotic missions, with and without time-delay. Our experience indicates that planning and scheduling is an integral component of space operations because it serves as the integration point of all operations. From that perspective, if crew is to have autonomy for exploration-class missions, NASA needs to find a way of providing crew the ability to easily incorporate their in-situ information their schedule without burdening them with the complexity of planning that currently requires dozens of ground controllers. Working with the HCI Group will allow our research to be conducted using the state-of-the-art planning and scheduling tools used in current space operations. These tools have supported missions that include Mars landers and rovers, Lunar orbiting satellites, and the International Space Station program. We will use SPIFe (Scheduling and Planning Interface For exploration) and Playbook in order to investigate how we can enable crew to perform planning and scheduling tasks, and the factors affect that performance, such as plan complexity, constraint complexity, and violation resolution. Our goal is not to have a schedule automatically planned for crew, but to investigate how crew can manipulate their schedule to achieve a plan that satisfies mission constraints. This work
will contribute to the Human Research Program, as part of Space Human Factors and Habitability. It also will contribute to the Advanced Exploration Systems program as they focus on developing and validating operational concepts for future human missions beyond Earth orbit, which includes autonomous mission operations.

**Expected opportunity outcome**
(i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

**Desired Student Academic Level**

**Opportunity By**

Jessica Marquez - AST, Computer Research and Development

**Contact Information**

jessica.j.marquez@nasa.gov,
650.604.6364
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<td>Ames Research Center</td>
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<tr>
<td><strong>Opportunity Title:</strong></td>
<td>Tensegrity Robotics Research</td>
</tr>
<tr>
<td><strong>Opportunity Description/Objective (specific student assignment):</strong></td>
<td>We are exploring how tensegrity (continuous tension network) robots can be used for NASA missions while also drawing inspiration from biological examples of tensegrity structures in cells and animal physiology. This opportunity is for students who will research the design, construction, and control of dynamic tensegrity robots. Depending on the skills of the student, project work may include physical design and construction of prototype robots, simulated design work in a physics simulation environment, or designing and evaluation control approaches for the robots. To learn more about our research, please visit: <a href="http://www.magicalrobot.org/">http://www.magicalrobot.org/</a> Review our publications at: <a href="http://www.magicalrobot.org/BeingHuman/vytas-sunspirals-publications">http://www.magicalrobot.org/BeingHuman/vytas-sunspirals-publications</a>.</td>
</tr>
<tr>
<td><strong>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</strong></td>
<td>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</td>
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<td><strong>Opportunity By</strong></td>
<td>Vytas Sunspiral - Dynamic Tensegrity Robotics Lab</td>
</tr>
<tr>
<td><strong>Contact Information</strong></td>
<td><a href="mailto:vytas.sunspiral@nasa.gov">vytas.sunspiral@nasa.gov</a>; 650-604-4363</td>
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</table>
Opportunity Number: ARC-007

Host Center: Ames Research Center

Opportunity Title: Rotorcraft Aeromechanics

The Aeromechanics Office is responsible for aeromechanics research activities that directly support the civil competitiveness of the U.S. helicopter industry and the Department of Defense. 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 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.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: William Warmbrodt - Aeromechanics Branch of the Flight Vehicle Research and Technology Division

Contact Information: william.warmbrodt@nasa.gov, 650.604.5642
Opportunity Number: ARC-008

Host Center: Ames Research Center

Opportunity Title: Carbon dioxide electrolysis for oxygen production in Mars

Description/Objective (specific student assignment):

For space exploration, oxygen is essential for spaceship propulsion and life support. In particular for missions to Mars, electrolysis of CO2 was suggested as one of the most promising approaches since Martian atmosphere is predominantly comprised of CO2. This fellowship opportunity will support technologies to enable lightweight, efficient and durable solid oxide-based CO2 electrolyzer for oxygen generation.

Critical to this innovation is fine nano-material engineering of electrolytic cells realized through innovative combination of fabrication and functionalization technology. Activities during this project may involve new material design/engineering, device fabrication using state-of-the-art deposition techniques, nanoscale material characterization, electrochemical analysis and reliability tests.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Jin-Woo Han - Center for Nanotechnology - Center for Nanotechnology

Contact Information: jin-woo.han@nasa.gov;
650.604.3985
Opportunity Number: ARC-009

Host Center: Ames Research Center

Opportunity Title: Fabrication of Flexible Biosensors

Opportunity Description/Objective (specific student assignment):

The biggest challenge in long duration missions, say for example to Mars, lies in sustaining humans for a long time in space probably few years. The changes that take place in human physiological conditions in space are not yet well understood. Efforts to increase knowledge in this area are currently underway. Wearable monitoring devices can play a crucial role in monitoring changes in astronaut physiology. At NASA Ames Research Center, we have developed an atmospheric pressure plasma based advanced technology for printing a range of materials including conductive, dielectric and sensor materials on flexible substrates. Materials that perform multiple functions, including detection, signal transduction, and signal amplification are required for biosensing.

Patterning of sensor materials and functionalization of surfaces using localised plasma processing, by eliminating the wet chemistry methods, will be the focus of this study. The materials printing using atmospheric plasma jet will be characterized using a range of techniques. To study the surface morphology and the film uniformity electron microscopic techniques and atomic force microscopy will be used. In order to assess the functionalization fourier transform infrared spectroscopy will be used. Electro chemical impedance spectroscopic study will be employed to assess the biosensing characteristics of the plasma jet fabricated flexible sensors.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Ramprasad Gandhiraman
Contact Information

ramprasad.gandhiraman@nasa.gov;
650.604.4702
Scientist or Engineer for Printed Sensors or Electronics Development

As NASA prepares for long-duration manned space missions, there is a necessity for in-space manufacturing technologies that can support mission activities and allow crew members to make necessary repairs. One such manufacturing technology of interest is printed sensors and electronics. At NASA ARC, we are exploring a variety of printing technologies including, but limited to, roll to roll processing, ink jet printing, 3D printing, plasma printing and microcontact printing. The devices may include the use of nanomaterials to increase sensitivity and specificity. Device structures can be, but are not limited to biosensors, stress-strain sensors, humidity sensors, and radiation sensors.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Opportunity Number: ARC-011

Host Center: Ames Research Center

Opportunity Title: Laboratory Investigations of Cloud Formation on Earth and Mars

Description/Objective (specific student assignment): Our group examines the interactions between gases and solid substrates representative of atmospheric aerosol and cloud particles on Earth, Mars, or other bodies with atmospheric pressures between $1 \times 10^{-6}$ and $1000$ hPa ($1 \times 10^{-9}$ – 1 bar). Researchers use a vacuum chamber that can contain low pressure and low temperature conditions ($155 – 298$ K) in order to simulate the atmospheres of Earth and Mars. Cloud formation can occur on a variety of substrates, including various dusts, salts, or organic materials. The laboratory includes an FTIR (infrared) spectrometer and various data collection instruments and computer tools. Possible studies could include cloud nucleation and growth experiments with a variety of substrates, as well as different gas components.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Laura Iraci

Contact Information: Laura.T.Iraci@nasa.gov; 650.604.0129
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<td><strong>Host Center</strong></td>
<td>Ames Research Center</td>
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<tr>
<td><strong>Opportunity Title:</strong></td>
<td>Investigations of the Current and Past Climates of Mars</td>
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<tr>
<td><strong>Opportunity Description/Objective (specific student assignment):</strong></td>
<td>Climate models for Mars are used in conjunction with a variety of observational data sets to address critical questions regarding the atmosphere and its climate. Specific research areas include: investigating the dust, water and carbon dioxide cycles, their mutual interactions, and how they influence the current climate system; characterizing how the climate has changed in the recent past due to Mars’ orbital variations; and understanding the nature of the early Mars climate. Such research topics are consistent with NASA’s exploration goals and objectives in planetary science because they seek to further our understanding of the content, origin, and evolution of the Solar System.</td>
</tr>
<tr>
<td><strong>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</strong></td>
<td>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</td>
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<td><strong>Desired Student Academic Level</strong></td>
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<td><strong>Opportunity By</strong></td>
<td>Melinda Kahre</td>
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<tr>
<td><strong>Contact Information</strong></td>
<td>650-604-3863 <a href="mailto:melinda.a.kahre@nasa.gov">melinda.a.kahre@nasa.gov</a></td>
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</table>
Opportunity Number: GRC-000

Host Center: Glenn Research Center

Opportunity Title: Student Proposed with Concurrence of NASA Technical Mentor

Opportunity Description/Objective (specific student assignment): The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Student, PI and NASA Technical Advisor

Contact Information: NASA Advisor
Opportunity Number: GRC-001

Host Center: Glenn Research Center

Opportunity Title: Advance power system control for turbo-electric and hybrid electric propulsion

Description/Objective (specific student assignment): Turbo-electric and hybrid electric propulsion systems have the potential to enable distributed propulsion for advanced air vehicles with significant improvements in fuel efficiency, noise reduction, and emissions. The use of advanced electric technologies to enable distributed propulsion include superconducting and high specific power electric machines, cryogenic power electronics, dc and high frequency ac power distribution, high specific energy storage, and advanced protection and power system control methods. Electric propulsion systems dominated by electric machines used for power generation, and electric motors driving ducted fans or propellers to produce thrust is very unique. Based on terrestrial power system experience with distributed wind turbine generators causing instabilities in the power system, even with low levels of wind generation, the distributed electric propulsion system will be significantly more challenging. To provide stable and robust electric power system operation for the distributed electric propulsion will require new control methods that provide an integrated and dynamic control involving the turbine engine driven generator, power distribution and protection system, electric propulsor motor and propeller/ducted fan pitch control, and vehicle flight control. New and novel control involving dynamic and adaptive methods for the electric power system control are being sought in this announcement.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Raymond F. Beach
Contact Information  
raymond.f.beach@nasa.gov; 216-433-5320
Opportunity Number: GRC-002

Host Center: Glenn Research Center

Opportunity Title: Corrosion of Turbine Engine Materials by CMAS

Opportunity Description/Objective (specific student assignment):

Fuel economy of gas turbine engines can be significantly increased by raising the inlet temperature of the gas or reduction of cooling requirements of components. However, in addition to the expected difficulties that come with raising the operating temperature, particulate ingestion in the form of sand or volcanic ash pose a much more significant threat to engine material durability. At temperatures above 2200F, these particulates transform into molten glassy deposits of calcium-magnesium-aluminosilicate (CMAS) that reacts with the coating materials and can damage components via thermomechanical or thermochemical attack, which accelerates material degradation and results in rapid failure. The objective of this project is to examine the properties of prospective CMAS glasses and their reaction products with potential thermal/environmental barrier materials and coatings at high temperatures. New coating chemistries and architectures could be designed and implemented to meet the CMAS mitigation requirements of next generation turbine engines. This investigation could be accomplished via experimentation, simulation, or a combination of the two.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Bryan Harder

Contact Information: bryan.harder@nasa.gov  216.433.8607
Characterization of High Temperature CMCs (Ceramic Matrix Composites) for Turbine Engine Hot Section Component Applications

SiC/SiC (silicon carbide fiber reinforced silicon carbide) ceramic matrix composites (CMCs) are candidate materials for various turbine engine hot section component applications because of their high specific strength and good creep and oxidation resistance at temperatures >2000°F. Understanding the environmental degradation of SiC/SiC CMCs subjected to typical operation stresses and temperatures is critical to being able to predict the long term durability of the composite material. The project will involve characterizing and understanding 1) the oxidation of composite constituents, and 2) cracking of the composite as a function of stress in order to generate data to support NASA GRC modeling of SiC/SiC environmental degradation. Specifically, we will conduct mechanical property testing and microstructural characterization to investigate how cracks form in CMCs and how material degradation occurs during stressed oxidation of test samples.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Energy and Thermal Efficiency of Shape Memory Alloy Actuators

The unique ability of shape memory alloys (SMAs) to remember and recover their original shape after large deformation offers vast potential for their integration in advanced engineering applications. One such example is compact, lightweight, high-force, solid-state actuators that enable improved air vehicle designs and adaptive structures that can reconfigure shape, form and/or properties according to need. However, before they can integrated into flight structures, the methods in which they are used to convert the thermal energy into mechanical work must quantified. Thus, the project will involve investigation of mechanical, thermal and energy efficiency of conventional and novel SMAs. Several project goals are sought including (i) formulating a schema for the determination of work per volume and efficiency (e.g., Carnot cycle) provided thermomechanical data of select SMA compositions, (ii) determining the mechanical work efficiency compared to conventional motors (electric, hydraulic, pneumatic) as a function of load capacity (e.g., normalized energy density), and (iii) determining the thermal energy required to transform an actuator and hold it in position throughout a simulated mission (e.g., flight conditions, deployment...). This fellowship opportunity entails both hands-on experience and theoretical work focused on thermodynamics and heat transfer.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Pursuing Master’s; Pursuing Doctorate

Dr. Othmane Benafan
othmane.benafan@nasa.gov; 216.433.5427
Opportunity Title: Additive Manufacturing of Materials and Structures for Extreme Environments

Description/Objective (specific student assignment): In order to improve fuel economy in commercial aircraft, ceramic matrix composites (CMCs) are widely considered a leading material system to replace metal-based turbine engine components, due to the lower density and high-temperature capabilities of CMCs compared with other conventional structural materials. However, the current inability to manufacture complex-shaped CMCs in an economical, high-throughput manner remains a barrier to their full implementation in aviation applications and beyond. Additive manufacturing, or 3D printing, has the potential to rapidly produce near-net shape components of a variety of material systems, including ceramics, yielding parts with complex geometries. The aim of this project is to develop an additive manufacturing process to more quickly and efficiently produce complex-shaped CMCs with material properties comparable to parts prepared by other more traditional CMC processing methods.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Dr. Valerie Wiesner

Contact Information: valerie.l.wiesner@nasa.gov
216.433.5427
Aircraft icing research at NASA is supported under Aeronautics Research Mission Directorate (ARMD) programs. Airframe icing is a key challenge whose aim is to develop improved computational and experimental simulation tools for swept wings operating in atmospheric icing including freezing drizzle and freezing rain. The objective of this research is to develop a fundamental understanding of how highly three-dimensional, scallop-shaped ice accretions affect the aerodynamics of a modern, realistic swept wing near stall. Experimental and computational studies are needed to investigate the details of the three-dimensional flowfield.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Opportunity Number: GRC-007

Host Center: Glenn Research Center

Opportunity Title: Impact/Dynamic Test Methods for Advanced Composite Aerospace Components

Description/Objective (specific student assignment): Development of test methods to support analysis of the impact and transient dynamic behavior of aerospace components composed of polymer matrix composite materials with complex material architectures, structural geometries and loading conditions is a research area of interest. Specific application areas of interest include jet engine containment structures subject to blade-out conditions, fan blades subjected to bird strikes, and rotating drive system components such as shafts, couplings, and gears. Research problems of interest include development of test methods to measure the behavior of composite structures and subcomponents under dynamic and ballistic impact loading conditions and developing techniques for measuring quantitative response variables that will be used as input to, or as validation for, improved analysis methods for the dynamic behavior of composite structures. The techniques are expected to provide data to quantify the effects of the composite material constituents and fiber architecture as well as local material defects and irregularities such as fiber angle changes and design discontinuities such as ply drops, and interfaces between the composite and non-composite components of the structure. The research is expected to utilize available experimental facilities at the NASA Glenn Research Center and will involve some use of commercially available transient dynamic finite element codes.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: J. Michael Pereira
Contact Information
mike.pereira@nasa.gov;
216-433-6738
Opportunity Number: GRC-008

Host Center: Glenn Research Center

Opportunity Title: High voltage insulation materials and structures for electric propulsion

Opportunity Description/Objective (specific student assignment): Emerging electric and hybrid-electric propulsion concepts for flight vehicles have the potential to offer game changing payoffs in terms of efficiency and environmental compatibility. Critical to the realization of these concepts is the ability to transfer, contain, and control high voltage current with minimum system weight. The project will involve design, analysis, and testing of materials and system concepts for insulation and control of high voltage AC. Specifically, extensive FEM and analytical modeling efforts will be made for the material down-selections involving high thermal conductivity, dielectric strength, or self-healing, and structural/electrical system optimizations.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Brett Bednarcyk

Contact Information: Brett.A.Bednarcyk@nasa.gov; 216-433-2012
**Opportunity Number**  
GSFC-000

**Host Center**  
Goddard Space Flight Center

**Opportunity Title:**  
Student Proposed with Concurrence of NASA Technical Mentor

**Opportunity Description/Objective (specific student assignment):**  
The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.

**Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):**  
The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

**Desired Student Academic Level**  
Pursuing Master’s; Pursuing Doctorate

**Opportunity By**  
Student, PI and NASA Technical Advisor

**Contact Information**  
NASA Advisor
Opportunity Number: GSFC-001

Host Center: Goddard Space Flight Center

Opportunity Title: Balloon Experimental Twin Telescope for Infrared Interferometry (BETTI): Graduate Fellowships

Opportunity Type: Fellowship

Description/Objective (specific student assignment): We are developing a new experiment for flight on a high-altitude balloon, the Balloon Experimental Twin Telescope for Infrared Interferometry (BETTI). BETTI will be an 8-meter long system with two telescopes, designed to provide high angular resolution measurements in the far-infrared. Graduate students with an interest in astronomical instrumentation, including interferometry, far-infrared instrumentation, or detectors are particularly encouraged, but we welcome applications from all candidates. Ultimately, a successful candidate will have the opportunity to work on an innovative new experiment that will provide unique new scientific data, and will gain a broad understanding on the development of missions and the system-level problems that must be solved to make these missions successful.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): Successful candidate will have the opportunity to carry out original work related to BETTI, far-infrared instrumentation, and/or far-infrared astronomy. We anticipate that this work would lead to a doctoral dissertation.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: STEPHEN RINEHART or Jonathan Gardner

Contact Information: jonathan.p.gardner@nasa.gov; 301.286.3938
Opportunity Number: GSFC-002

Host Center: Goddard Space Flight Center

Opportunity Title: NEN and SN Compatible CubeSat Communication System

Opportunity Description/Objective (specific student assignment): Cube/Small Sat antenna design and simulation work for CubeSats. This will require small, compact, low cost, efficient, reliable, and robust communication system designs with stable electrical and radiation characteristics in harsh space environments to compensate for typical limitations such as power and physical size/shape. These antennas will be designed at S-, X- and Ka-band. The project will offer invaluable experience and insight working on CubeSatellite communication system design including transceivers, antenna performance characterization, cube satellite dynamic/static link budget calculations and deep knowledge on current NASA Communication Networks. The student will work on design and simulate single cubesats and constellations.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: SERHAT ALTUNC

Contact Information: serhat.altunc@nasa.gov; 301.286.2933
Opportunity Number: GSFC-003

Host Center: Goddard Space Flight Center

Opportunity Title: Exoplanets and Gravitational Microlensing

Description/Objective (specific student assignment):
The Wide Field Infrared Survey Telescope (WFIRST) is the highest ranked recommendation for a large space mission in the recent New Worlds, New Horizons in Astronomy and Astrophysics, 2010 Decadal Survey. The most pressing scientific questions in astrophysics today - probing the nature of dark energy, cataloguing the variety of exoplanet systems, and mapping the distribution of matter across cosmic time - require a very wide-field survey in order to be answered. The phenomenon of gravitational microlensing will be exploited by the WFIRST mission to detect new worlds - from Solar System analogs down to the size and orbit of Mars to free-floating, unbound planets. Together with Kepler, WFIRST will complete a census of all of the types of exoplanets in the Milky Way Galaxy. The research described below will directly aid in the reduction of scientific risk for the WFIRST mission and will increase familiarity and human potential for NASA and the scientific community. These activities are called out specifically in the ExoPAG Science Analysis Group 11 report in their recommendation to NASA for improved or new capabilities. The prospective Fellow will conduct research leading to a doctoral thesis in the development of new computational methods for modeling gravitational microlensing events. Examples of the work to be proposed by the prospective Fellow could address an approach to the following: Modeling of lenses with two or more masses Incorporation of WFIRST observatory systematics Galactic bulge dust obscuration Finite source effects Incorporation of microlensing parallax using observations from other observatories Source binarity in the Galactic bulge High speed processing using, for example, parallelized codes or scalable supercomputer nodes Modeling of free-floating planets Testing of data analysis approaches for the WFIRST microlensing survey.

Expected opportunity outcome (i.e. research, final report, journal publication): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be
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<th>Desired Student Academic Level</th>
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<tr>
<td>Opportunity By</td>
<td>RICHARD BARRY</td>
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<tr>
<td>Contact Information</td>
<td><a href="mailto:richard.k.barry@nasa.gov">richard.k.barry@nasa.gov</a>; 301.286.0664</td>
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</table>
Effect of atmospheric aerosols on UV radiation measured by satellites

Study how atmospheric aerosols, particularly UV-absorbing aerosols, such as smoke, desert dust, and volcanic ash affect satellite-measured radiation in the 300-500 nm wavelength range.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Pursuing Master's; Pursuing Doctorate

PAWAN BHARTIA

pawan.k.bhartia@nasa.gov; 301.614.5731
Opportunity Number: GSFC-005

Host Center: Goddard Space Flight Center

Opportunity Title: Archival Investigations of X-ray Binary Stars

Opportunity Description/Objective (specific student assignment):
An X-ray binary star system is composed of a compact stellar remnant (a neutron star or black hole) accreting material from a stellar companion. X-ray binaries vary on timescales from milliseconds to decades. The rapid X-ray variability due to the accretion of material onto the compact object has been comparatively well-studied, but pronounced variability is often also observed on timescales of tens to hundreds of days, much longer than the binary orbital periods. The physical drivers for this superorbital, not strictly periodic, variability are not well understood, and the connections between the short-term variability and these long-term variations remain under-studied. There now exists an impressive collection of data from NASA’s suite of archival and operating missions that can be used to investigate variability at X-ray, gammaray, UV and optical wavelengths, on timescales of days to decades. For example, archival light curves from the RXTE All-Sky Monitor (1995-2012) can be combined with the data from ongoing monitoring by MAXI and the Swift BAT to provide almost continuous, nearly evenly sampled light curves over twenty years, much longer than the long-term variations. High quality data from numerous pointed observations of these sources by RXTE, Chandra, XMM, Suzaku, and Swift allow us to probe this variability in finer detail. These rich datasets can be mined and combined to characterize the long-term spectral and timing variability, and the results compared with dynamical and geometric models. With the quantity and quality of data now in hand we can apply a consistent analysis to the many systems that show high amplitude long-term variability, and search for similarities and differences in their spectral and timing evolution that could illuminate the underlying physical mechanisms governing accretion disk dynamics.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):
The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference
Desired Student Academic Level | Pursuing Master's; Pursuing Doctorate
---|---
Opportunity By | PATRICIA BOYD
Contact Information | patricia.t.boyd@nasa.gov;
| 301.286.2550

will also be encouraged depending on the outcome of the research effort.
Opportunity Number: GSFC-006

Host Center: Goddard Space Flight Center

Opportunity Title: X-ray studies of galaxies near and far (2016)

Description/Objective (specific student assignment): This opportunity covers studies of X-ray emission from starforming galaxies. This X-ray emission, which is studied via analysis of X-ray datasets from NASA and other space-based instruments, including emission from neutron star and black hole populations and the hot interstellar medium. We will study the connection between the X-ray properties of these various components of galaxies and galaxy parameters such as stellar mass, metallicity, and overall star formation rate. The work involves datasets from missions and instruments developed at or in collaboration with the NASA GSFC X-ray astrophysics laboratory, including microcalorimeters, X-ray optics and other technology.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: ANN CARDIFF

Contact Information: ann.h.cardiff@nasa.gov; 301.286.7632
Opportunity Number: GSFC-007

Host Center: Goddard Space Flight Center

Opportunity Title: Radar remote sensing of planetary surfaces

Description/Objective (specific student assignment): Radar remote sensing provides unique information about the stratigraphy and surface properties of planetary surfaces. For this project, the student will work with Dr. Lynn Carter and others in the Planetary Geodynamics Laboratory on a project utilizing remote sensing data (particularly radar) that are related to the student’s chosen thesis topic. Current research topics span a wide range of planetary surface processes including volcanism, impact cratering, regolith development, and comparative climatology. Graduate student research projects could include, for example, analysis of lunar radar data to study volcanoes or regolith properties, studies of the Martian surface and stratigraphy using sounding radar, radar imaging to determine asteroid surface properties, studies of Venus volcanology or cratering, ground-penetrating radar fieldwork, or development of new radar techniques. These projects would generally involve cross-comparison of radar remote sensing data with other data sets. Common sources of comparison include infrared data, optical imaging, topographic data, earth imaging radar, and terrestrial analog fieldwork. The Planetary Geodynamics Lab is particularly strong in the area of volcanology, so proposals to work on some aspect of planetary volcanism are especially encouraged because there would be opportunities to collaborate with multiple Goddard scientists. The Lunar Reconnaissance Orbiter is also managed at Goddard, and so there is a strong lunar science program with access to multiple types of data in addition to radar. This project description is intentionally fairly broad to allow students to select a research area that is most closely aligned with their interests and chosen thesis, and it is expected that the student proposal will identify the preferred topic (e.g. Moon, Venus, comparative volcanology, instrumentation) and discuss the relevance of a radar remote sensing project to their thesis (e.g. to determine surface roughness, investigate stratigraphy, model surface properties, detect differences in volcanic eruption styles, compare multiple wavelengths of remote sensing data). Focused projects are...
desirable; for example, a study of small number of asteroids, or a focus on volcanoes or craters in a specific size range, or having a subset of properties of interest to the student. Detailed project goals and timeline will be developed between the student, Dr. Carter, and the thesis advisor when a fellowship is awarded.

**Expected opportunity outcome**
(i.e. research, final report, poster presentation, etc.):
The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort. For the chosen project, students would be responsible for processing and analysis of relevant radar data, and it is likely (depending on funds) that results could be presented at a major conference.

**Desired Student Academic Level**
Pursuing Master’s; Pursuing Doctorate

**Opportunity By**
LYNN CARTER

**Contact Information**
lynn.m.carter@nasa.gov;
301.614.6025
Opportunity Number: GSFC-008

Host Center: Goddard Space Flight Center

Opportunity Title: High Energy Energetic Particles in the Heliosphere

Description/Objective (specific student assignment): Student will work on the calibration and testing of the Energetic Particle Instrument - High Energy (EPI-Hi) for the Solar Probe Plus mission which will launch in 2018. This will lead to data analysis and science research after launch. EPIHi measures electrons and ions from the Sun at energies between about 1 and 100 MeV. The Solar Probe Plus mission will approach within 4 million miles of the surface of Sun, far closer than any other mission.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: ERIC CHRISTIAN

Contact Information: eric.r.christian@nasa.gov; 301.286.2919
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<tr>
<td><strong>Opportunity Title:</strong></td>
<td>Instrument Development for energetic particles on Small Satellite platforms</td>
</tr>
<tr>
<td><strong>Description/Objective (specific student assignment):</strong></td>
<td>Develop, calibrate, and test instrumentation for energetic particle and neutron/gamma-ray spectrometers appropriate for small satellite platforms. The student will help to design the overall instrument, readout, front-end electronics where applicable, test the instrument at an accelerator and interpret the results. The instrument development and accelerator results will result in scientific publications. The instrument is being proposed for several CubeSat opportunities.</td>
</tr>
<tr>
<td><strong>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</strong></td>
<td>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</td>
</tr>
<tr>
<td><strong>Desired Student Academic Level</strong></td>
<td>Pursuing Master's; Pursuing Doctorate</td>
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<tr>
<td><strong>Opportunity By</strong></td>
<td>GEORGIA DE NOLFO</td>
</tr>
<tr>
<td><strong>Contact Information</strong></td>
<td><a href="mailto:georgia.a.denolfo@nasa.gov">georgia.a.denolfo@nasa.gov</a>; 301.286.1512</td>
</tr>
</tbody>
</table>
Opportunity Number: GSFC-010

Host Center: Goddard Space Flight Center

Opportunity Title: Integration of Optically Transparent Printed Antennas with Solar Cells for CubeSat and SmallSat Platforms

Description/Objective (specific student assignment): The emphasis of this research topic is to design and develop printed antenna technology that will allow integration of efficient optically transparent wide band printed antennas on bodyly mounted solar panels currently used on NASA's CubeSats and SmallSats. Special emphasis will be on (1) optimal selection of material for printed antenna offering low RF loss and highly optically transparent medium, (2) Optimum design of antenna mesh structure that will minimize the antenna surface area without degrading its RF performance, and (3) fabrication and testing of final optimum design for experimental validation. The topic described above has very strong relevance to NASA's future CubeSat and SmallSat programs. The proposed technology can substantially reduce the volume, weight and cost of satellites and allow the design of more complex antenna systems, such as arrays and lead to a more RF functionality for future CubeSats. In this research student will design printed antennas (placed on the surface of solar cells) at L-band (GPS frequencies) using various optically transparent materials including graphine. In order to minimize optical energy blockage (by the antenna structure), the antenna structure need to be optimal mesh. In this work student need to be optimizing this mesh configuration to increase RF radiation and minimize the optical energy blockage. After the optimum design student need to fabricate such antenna and validate its performance experimentally.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate
Opportunity By MANOHAR DESHPANDE

Contact Information manohar.d.deshpande@nasa.gov;
301.286.2435
Opportunity Number: GSFC-011

Host Center: Goddard Space Flight Center

Opportunity Title: Near-Infrared Window for Studies of Cometary Volatil

Description/Objective (specific student assignment): State-of-the-art high resolution spectroscopy will be used to establish the composition of ices in cometary nuclei. This will permit placing comets in the context of solar system formation and early evolution.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: MICHAEL DISANTI

Contact Information: michael.a.disanti@nasa.gov; 301.286.7036
Opportunity Number: GSFC-012

Host Center: Goddard Space Flight Center

Opportunity Title: Snow and Ice Research using Satellite Data

Description/Objective (specific student assignment): This opportunity is directed toward post-doctoral students who have completed a Ph.D. degree in a field of study relating to the cryosphere and who wish to employ multiple NASA and perhaps non-NASA satellite data to enhance their studies of snow- or land ice-related topics. In particular we seek researchers who intend to make use of data sets that span multiple decades to study changing features on the Earth's surface. Interdisciplinary studies, with a focus on the cryosphere, are encouraged. The post-doc will work closely with NASA researchers.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: DOROTHY HALL

Contact Information: dorothy.k.hall@nasa.gov; 301.614.5771
Opportunity Number: GSFC-013

Host Center: Goddard Space Flight Center

Opportunity Title: Development of the Next Generation X-ray Polarimeter

Opportunity Description/Objective (specific student assignment): The student will assist with the development of a polarimeter 10 times more sensitive than currently available and able to study the behaviour of black holes. We have modelled a design and need a student to help implement and test the new design. The student will use laboratory based X-ray generators to test the performance and to characterise the sensitivity. Interest in laboratory work is a must. Experience with vacuum systems is a plus but not required.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: JOANNE HILL-KITTLE

Contact Information: joanne.e.hill@nasa.gov; 301.286.0572
Opportunity Number: GSFC-014

Host Center: Goddard Space Flight Center

Opportunity Title: Orbital and Physical studies of meteoroids

Description/Objective (specific student assignment): The space weather laboratory at GSFC/NASA is interested in expanding existing expertise in meteor science related to both solar system and atmospheric studies. Opportunities exist to participate in both theoretical and observational studies of meteors using ground-based and satellite measurements. Research includes, but is not limited to, to resolve major outstanding problems related to the impact of the meteoric flux in the upper atmosphere, with primary emphasis on ablation processes, seasonal an geographical variability and their role on the aeronomy of the Mesosphere and Lower Thermosphere (MLT) atmospheric region. Specific applications include: (1) The sources and variations (temporal and geographical) of the meteoric flux, and its role in the chemical composition of the MLT; (2) The origin and global distribution of the metallic layers, dynamical transport of metals, and modelling the subsequent formation of meteoric smoke and its seasonal distribution in the MLT; (3) Orbital dust distribution and populations in the solar system; (4) The mechanisms by which metallic atoms are ablated from the meteoroid body and deposited in the MLT; and (5) Physical and Electronic risk assessment to satellites due to meteoroid impacts.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: DIEGO JANCHES
diego.janches@nasa.gov; 301.286.0597

Contact Information:
Opportunity Number: GSFC-015

Host Center: Goddard Space Flight Center

Opportunity Title: Creating an Air Quality Exposure Picture for Major Urban Regions

Description/Objective (specific student assignment): Airborne particles concentrated in and downwind of urban environments can have both acute and chronic impacts on human health. Surface sampling around many cities provides the most detailed information about particle properties, but only at a very limited number of ground sites, and rarely in the downwind direction. Regional air-quality modeling is commonly used to create a regional picture, but unconstrained assumptions and model biases raise uncertainties about the results. Satellite data, especially multiangle, multi-spectral observations from instruments such as the NASA Earth Observing System's Multi-angle Imaging SpectroRadiometer (MISR) can help fill the gap in assessing regional air quality, offering frequent total column aerosol amount (AOD) as well as column-effective aerosol type mapping from space. Aerosol vertical distribution can be constrained by a combination of modeling results and where available, space-based lidar, e.g., from the CALIOP instrument. This opportunity focuses on applying MISR data to constrain regional aerosol air mass type over urban regions, taking advantage of a 15+ record of approximately once-weekly global measurements, supplemented with AOD from MISR and MODIS, and aerosol vertical distribution from CALIOP and regional aerosol transport modeling. The aim is to create regional air quality pictures having enough detail and accuracy to monitor spatial and temporal exposures for major urban areas, globally.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate
Opportunity By

RALPH KAHN

Contact Information

ralph.a.kahn@nasa.gov;
301.614.6193
Opportunity Number: GSFC-016

Host Center: Goddard Space Flight Center

Opportunity Title: Impulsive Heating and Particle Acceleration in Solar and Stellar Coronae

Description/Objective (specific student assignment): Understanding how the Sun's corona and the coronae of other late-type stars are heated to multi-million degree temperatures is one of the cornerstone problems in space science. Recent results suggest that the solar corona is heated by many small energy bursts called nanoflares. It is presently unknown whether nanoflares accelerate a subset of particles to very high energy, as do regular flares. This graduate research opportunity entails one or both of the following projects. Apply the observational and theoretical techniques used to infer solar nanoflares to extreme ultra-violet observations of other stars. Probe solar microwave data for evidence of multiple overlapping type-III bursts that would indicate energetic particles.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: James Klimchuk

Contact Information: james.a.klimchuk@nasa.gov; 301.286.9060
Opportunity Number: GSFC-017

Host Center: Goddard Space Flight Center

Opportunity Title: Instrumentation for Inflationary Cosmology

Description/Objective (specific student assignment): Polarization of the cosmic microwave background provides a unique window into the physics of the early universe. Detection of a unique "handedness" signature would be a landmark discovery, testing physics at energies a trillion times higher than possible with particle accelerators while providing the first direct evidence that gravity obeys quantum mechanics. Detecting the cosmological signal and distinguishing it from competing foregrounds within the Milky Way galaxy requires a new generation of sensitive millimeter-wave instrumentation. The project develops instrumentation, analysis, and supporting technologies for balloon-borne and satellite observations of the cosmic microwave background.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: ALAN KOGUT

Contact Information: alan.j.kogut@nasa.gov; 301.286.0853
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<tr>
<th><strong>Opportunity Number</strong></th>
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<tr>
<td><strong>Host Center</strong></td>
<td>Goddard Space Flight Center</td>
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<tr>
<td><strong>Opportunity Title:</strong></td>
<td>Laser instrument</td>
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<tr>
<td><strong>Opportunity Description/Objective (specific student assignment):</strong></td>
<td>Assist with research and development of a laser-based science instrument. Present R&amp;D includes - sodium lidar, laser-based atomic magnetometer, femtosecond laser based laser ranging, intensity interferometer based optical correlation receiver, remote sensing of carbon dioxide, methane and oxygen, RF over optical laser ranging.</td>
</tr>
<tr>
<td><strong>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</strong></td>
<td>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</td>
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<td><strong>Desired Student Academic Level</strong></td>
<td>Pursuing Master's; Pursuing Doctorate</td>
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<tr>
<td><strong>Opportunity By</strong></td>
<td>MICHAEL KRAINAK</td>
</tr>
<tr>
<td><strong>Contact Information</strong></td>
<td><a href="mailto:michael.a.krainak@nasa.gov">michael.a.krainak@nasa.gov</a>; 301.614.6797</td>
</tr>
</tbody>
</table>
Opportunity Number GSFC-019

Host Center Goddard Space Flight Center

Opportunity Title: Integrated photonics

Opportunity Description/Objective (specific student assignment): Use Optodesigner 5 software to develop Integrated Photonics Circuits for laser and electro-optics science and engineering applications.

Expected opportunity outcome The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level Pursuing Master's; Pursuing Doctorate

Opportunity By MICHAEL KRAINAK

Contact Information michael.a.krainak@nasa.gov; 301.614.6797
Gravitational Waves promise to open the first new window for observing the Universe in a century. Gravitational waves are propagating disturbances in space-time predicted by all theories of gravity and produced most efficiently by the rapid motions of massive compact objects. Observation of gravitational waves will provide a powerful new tool for understanding these objects, their environments, and the underlying physics of gravity itself, including detailed tests of General Relativity in the strong field limit. The group has two main efforts: Numerical Relativity and the Space-based Gravitational-wave Observatory technology development. The Numerical Relativity effort has achieved breakthroughs in the study of merging black holes, as well as developing data analysis methods for gravitational wave detectors that incorporate numerical waveforms. The technology development projects include lasers, telescopes, photo receivers, and high precision bonded optical benches. Research opportunities in the gravitational wave astrophysics group include (1) design and development of space-based gravitational wave instrument technology, (2) development of data analysis techniques and estimation of LISA's measurement performance, (3) prediction of source waveforms using both numerical relativity and analytic approximation methods, and (4) astrophysics of LISA-observable systems.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Contact Information: jeffrey.livas-1@nasa.gov; 301.286.7289
Opportunity Number: GSFC-021

Host Center: Goddard Space Flight Center

Opportunity Title: Modeling of illumination conditions on the Moon, Mercury, and Beyond

Description/Objective (specific student assignment): The student will first learn how to use an in-house numerical tool to model the illumination conditions at the poles of the Moon and Mercury. Several types of studies are possible, such as: landing site illumination studies near the lunar south pole - high-resolution mapping of areas of high illumination and permanent shadow on the Moon - environmental conditions of the bright and dark deposits discovered in Mercury’s north pole - accurate calibration of instrumental data from spacecraft (LRO’s LAMP, LEND, LOLA, LROC) and from ground observatories (Arecibo radar) through novel use of illumination modeling (multiple sources, wavelengths) After an initial training session, the student is expected to be able to conduct the research independently, but with regular meetings with the mentor for help and feedback.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Erwan Mazarico

Contact Information: erwan.m.mazarico@nasa.gov; 301.614.6504
Since 2004, the Cassini spacecraft has been orbiting Saturn, and made more than 100 close flybys of the giant moon Titan in the last decade - the only moon in the solar system with a significant atmosphere. Both Saturn and Titan exhibit an active atmospheric chemistry that leads to the creation of complex organic molecules that may be precursors to astrobiology. Carried on-board the spacecraft is the Composite Infrared Spectrometer (CIRS), built and managed by NASA Goddard Space Flight Center. CIRS is a versatile instrument, capable of making diverse measurements of planetary atmospheres including temperatures, gas abundances, cloud properties and isotopic and elemental ratios. These data inform scientists about the formation, evolution and present day processes on solar system bodies. This exciting student fellowship opportunity is to actively participate in the analysis of CIRS data, focusing on modeling the spectra to make important estimates of the abundances of the complex organic molecules, and even larger organic particles. Uncovering the links from the molecules to the haze particles will be a primary goal of this research project.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Opportunity Number: GSFC-023

Host Center: Goddard Space Flight Center

Opportunity Title: X-ray Astrophysics using Astro-H

Astro-H is a major Japan/NASA X-ray observatory, to be launched in early 2016. Its instrumentation includes GSFC’s revolutionary Soft X-ray Spectrometer, which will make unprecedented high spectral resolution observations of a wide variety of astronomical X-ray sources, including galaxies and clusters of galaxies, stellar mass and supermassive black holes, and supernova remnants. Students will have the opportunity to work with members of the GSFC Astro-H science team to analyze SXS data, and interpret the results.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: ROBERT PETRE

Contact Information: robert.petre-1@nasa.gov; 301.286.3844
Opportunity Number: GSFC-024

Host Center: Goddard Space Flight Center

Opportunity Title: Exploring the Heating and Dynamics of the Solar Corona

Opportunity Description/Objective (specific student assignment): How the solar corona is heated to over a million degrees is a central and longstanding problem of solar physics. This is an opportunity to use temperature, density, and velocity diagnostics in the spectra of a successful sounding rocket instrument (EUNIS), together with coordinated observations from other space- and ground-based instruments, to explore the spatial and temporal variability of solar coronal structures and to test theories of coronal heating such as the nanoflare mechanism. The Extreme Ultraviolet Normal Incidence Spectrograph (EUNIS) is a sounding rocket instrument that has made three successful flights, most recently in April 2013. There is also an opportunity to work on the EUNIS instrument in the laboratory, depending on the fellow's interest.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: DOUGLAS RABIN
douglas.rabin@nasa.gov; 301.286.5682

Contact Information:
Opportunity Title: Novel Diffractive Optics with Applications to Solar Physics

Key physical processes in the solar atmosphere, such as magnetic reconnection, occur on characteristic length scales that require very high angular resolution to be observed from the vicinity of Earth. This is an opportunity to explore new types of optics and analysis methods that have the potential to provide 1 milliarcsecond (5 nanoradian) imaging of the Sun or other celestial objects in narrow wavelength bands. Diffractive optics such as photon sieves are diffraction limited at extreme ultraviolet wavelengths while conventional optics cannot approach the diffraction limit with existing fabrication techniques. Depending on the fellow's interest, the opportunity can emphasize analytical work on diffractive or nano-structured optics, or laboratory work on a prototype sounding rocket instrument to validate this approach to solar imaging.

Expected opportunity outcome
The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level
Pursuing Master's; Pursuing Doctorate

Opportunity By
DOUGLAS RABIN

douglas.rabin@nasa.gov; 301.286.5682
Opportunity Number: GSFC-026

Host Center: Goddard Space Flight Center

Opportunity Title: Synthetic Aperture Radar


Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: RAFAEL RINCON

Contact Information: rafael.rincon@nasa.gov; 301.614.5725
Opportunity Number: GSFC-027

Host Center: Goddard Space Flight Center

Opportunity Title: Planet Formation in the Solar Neighborhood

Description/Objective (specific student assignment): Over the last two decades, a myriad of diverse planets have been found orbiting other stars. Many of these planets are unlike those found in the Solar System and provide a challenge to our understanding of planet formation. The fellow will help further our knowledge of planet formation as a general process by carrying out observational and/or theoretical studies of protoplanetary and/or debris disks around nearby young stars. Mentor: Dr. Aki Roberge (Exoplanets and Stellar Astrophysics Laboratory, NASA Goddard Space Flight Center).

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Aki Roberge

Contact Information: aki.roberge-1@nasa.gov; 301.286.2967
Opportunity Number: GSFC-028

Host Center: Goddard Space Flight Center

Opportunity Title: Auroral Imaging for studying Magnetosphere-Ionosphere Coupling

Opportunity Description/Objective (specific student assignment): We encourage topics that seek to include a significant component of ground based imaging data in addressing questions of ionosphere-magnetosphere coupling through auroral studies. We can provide such data from 2011 onward and are particularly keen on studies that focus on the structure and dynamics of the aurora through the combination of several observational platforms. Coordinated efforts between satellites measuring the in situ plasma parameters in the near-Earth environment, and ground based observations, in order to gain insight into the particle acceleration processes that ultimately lead to the aurora are especially desirable. This opportunity is submitted for consideration under the 2016 Graduate Fellowship Research Opportunities call.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Maria Samara

Contact Information: marilia.samara@nasa.gov; 301.286.2813
Opportunity Number: GSFC-029

Host Center: Goddard Space Flight Center

Opportunity Title: Electromagnetic and Optical Analysis of the Carbon Nanotubes Coated Petal-shaped Masks in the Space-based Telescopes

Description/Objective (specific student assignment): The petal-shaped masks have shown to be effective in wideband suppression of the intensity along the optical axis of space-based telescope. Experiments conducted in transmission employ the metallic mask as it obscures the incident beam between the light source and the detector. However, these masks fail to perform needed level of suppression in the reflection due to the darkness of the material. Alternatively, there is growing evidence that carbon nanotube (CNT) coated mask, fabricated on the surface a reflective background (mirror), could suppress the incident beam equivalent to the transmission setup. This allows a number of space-based telescopes to employ such system to suppress the on-axis reflected light before it enters the detector. The Goddard Space Flight Center has mastered the successful fabrication of double-walled carbon nanotubes for the space applications. Despite this achievement, the application of CNT as suppressing material in space-based telescope is an open research area where the optical and electromagnetic properties of the carbon nanotubes are not well understood. One contributing factor to be examined is the interaction of CNT with light when it's geometrical size is in the orders of the incident wavelength. Even though early studies show CNT suppression of up to 4 orders of magnitude in selective bandwidths, but comprehensive electromagnetic analysis in conjunction with physical optics analysis is required to validate the earlier reports and extend the suppression level of the material. This study is well suited for a graduate student who is pursuing computational electromagnetics and/or physical optics with focus on the space application of nanostructures. This effort could become a dissertation topic in collaboration with the student's graduate advisor.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed
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<th>(i.e. research, final report, poster presentation, etc.):</th>
<th>journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</th>
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<td>Desired Student Academic Level</td>
<td>Pursuing Master's; Pursuing Doctorate</td>
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<tr>
<td>Opportunity By</td>
<td>RON SHIRI</td>
</tr>
<tr>
<td>Contact Information</td>
<td><a href="mailto:ron.shiri@nasa.gov">ron.shiri@nasa.gov</a>; 301.286.3383</td>
</tr>
</tbody>
</table>
**Opportunity Number**: GSFC-030

**Host Center**: Goddard Space Flight Center

**Opportunity Title**: Solar Wind Properties and Structures

**Opportunity Description/Objective (specific student assignment)**: Student will work with in-situ solar wind observations made in the near-Earth environment by Wind, ACE and by the recently launched DSCOVR spacecraft. There is an opportunity to study the solar wind at multiple scale-lengths from wave-particle interactions to interplanetary coronal mass ejections. Ultimately, these observation will be compared to inner heliospheric measurements made by Solar Probe Plus and Solar Orbiter.

**Expected opportunity outcome**: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

**Desired Student Academic Level**: Pursuing Master’s; Pursuing Doctorate

**Opportunity By**: ADAM SZABO

**Contact Information**: adam.szabo-1@nasa.gov; 301.286.5726
Opportunity Number: GSFC-031

Host Center: Goddard Space Flight Center

Opportunity Title: Trans-Atlantic Dust Transport, Deposition, and Impacts

Description/Objective (specific student assignment): Massive dust emitted from Sahara desert is carried by trade winds across the tropical Atlantic Ocean, reaching the Amazon Rainforest, Caribbean Sea, and southeastern U.S. Airborne dust degrades air quality and interacts with radiation and clouds. Dust falling to land and ocean adds essential nutrients that could increase the productivity of terrestrial and aquatic ecosystems and modulate the biogeochemical cycles and climate. The resultant climate change will feed back on the production of dust in Sahara desert and its subsequent transport and deposition. The objective of this project is to make a comprehensive characterization of trans-Atlantic dust transport and deposition through integrating spaceborne observations (CALIOP, MODIS, MISR, SEVIRI, CATS, and others), ground-based measurements (AERONET, lidars, surface concentrations of dust, PM2.5, and PM10), and model simulations (GOCART and MERRA2). Impacts of transported dust on air quality and ocean biogeochemical cycle will also be investigated.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Hongbin Yu

Contact Information: hongbin.yu-1@nasa.gov
301.614.6209
Opportunity Number: GSFC-032

Host Center: Goddard Space Flight Center

Opportunity Title: Optimization of SmallSat/CubeSat Constellation Concept for Global Earth Surface Sensing Using GEO-LEO Delay-Doppler Mapping

Description/Objective (specific student assignment): In this research topic, student will analyze and study end-to-end communications concepts for a mission that utilizes constellations of CubeSats in LEO orbit and signals of opportunity in GEO orbit to provide global Earth surface sensing. The methodology uses a sensitive receiver (installed in the CubeSat) to measure the ground reflection of VHF band signals transmitted from GEO communications satellites. This is done using two antennas on the SmallSat terminals to receive the direct signal from the transmitter and the reflected signal from the ground. The reflection coefficient (in the form of a delay-Doppler map or DDM) of the Earth surface is determined by cross-correlating the two signals. This study will define the optimum CubeSat/SmallSat constellation architecture, detailed functional design, performance requirements, and interface requirements to meet required spatial resolution with revisit time of 3 days. Design, Simulate, Test and Analyze and study end-to-end communications concepts for a mission that utilizes constellations of CubeSats in LEO orbit and signals of opportunity in GEO orbit to provide global Earth surface sensing.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: SERHAT ALTUNC

Contact Information: serhat.altunc@nasa.gov; 301.286.2933
Opportunity Number: GSFC-033

Host Center: Goddard Space Flight Center

Opportunity Title: Analysis of Polar Deposits on Mercury and the Moon

Opportunity Description/Objective (specific student assignment): Students applying for fellowship opportunities will be required to submit a proposal to the mentor. Prior to submitting a proposal, students will create a proposal summary with a description of their idea, and they will submit it to the mentor for their approval. The mentor has 10 business days to respond to each proposal summary. It is anticipated that mentors will only approve a couple proposal summaries, and they will work with those students to create their proposals and to make sure the topic is mutually beneficial to both the mentor and student.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Gregory Neumann

Contact Information: gregory.a.neumann@nasa.gov; 301.614.6026
<table>
<thead>
<tr>
<th><strong>Opportunity Number</strong></th>
<th>JPL-000</th>
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<tr>
<td><strong>Host Center</strong></td>
<td>Jet Propulsion Laboratory</td>
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<tr>
<td><strong>Opportunity Title:</strong></td>
<td>Student Proposed with Concurrence of NASA Technical Mentor</td>
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<td><strong>Opportunity Description/Objective (specific student assignment):</strong></td>
<td>The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.</td>
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<td><strong>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</strong></td>
<td>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</td>
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<td><strong>Desired Student Academic Level</strong></td>
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<td><strong>Opportunity By</strong></td>
<td>Student, PI and NASA Technical Advisor</td>
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<tr>
<td><strong>Contact Information</strong></td>
<td>NASA Advisor</td>
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</tbody>
</table>
Opportunity Number: JSC-001

Host Center: Johnson Space Center

Opportunity Title: Human Robotic Interface Research and Design

Opportunity Description/Objective (specific student assignment): Soliciting independently conceived research proposals in the area of human-robotic interface as applied to human space exploration. Areas can include human/robot interface design, telepresence and automated control system design and advanced technology development.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Bryan Dansberry

Contact Information: bryan.e.dansberry@nasa.gov, 281.483.0707
Opportunity Number: JSC-002

Host Center: Johnson Space Center

Opportunity Title: Human Extra-Vehicular Activities (EVA) Systems Design

Opportunity Description/Objective (specific student assignment): Soliciting independently conceived research proposals in the area of human EVA and EMU. Areas can include EMU and EVA tools & hardware design; EVA surface mobility systems design; EVA/robotic systems integration; EVA systems lunar and Mars habitat-related advanced technology development.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Bryan Dansberry

Contact Information: bryan.e.dansberry@nasa.gov, 281.483.0707
Opportunity Number: JSC-003

Host Center: Johnson Space Center

Opportunity Title: Life Support, health monitoring and habitation research and development

Opportunity Description/Objective (specific student assignment): Soliciting independently conceived research proposals in the area of human life support and habitation systems design as well as human health and performance monitoring. Areas including closed loop regenerative life support systems, habitation systems design, exercise countermeasures equipment design, environmental monitoring systems design, and biomedical systems design.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Bryan Dansberry

Contact Information: bryan.e.dansberry@nasa.gov, 281.483.0707
Opportunity Number: JSC-004

Host Center: Johnson Space Center

Opportunity Title: Human health and performance research and development

Description/Objective (specific student assignment): Soliciting independently conceived research proposals investigating the mechanisms by which space flight affects human physiology at the cellular level.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Bryan Dansberry

Contact Information: bryan.e.dansberry@nasa.gov, 281.483.0707
Opportunity Number: KSC-000

Host Center: Kennedy Space Center

Opportunity Title: Student Proposed with Concurrence of NASA Technical Mentor

Opportunity Description/Objective (specific student assignment): The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Student, PI and NASA Technical Advisor

Contact Information: NASA Advisor
Opportunity Number: KSC-001

Host Center: Kennedy Space Center

Opportunity Title: Molecular modeling for carbon dioxide to fuel two-dimensional and multi atomic layer photocatalysts

Description/Objective (specific student assignment): Photocatalysts with properties that convert carbon dioxide into fuel through hydrogen reduction are being studied for fuel production on Mars. KSC is investigating several photocatalytic materials for this fuel production reaction under the Mars solar spectrum. Molecular level modeling for these two dimensional and multi atomic layer photocatalysts is needed to supplement experimental work and help predict behaviors of this activity. Utilizing experimental data coupled with fundamental physics, the modeling can support the predictions of carbon dioxide conversion pathways or synthesis and growth formations of the nanomaterials.

Typical modeling software for this type of work will include Density Functional Theory (DFT) or Monte Carlo Simulations. KSC is looking for student support that will aide in molecular level modeling of synthesis and/or specific reaction pathways for the photocatalytic process to aide in the production of fuel on Mars.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Anne Meier

Contact Information: anne.meier@nasa.gov; 321.861.9315
Opportunity Number: KSC-002

Host Center: Kennedy Space Center

Opportunity Title: Analytical Chemistry Method Development for Propellant Handlers Ensemble Suit Materials

Description/Objective (specific student assignment): The purpose of this solicitation is to research and develop novel analytical methods to detect methyl pyridine carboxylic acid (mPCA), pyridine carboxylic acid (PCA), alpha ketoglutaric acid (AKGA), AF-M315E and LMP-1035 green propellants after being exposed to NASA's Propellant Handlers Ensemble (PHE) suit materials. PHE is a self-contained atmospheric protective ensemble (SCAPE) designed specifically to protect personnel from dermal and respiratory exposure to hypergols and specific industrial chemicals that are used for launch and payload operations. Although the SCAPE suit has been certified by NASA per NASA STD-6001-B "Flammability, Offgassing, and Compatibility Requirements and Test Procedures; it has not been certified by NIOSH. Previously, fully encapsulated suits like the SCAPE suit were not considered respirators and were therefore not required to be NIOSH certified. When the OSHA standard, 42 CFR 1910.134(d)(1)(ii), changed the definition of respirators included air supplied fully encapsulated suits. NIOSH is currently collaborating with ASTM to develop specifications for the design and performance criteria for air-fed protective ensembles where the non-respiratory components have met or exceeded the requirements of the ASTM standards. NIOSH is considering the certification methods developed by NASA and several other organizations in the certification requirements. This technology provides a proactive approach to improve current operations to ensure that we meet future requirements for safely handling hypergols and a better understanding on how the PHE suit material performs while exposed to harsh chemicals.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Desired Student Academic Level
Pursuing Master's; Pursuing Doctorate

Opportunity By
DIONNE JACKSON

Contact Information
dionne.b.jackson@nasa.gov;
321.867.9409
Opportunity Number: KSC-003

Host Center: Kennedy Space Center

Opportunity Title: Augmented/Virtual Reality

Opportunity Description/Objective (specific student assignment): The Augmented/Virtual Reality (AVR) Lab at KSC is designed to investigate the use of AR and VR technologies for use in NASA projects, programs, and missions. The primary goal of this opportunity is to research the capabilities of various emerging technologies (e.g., Microsoft Kinect, Oculus Rift, Lap Motion, OptiTrack Motion Capture, etc.), determine their accuracy and reliability, and derive means to improve their accuracy and reliability to meet NASA's requirements.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: WILLIAM LITTLE

Contact Information: william.l.little@nasa.gov; 321.861.8938
Data mining uses pattern based queries, searches, or other analyses of one or more electronic databases in order to discover or locate a predictive pattern or anomaly indicative of lessons learned, or system failures. Throughout NASA, hundreds of data systems are designed and tailored to serve specific engineering and business needs. Many of these systems use relational algebra with structured query language to categorize and retrieve data. In these systems, data analyses are limited and require prior explicit knowledge of metadata and database relations; lacking exploratory data mining and discoveries. The purpose of this project is to infuse data mining techniques, methods and algorithms to improve data evaluations and analyses in NASA Data Systems.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Opportunity Number: KSC-005

Host Center: Kennedy Space Center

Opportunity Title: Robotic Joints

Description/Objective (specific student assignment):
The candidate will be conducting research in the mechanical actuation of joints for robots. The research area is focused on a "Smart Actuator" where forces and torques are sensed and responded to real time during operation. The candidate should have experience with brushless DC motors, strain wave gearboxes, sensors, and motor control design.

NASA’s Technology Roadmap TA 4.1.5 Force and Tactile Sensing objective is to sense and react to the forces and torques that build up in complex manipulation tasks, such as coring rocks on slopes, engaging and disengaging tools, and docking or undocking modules. The challenge includes developing space-qualifiable designs for six-DOF force-torque sensors, with dual redundancy for each sensing axis and tactile sensor, to enable generalized object grasping in space. It also includes miniaturization and increased affordability for more abundant use in robotic tasks.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):
The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort. In addition, hardware will need to be designed, fabricated and tested.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Jonathan Drew Smith

Contact Information: jonathan.d.smith@nasa.gov
321.867.8726
Opportunity Number: LARC-000

Host Center: Langley Research Center

Opportunity Title: Student Proposed with Concurrence of NASA Technical Mentor

Opportunity Description/Objective (specific student assignment): The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Student, PI and NASA Technical Advisor

Contact Information: NASA Advisor
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<th><strong>Opportunity Number</strong></th>
<th>LARC-001</th>
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<tr>
<td><strong>Host Center</strong></td>
<td>Langley Research Center</td>
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<tr>
<td><strong>Opportunity Title:</strong></td>
<td>Synthesis of Novel Meso-scaled Materials</td>
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<tr>
<td><strong>Opportunity Description/Objective (specific student assignment):</strong></td>
<td>Polystyrene microspheres (PSL)s are a great platform for an array of both fundamental and highly applied research endeavors. Similarly, they represent a &quot;middle ground&quot; between macroscopic properties and nanometer (or quantum)behaviors. As such, there is a wealth of information and opportunity to conduct research using these materials. PSLs can be readily generated and modified for a variety of applications. A candidate for this research would need to investigate novel routes for generation of ultra-low density PSLs, reversibly connectable architectures made from these materials, and how these materials can be applied to answer aeronautics and space exploration needs</td>
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<td><strong>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</strong></td>
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<td><strong>Desired Student Academic Level</strong></td>
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<td><strong>Opportunity By</strong></td>
<td>Christoper Wohl</td>
</tr>
<tr>
<td><strong>Contact Information</strong></td>
<td><a href="mailto:c.j.wohl@nasa.gov">c.j.wohl@nasa.gov</a></td>
</tr>
</tbody>
</table>
**Opportunity Number**: LARC-002

**Host Center**: Langley Research Center

**Opportunity Title**: Next-Generation Computational Methods for Scalable Computing

**Opportunity Description/Objective (specific student assignment)**: Novel scalable scientific algorithms are needed to enable key NASA applications to exploit the computational power of massively parallel systems. This is especially true for the current tier of leading petascale machines and the road to exascale computing as HPC systems continue to scale up. These systems require unique scientific algorithms to hide network and memory latency, achieve very high computation-to-communication ratios, and minimize synchronization. Algorithms must be fault-tolerant, as the probability of component failure increases with scale and cannot be neglected. With the advent of heterogeneous computer nodes that employ a broad range of processing units, algorithms must be specifically designed and implemented to leverage the strengths of these architectures in order to maximize performance. As HPC continues to play an ever-larger role in today’s science and engineering disciplines, a broad range of research avenues is available. The selected student will conduct a leading-edge research program that will advance the state of the art in fluid dynamics computations on extreme-scale HPC systems to benefit a broad range of multidisciplinary NASA applications.

**Expected opportunity outcome (i.e. research, final report, poster presentation, etc.)**: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

**Desired Student Academic Level**: Pursuing Master’s; Pursuing Doctorate

**Opportunity By**: William Kleb

**Contact Information**: bil.kleb@nasa.gov
Opportunity Number: LARC-003

Host Center: Langley Research Center

Opportunity Title: Modeling sonic boom propagation from supersonic aircraft

Description/Objective (specific student assignment): This opportunity is for acoustics research on modeling sonic boom propagation from supersonic aircraft. In order to enable the development of a new generation of civil supersonic aircraft, NASA is researching approaches to minimizing sonic boom noise, and is participating in development of a new certification standard for permissible overland supersonic flight. To aid in these efforts, research is sought to extend existing acoustic propagation codes to improve predictions of the sonic booms from new aircraft designs that produce non-traditional, low-noise signatures. Areas for improvement may include: propagation through real, complex atmospheres; noise in the region around the lateral extent of the boom carpet; secondary sonic booms (initially propagated upward, but refracted downward by the atmosphere); and parameter sensitivities associated with Mach cutoff operations (acoustic refraction at low Mach numbers, resulting in the signature not reaching the ground). Application of the improved methodology to the analysis of conceptual aircraft designs, including assessment of noise metrics relevant to certification standards development, is also desired. Visualization of the phenomena and resulting ground sonic boom noise could be an additional component of the research. Recommended for students with an interest in nonlinear acoustics and meteorological effects on acoustic propagation. Computer programming skills in Fortran and/or Matlab required. Familiarity with LaTeX documentation is a plus.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate
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<th><strong>Opportunity Number</strong></th>
<th>LARC-004</th>
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<tr>
<td><strong>Host Center</strong></td>
<td>Langley Research Center</td>
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<tr>
<td><strong>Opportunity Title:</strong></td>
<td>Protective Coatings for Carbon-Carbon Composites to 4000°F</td>
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<tr>
<td><strong>Opportunity</strong></td>
<td>This opportunity focuses on the development of protective coatings for carbon-carbon composite materials exposed to surface temperatures up to 4000°F for up to 30 minutes in highly reactive environments. Despite over fifty years of research supporting the development of mechanically robust oxygen-impermeable protective coatings, the barrier material of choice (i.e., silica) remains unchanged. However, silica undergoes a passive-to-active oxidation transition at temperatures above ~3000°F, depending on pressure, rendering its use at further elevated temperatures ineffectual beyond short duration applications. In the absence of an economical replacement for silica, an alternative approach to designing protective coatings for carbon-carbon composites is desired. The student will be responsible for developing a feasible coating scheme, including a theoretically rigorous basis for rational design of coatings as well as detailed methods of coating application, microstructural characterization, and performance evaluation. The use of advanced high temperature in-situ and post-situ material characterization techniques on-site at the students laboratory, such as x-ray diffraction, hot stage microscopy, thermogravimetric analysis, thermal conductivity measurements, etc. is considered to be required for successful completion of the effort. The student can work with the mentor to test coated test specimens in the HYMETS arc-jet at NASA Langley</td>
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<td><strong>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</strong></td>
<td>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</td>
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<td>Pursuing Master’s; Pursuing Doctorate</td>
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<tr>
<td><strong>Opportunity By</strong></td>
<td>DAVID GLASS</td>
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</tbody>
</table>
Contact Information
david.e.glass@nasa.gov;
757.864.5423
Opportunity Number: LARC-005

Host Center: Langley Research Center

Opportunity Title: Optical Emission Spectroscopy In a Plasma Environment

Description/Objective (specific student assignment): This opportunity focuses on the development of optical emission spectroscopy techniques in relation to spacecraft atmospheric entry and their application to ground facility plasma flows as generated in the HYMETS arc-jet at NASA Langley. The conditions produced by the test facility need to be thoroughly understood in terms of quantifying the free-stream plasma flow characteristics. There is also a need to better understand how different thermal protection system materials behave and respond in such a plasma environment. The material response of ablative and re-useable thermal protection systems (TPS) will change in the presence of ablation and erosion products in the stagnation region in front of the samples and can be quantified by their spectral emission. At elevated temperatures, the surface emissivity of a material often deviates from the values at room temperature. This will affect the overall amount of energy dissipated by the system through radiation, in particular for re-useable systems where the main heat dissipation mechanism is given by radiative cooling. Understanding how a material ablates over time under varying conditions, as experienced in atmospheric entry, is another area of concern that can be addressed with optical emission spectroscopy of seeded TPS materials. The student’s work is anticipated to tie together optical emission spectroscopy techniques in the understanding of a free-stream and stagnation region plasma environment, how TPS materials surface emissivities might change at elevated temperatures, and characterizing seed materials for remote recession applications.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate
Opportunity By: DAVID GLASS

Contact Information: david.e.glass@nasa.gov;
757.864.5423
Nitric oxide (NO) is an important molecule in many NASA flight, combustion and atmospheric science applications. For example, high speed flight vehicles that launch in, cruise through or enter Earth's atmosphere heat the air passing over the vehicle, dissociating the air, generating nitric oxide (NO) and other species. Many ground test facilities that simulate high speed flight and atmospheric entry environments, like arc-jets, shock tubes, and shock tunnels also produce NO as a byproduct of adding enthalpy to the test gases. NO is used to study mixing of fluid streams for various applications including fuel-air mixing for combustion such as in gas turbine engines. Since it is a relatively stable molecule, it is sometimes doped into supersonic or hypersonic flowfields to allow visualization and quantification of freestreams, compressions, expansions, boundary layers, shock interactions, flow separation and other fluid dynamic phenomena. Finally, it is important to monitor and reduce production of NO in combustion applications to prevent pollution, since NO contributes to smog and is involved with atmospheric chemistry. Clearly, NO is an important molecule for a variety of NASA applications. Planar laser-induced fluorescence (PLIF) of NO is a commonly used method used to probe these various environments. NO PLIF results is relatively easy to perform with commercial off the shelf equipment and provides high signal-to-noise ratio images. In these applications, but particularly in ground testing, NO PLIF can measure temperature, pressure, velocity, concentration and can quantify fluid mixing. The spectroscopy of NO must be well understood in order to make these high-quality thermodynamic property measurements. While many prior measurements have been performed on NO using LIF, and many models have been developed to interpret these measurements, numerous discrepancies between measured data and models exists. For example, discrepancies are observed in predicting the signal intensity as a function of temperature, pressure and mole fraction of NO. Also discrepancies are
observed in the attenuation of the signal across a field of view caused by absorption of the incident laser beam. Experimental data over a wide range of controlled operating conditions and modeling of this data is incomplete, resulting in large uncertainties in measured parameters such as NO concentration. A carefully planned, comprehensive research effort is needed to better understand the spectroscopy and fluorescence properties of NO over a wide range of conditions appropriate to NASA applications. The results of the study should have broad application to a number of different NASA research areas including space vehicle launch, hypersonic vehicle cruise, entry, descent and landing, fundamental supersonic fluid flow applications, gas turbine combustion applications, as well as science missions

**Expected opportunity outcome** (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

**Desired Student Academic Level**

**Opportunity By**

Pursuing Master’s; Pursuing Doctorate

Paul M. Danehy

**Contact Information**

paul.m.danehy@nasa.gov

757.864.4737
Opportunity Number: LARC-007

Host Center: Langley Research Center

Opportunity Title: Multidisciplinary topology optimization for improved structural and vibroacoustic performance of aerospace systems

Description/Objective (specific student assignment): Topology optimization is a method that applies elementary design instructions to optimize material layout within a design space to improve the design with respect to one or more objectives. To date, topology optimization applications have been largely focused on the improvement of static load mechanics and basic structural dynamic aspects. However, realistic aerospace systems can be subjected to spatially complex, broad spectrum aerodynamic and acoustic excitation fields that may lead to critical component failure. Consequently, the application of topology optimization for the design of safe and reliable aerospace systems subject to realistic loads in a multidisciplinary framework focused on structural and vibroacoustic performance is desired.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Albert Allen

Contact Information: albert.r.allen@nasa.gov
757-864-8462
Opportunity Number: LARC-008

Host Center: Langley Research Center

Opportunity Title: Optimized Coherent Doppler Lidar Signal Processor

Opportunity Description/Objective (specific student assignment):
Coherent Doppler Lidar is a powerful tool for remote measurements of atmospheric winds and turbulence and providing vector velocity of hard targets. Efficient real-time extraction of the Doppler frequency shift resulting from the moving target is essential for the development of viable lidar instruments for a wide range of applications including weather forecasting, aviation safety and efficiency, and precision navigation for both terrestrial and space vehicles. We are seeking proposals for comparative investigation of existing radar signal processing techniques developed over the past half a century as applied to much higher frequency regime of Doppler lidars. This work shall also produce new signal processing techniques optimized specifically for coherent Doppler lidar systems.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):
The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Farzin Amzajerdian

Contact Information: famzajerdian@nasa.gov, 757-864-1533
Opportunity Number: LARC-009

Host Center: Langley Research Center

Opportunity Title: Pulsed Single-Mode Fiber Optic Amplifiers

Opportunity Description/Objective (specific student assignment):

Many future NASA sensors will employ lasers to measure parameters of the atmospheres and surfaces of Earth and other planets, assist navigation and operation of space vehicles, and provide high speed data links between space vehicles and earth. These sensors would benefit tremendously from increases in efficiency and laser power, with corresponding decreases in mass and power budgets. We are seeking proposals for new and novel pulsed, single-mode, fiber amplifiers operating at 1.5 micron wavelength regime capable of generating 10s of milli-joules at repetition rates of hundreds of pulses per second. The proposed concept must be highly efficient and compact and suitable for operation in space environment.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Farzin Amzajerdian

Contact Information: famzajerdian@nasa.gov, 757-864-1533
Opportunity Number: LARC-010

Host Center: Langley Research Center

Opportunity Title: Development of Advanced Optical Diagnostics for NASA Ground Test Facilities

Opportunity Description/Objective (specific student assignment): The purpose of this opportunity is to work towards the development of a non-intrusive, advanced optical measurement technique for use in NASA wind tunnel facilities in support of several strategic thrusts identified by NASA’s Aeronautics Research Mission Directorate (ARMD). These include Innovation in Commercial Supersonic Aircraft, Ultra-Efficient Commercial Vehicles, and Transition to Low-Carbon Propulsion as well as conducting crosscutting research and testing. The work performed during this opportunity will also provide datasets that address the validation needs for computational modeling efforts as outlined in NASA’s CFD Vision 2030 Study (NASA/CR-2014-218178). In order to develop a non-intrusive optical measurement for use in NASA wind tunnel facilities, the student will be required to work in a laboratory setting to design, construct, and test the proposed technique with a specific emphasis on sub-sonic fixed-wing and rotary-wing vehicle testing. The student will implement the measurement system in a NASA test facility where it can be used to support agency strategic thrusts and validation dataset needs of the computational modeling community by providing high quality, non-intrusive measurements of relevant aerodynamic parameters (i.e. density, pressure, temperature, and/or velocity). The student must have sufficient experience using optical equipment (such as digital cameras, lasers, photodiode detectors, and lenses) and electronic measurement equipment (such as digital oscilloscopes, thermocouples, pressure sensors, voltage meters, and power supplies) to characterize measurement sensitivities and uncertainties. The student will need to have some experience with LabVIEW programming, as much of the work will require the development and use of experimental control and data acquisition software. Familiarity with data processing using Microsoft Excel and/or Matlab is required. The abilities to think critically and to work both independently and with a team are essential. Disciplines considered:
Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level

Pursuing Master's; Pursuing Doctorate

Opportunity By

Brett Bathel, PhD

Contact Information

brett.f.bathel@nasa.gov,
757-864-8368
Opportunity Number: LARC-011

Host Center: Langley Research Center

Opportunity Title: Integrated Adaptive Wing Technology Maturation

Description/Objective (specific student assignment): This novel concept is a joint NASA-Boeing effort to utilize distributed active controls to reduce gust loads, maneuver loads, drag, and to improve aeroelastic stability margin such that a high-aspect ratio wing can be utilized at reduced weight thereby significantly increasing aircraft performance. The project culminates with a wind-tunnel test in the NASA Langley Transonic Dynamics Tunnel (TDT) in 2018/2019 to demonstrate the effectiveness of the active controls. Work involves Fiber Optic Shape Sensing and Control Law Development. Knowledge of controllers is a plus, in addition to the ability to program in MATLAB with SIMULINK and SIM-MECHANICS tool boxes, LabVIEW, and C++. Student must be willing to learn and adapt to the different software needs of the test. Master or PhD candidates are welcome. The student must be able to work with minimal guidance in a research environment (i.e. one that requires unique thinking in the absence of traditional understanding). The ability to program in MATLAB, LabVIEW and C++ are a plus but not required. However, the student must be willing to immerse into and learn the programming not already understood. A basic knowledge of wind-tunnel operation is also a plus. Knowledge of active controls and closed-loop real-time systems is a plus but not required.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Thomas G. Ivanco

Contact Information: thomas.g.ivanco@nasa.gov, 757-864-5092
Energy Absorber For Passive Earth Entry Vehicles

Passive Earth Entry Vehicle (EEV) is a relatively new class of entry vehicle that does not rely on parachutes or any other active system to reduce the landing velocity. Lack of active systems makes passive EEVs very reliable compared to conventional counterparts and hence attractive for planetary sample return missions. Successful delivery of planetary samples relies on passive energy absorbers to cushion and protect the payload during high-speed landing. In the past, crushable composite energy absorbers have been utilized due to their high specific energy absorption capability. The objective of this research area is to either develop further existing energy absorber designs and/or propose new concepts that can be tailored to given mission requirements.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum, a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Opportunity Number: LARC-013

Host Center: Langley Research Center

Opportunity Title: Complex Adaptive Systems Metrics

Opportunity Description/Objective (specific student assignment): NASA is developing concepts, algorithms, technologies, and architectures to safely enable airspace operations of greater complexity, density, scalability, mobility, efficiency, and affordability by justifiable combination of automation and autonomy. In order to make these visions a reality, NASA must be able to quantify and measure the performance and safety of systems where machine intelligence works in collaboration with humans. This work will support NASA’s Aeronautics Research Mission Directorate goals of increased safety and operational efficiency of human-machine teaming, system wide safety assurance, advanced human-machine harmonization, and highly reliable trusted systems. The student will investigate, verify and validate metrics for quantifying system performance, identify state-of-the-art approaches to certification and licensing of increasingly autonomous systems, and investigate the fluidity of human-machine teaming.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Lisa Le Vie

Contact Information: lisa.r.levie@nasa.gov,
757-864-3676
**Opportunity Number**: LARC-014

**Host Center**: Langley Research Center

**Opportunity Title**: Next-Generation Computational Methods for Scalable Computing

**Opportunity Description/Objective (specific student assignment)**: A student is sought to pursue research in the field of High Performance Computing (HPC) for large-scale computational fluids and other multidisciplinary aerospace applications. Novel scalable scientific algorithms are needed to enable key NASA applications to exploit the computational power of massively parallel systems. This is especially true for the current tier of leading petascale machines and the road to exascale computing as HPC systems continue to scale up. These systems require unique scientific algorithms to hide network and memory latency, achieve very high computation-to-communication ratios, and minimize synchronization. Algorithms must be fault-tolerant, as the probability of component failure increases with scale and cannot be neglected. With the advent of heterogeneous computer nodes that employ a broad range of processing units, algorithms must be specifically designed and implemented to leverage the strengths of these architectures in order to maximize performance. As HPC continues to play an ever-larger role in today’s science and engineering disciplines, a broad range of research avenues is available. The selected student will conduct a leading-edge research program that will advance the state of the art in fluid dynamics computations on extreme-scale HPC systems to benefit a broad range of multidisciplinary NASA applications.

**Expected opportunity outcome (i.e. research, final report, poster presentation, etc.)**: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

**Desired Student Academic Level**: Pursuing Master’s; Pursuing Doctorate

**Opportunity By**: Elizabeth M. Lee-Rausch

**Contact Information**: e.lee-rausch@nasa.gov

757-864-8422
Opportunity Number: LARC-015

Host Center: Langley Research Center

Opportunity Title: Probabilistic Analysis of Crash Conditions for a General Aviation Aircraft

During the summer of 2015, three full scale crash tests of a general aviation aircraft were conducted at NASA Langley Research Center. These tests were conducted under the emergency locator transmitter survivability and reliability project (ELT-SAR) with the ultimate goal of improving ELT reliability. Analytical models of these aircraft have been developed and tuned to the test data. This proposed project involves utilizing the analytical models in a probabilistic study to evaluate the probability of aircraft damage and occupant injury and the reliability of ELTs over a range of near-stall speed crash conditions. Uncertainties to be studied include soil parameters, impact speed, impact angles, ELT locations, aging aircraft materials, and uncertainties in the analytical simulations.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Mr. Brian H. Mason and Dr. T. Krishnamurthy

Contact Information: brian.h.mason@nasa.gov, 757-864-4895
Opportunity Number: LARC-016

Host Center: Langley Research Center

Opportunity Title: Aeronautics Conceptual Design Methods

Opportunity Description/Objective (specific student assignment): Develop innovative, multi-disciplinary, multi-fidelity analysis and design methodologies for advanced aircraft concepts and technologies that improve the fuel efficiency and environmental impact of future aircraft. Analysis methods and design processes intelligently balance the desire for accuracy and detail with the need to quickly evaluate many different design options during conceptual design. New methods replace traditional empirical correlations of existing aircraft with more physics-based analysis, improving the validity for unconventional aircraft concepts and technologies. Example research areas currently being pursued by NASA include: hybrid wing-bodies, truss-braced wings, hybrid-electric propulsion, structural batteries, dynamic aeroelastic optimization, non-traditional and/or autonomous missions, and design of aircraft using active control systems. Innovative ideas in other aspects of aircraft analysis and design are welcome, as well.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Erik Olson, Ph.D

Contact Information: erik.d.olson@nasa.gov, 757-864-7628
Opportunity Number: LARC-017

Host Center: Langley Research Center

Opportunity Title: Multifunctional Boron Nitride Nanotube Composites for Aerospace Applications

Description/Objective (specific student assignment): The Boron Nitride Nanotube (BNNT) is a structural analogue of the carbon nanotube (CNT). Having extraordinary mechanical properties, BNNTs also offer unique high thermal stability (> 900°C in air), chemical stability, high dielectric strength, neutron radiation shielding, piezoelectricity (sensing/actuation), and a dyeable white color. Developed at NASA, our novel high pressure, high temperature BNNT synthesis produces clean white, highly crystalline, small diameter, long BNNTs without using a catalyst. To explore BNNTs, new BNNT composites, fibers, and yarns will be developed using polymers, metals, and ceramics to study their mechanical, thermal, electrical, sensing/actuation, and radiation shielding properties systematically for aerospace applications. An organized, talented and gifted student is sought to research and develop new multifunctional BNNT-fibers, and BNNT-composite materials that will be used for real-world aerospace applications.

Expected outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Cheol Park, Ph.D.

Contact Information: cheol.park-1@nasa.gov, 757-864-8360
Opportunity Number: LARC-018

Host Center: Langley Research Center

Opportunity Title: Unmanned Vehicle Systems Research

Description/Objective (specific student assignment): Research opportunity for subscale unmanned vehicle systems development. System design, software development and flight testing (if schedule permits). The project involves development of intelligent capabilities on unmanned vehicles to manage mission contingency with the goal of 1) ensuring safe flight and 2) optimized mission which adjusts for contingencies. The practical end products are research flight electronics and algorithms which monitor for unsafe conditions and determine corrective action ahead of time. Unsafe conditions include, such things as, vehicle systems or navigation failure, fuel adequacy, traffic conflicts. Mission optimization area include algorithms on-board which modify the mission during execution to maximize objectives while meeting safety or other constraints. Activities include system design, software development, systems integration, and finally lab and flight testing. This multi-disciplinary research opportunity covers aspects of stochastic or heuristic predictive algorithms, low level and supervisory controls integrations, traditional and formal software and system verification methods, systems engineering for flight, hazard analysis and safety assurance.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Cuong Quach, “Patrick”

Contact Information: cuong.c.quach@nasa.gov, 757-864-6688
Opportunity Number: LARC-019

Host Center: Langley Research Center

Opportunity Title: Human Exploration Capabilities

Description/Objective (specific student assignment): The Human Exploration Capability Team analyzes data collected from NASA’s 12 System Maturation Teams (SMTs) to communicate capability developments that are critical to the Journey to Mars. The Capability Team integrates the multiple, complimentary yet disparate SMT datasets into a cohesive human exploration capability story that is used to communicate NASA’s exploration investments. One method used for communication is visualization of the data through capability roadmaps produced through computer programs. The student will work with the Capability Team to conduct research on effective data communication techniques, experiment with alternative visualization formats, and develop new ways to visualize and communicate human exploration capability developments. The newly developed visualization formats will then be incorporated into the existing visualization computer program.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Dr. Erica Rodgers

Contact Information: erica.rodgers@nasa.gov, 757-864-9543
Opportunity Number: LARC-020

Host Center: Langley Research Center

Opportunity Title: Aerospace Crew State Monitoring Research

Opportunity Description/Objective (specific student assignment): NASA Crew State Monitoring research develops novel, and leverages existing, psychophysiology techniques, neurotechnology, and brain-computer interface technologies to improve aviation safety in the National Airspace System. Supported projects will investigate suboptimal operator functional states through verification and validation of related mental state induction capabilities including interaction/use of current generation automation technologies, NextGen capabilities, and increasingly autonomous systems in laboratory and flight simulation facilities at Langley Research Center. This work will support NASA’s Aeronautics Research Mission Directorate goals of increased safety and operational efficiency of human-machine teaming, system wide safety assurance, advanced human-machine harmonization, and highly reliable trusted systems. The student will support ongoing studies and conduct investigations of the effects of automation and autonomous technology on human operators.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Chad Stephens
Alan Pope

Contact Information: chad.l.stephens@nasa.gov
757-864-7793
alan.t.pope@nasa.gov
757-864-7793
Opportunity Number: LARC-021

Host Center: Langley Research Center

Opportunity Title: Algorithms and Interaction Rules for Self-Separating and Self-Organizing Air Traffic

Description/Objective (specific student assignment):
The introduction of unmanned aerial vehicles (UAVs), on-demand flights, flying cars and other yet-to-be-designed vehicles will change the fundamental use of the National Airspace System. These air vehicles will perform a diverse set of missions and have the capability of entering and exiting the airspace at almost any location. There is a need for a new flexible and scalable air traffic management system that has the ability to support a large number of heterogeneous aircraft conducting a diverse set of missions with minimal ground-based infrastructure. To address this problem, the project is evaluating the feasibility of using a set of automated interaction rules to enable air vehicles to self-separate and self-organize. In order to support air vehicles that have limited ability to communicate full trajectories, the focus of this project is on the development of interaction rules that use a minimal amount of aircraft-to-aircraft intent information. This project will combine knowledge from a wide range of fields including self-organizing systems, emergent behavior, machine learning, autonomous decision making, airspace modeling, flight dynamics, and aircraft conflict management in order to design, implement, and test the interaction rules and procedures.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):
The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Kurt A. Swieringa

Contact Information:
kurt.a.swieringa@nasa.gov
757.864.9789
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<th><strong>Opportunity Number</strong></th>
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<tr>
<td><strong>Host Center</strong></td>
<td>Langley Research Center</td>
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<tr>
<td><strong>Opportunity Title:</strong></td>
<td>Human Exploration Spacecraft Research and Conceptual Design of Spacecraft Operating During Long Duration Dormant Periods</td>
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<tr>
<td><strong>Opportunity Description/Objective (specific student assignment):</strong></td>
<td>Research and design a human spacecraft capable of operating during long duration dormant periods of a human exploration mission to the surface of Mars. Activities include benchmark research of spacecraft operation of long duration robotic science mission. Research ISS documentation for operation during dormant or quiescent periods during buildup or decommission of ISS. Research human spacecraft and design a conceptual human spacecraft for Mars missions. Identify human systems most affected by dormant periods. Provide detailed information regarding spacecraft design, vehicle autonomous operation and specific monitoring needed for long duration human missions applicable to operation during dormant periods.</td>
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<tr>
<td><strong>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</strong></td>
<td>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</td>
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<td><strong>Desired Student Academic Level</strong></td>
<td>Pursuing Master's; Pursuing Doctorate</td>
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<td><strong>Opportunity By</strong></td>
<td>Julie Williams-Byrd</td>
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<tr>
<td><strong>Contact Information</strong></td>
<td><a href="mailto:Julie.a.williams-byrd@nasa.gov">Julie.a.williams-byrd@nasa.gov</a> 757-864-1629</td>
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Opportunity Number: LARC-023

Host Center: Langley Research Center

Opportunity Title: Statistical Engineering for Aerospace Applications

Opportunity Description/Objective (specific student assignment): Statistical engineering involves collaboration with engineers and scientists to strategically infuse statistical thinking into aspects of program planning and execution from concept formulation through operations. The overarching goal and benefit to NASA is to recognize and rigorously quantify uncertainty to support risk-informed decision-making and ensure technical excellence with defendable outcomes derived from the efficient utilization of resources. Aerospace applications include experimental research, computational modeling, measurement systems, and the development and testing of flight articles. Statistical design of experiments, response surface methodology, advanced regression modeling, and uncertainty analysis applied to both physical and computational data is a particular focus. This research requires the ability to comprehend and translate engineering and science objectives into statistical approaches that ensure defendable and insightful results.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Sara R. Wilson, Ph. D.

Contact Information: sara.r.wilson@nasa.gov
757-864-8587
Opportunity Number: LARC-024

Host Center: Langley Research Center

Opportunity Title: Weather Integration in Airborne Trajectory Management

Description/Objective (specific student assignment): Advancements in onboard surveillance, data connectivity, and automation will soon enable pilots to manage their own trajectories in the presence of traffic, weather, and other operational constraints. NASA is exploring a roadmap of Airborne Trajectory Management concepts, from near-term applications – like Traffic Aware Strategic Aircrew Requests (TASAR) with onboard automation advising pilots of ATC-approvable trajectory changes benefitting the flight – to long-term applications – like Autonomous Flight Rules (AFR) where pilots and automation autonomously self-separate from traffic and weather. The research objective is to study integration of weather hazard avoidance (e.g., convection, turbulence, volcanic ash) into airborne trajectory management. Example challenges: integrating disparate weather data sources, managing weather dynamics and prediction uncertainties, and designing human-automation interfaces and functionality to support pilot decision-making.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: David Wing

Contact Information: david.wing@nasa.gov
757-864-3006
Opportunity Number: LARC-025

Host Center: Langley Research Center

Opportunity Title: Multi-axial Stochastic Fatigue Analysis Methods

Description/Objective (specific student assignment): This opportunity focuses on the extension of idealized uniaxial stochastic fatigue methods to more realistic situations of multi-axial applied loads. Rainflow cycle identification is the standard method for reducing a uniaxial random stress time history to a table of amplitude-cycle pairings prior to application of the Palmgren-Miner cumulative damage calculation. Various frequency domain methods are also available. This research topic would be to perform a comprehensive review of available formulations for multi-axial fatigue damage; develop extensions in both the time and frequency domains particularly suited to stochastic response processes that may non-stationary and/or non-Gaussian; and anchor the methods developed with experiment studies. PLEASE CONTACT THE NASA TECHNICAL LEAD PRIOR TO SUBMITTING YOUR APPLICATION IF YOU PLAN TO WRITE A PROPOSAL IN SUPPORT OF THIS TOPIC.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Curtis E. Larsen, Ph.D., P.E., NASA Technical Fellow for Loads and Dynamics

Contact Information: curtis.e.larsen@nasa.gov; 281-483-8401
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<tr>
<th>Opportunity Number</th>
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<tr>
<td>Host Center</td>
<td>Langley Research Center</td>
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<tr>
<td>Opportunity Title:</td>
<td>Intelligent Sensor Systems</td>
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<tr>
<td>Opportunity Description/Objective (specific student assignment):</td>
<td>Survey the state-of-technology of low size-weight-power-cost (SWAP-C) remote sensors for applicability to UAV situation awareness and for SmallSat and UAV science applications. Survey would include Active (radar/lidar/sonar) and Passive (UV/visible/IR/THz/RF) sensors. - Based on the survey results and sensor availability, down-select to a sensor suite to experimentally evaluate/validate the results of the survey.</td>
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<td>Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):</td>
<td>Expected opportunity outcomes would include: written report and presentation (local and/or conference) on the state-of-technology survey, a research proposal for the sensor suite to be used for the experimental validation, and a final report encompassing the survey and the experimental effort and results. The final report would be expected to be on the level of a master's thesis in an engineering or science graduate department.</td>
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<td>Desired Student Academic Level</td>
<td>Pursuing Master’s; Pursuing Doctorate</td>
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<td>Opportunity By</td>
<td>Ivan O. Clark, Ph.D.</td>
</tr>
<tr>
<td>Contact Information</td>
<td><a href="mailto:Ivan.o.clark@nasa.gov">Ivan.o.clark@nasa.gov</a>; 757-864-1500</td>
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Opportunity Number: LaRC-027

Host Center: Langley Research Center

Opportunity Title: Computational Aeroelasticity and Aeroservoelasticity

Description/Objective (specific student assignment): The technical discipline of aeroelasticity is a critical ingredient necessary in the design process of a flight vehicle for maintaining optimal performance while ensuring freedom from aeroelastic and aeroservoelastic instabilities. This discipline requires a thorough understanding of the complex interactions between a flexible structure and the steady and unsteady aerodynamic forces acting on the structure, along with interactive control systems for flight vehicle performance and stability. There are several challenges associated with this technical discipline including but not limited to:

(a) aeroelastic, aeroservoelastic, and unsteady aerodynamic analyses at the appropriate level of fidelity for the problem at hand;
(b) development of computational-fluid-dynamic, computational-aeroelastic, and computational-aeroservoelastic analysis tools that advance the state of the art in aeroservoelasticity through novel and creative application of aeroelastic knowledge;
(c) development and application of advanced methods (such as Reduced-Order Models) to enable computational efficiency and insight into the complex physics;
(d) development and application of Uncertainty Quantification (UQ) and Verification & Validation (V&V) methods to complex aeroelastic and aeroservoelastic problems;
(e) development and application of modern optimization techniques that can be applied to multiple disciplines in a computationally-efficient and mathematically rigorous manner;

High-quality contributions in any of these categories will be a significant contribution to aeronautics as well as an advancement of the state of the art.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference
Desired Student Academic Level | Pursuing Master’s; Pursuing Doctorate  
---|---  
Opportunity By | Dr. Walter A. Silva  
Contact Information | Walter.A.Silva@nasa.gov  
| 757-864-2834
Opportunity Number: LaRC-028

Host Center: Langley Research Center

Opportunity Title: Intelligent Sensor Systems

This opportunity focuses on the development of optical emission spectroscopy techniques in relation to spacecraft atmospheric entry and their application to ground facility plasma flows as generated in the HYMETS arc-jet at NASA Langley. The conditions produced by the test facility need to be thoroughly understood in terms of quantifying the free-stream plasma flow characteristics. There is also a need to better understand how different thermal protection system materials behave and respond in such a plasma environment. The material response of ablative and re-useable thermal protection systems (TPS) will change in the presence of ablation and erosion products in the stagnation region in front of the samples and can be quantified by their spectral emission. At elevated temperatures, the surface emissivity of a material often deviates from the values at room temperature. This will affect the overall amount of energy dissipated by the system through radiation, in particular for re-useable systems where the main heat dissipation mechanism is given by radiative cooling. Understanding how a material ablates over time under varying conditions, as experienced in atmospheric entry, is another area of concern that can be addressed with optical emission spectroscopy of seeded TPS materials. The student’s work is anticipated to tie together optical emission spectroscopy techniques in the understanding of a free-stream and stagnation region plasma environment, how TPS materials surface emissivities might change at elevated temperatures, and characterizing seed materials for remote recession applications.

Expected opportunity outcomes would include: written report and presentation (local and/or conference) on the state-of-technology survey, a research proposal for the sensor suite to be used for the experimental validation, and a final report encompassing the survey and the experimental effort and results. The final report would be expected to be on the level of a master’s thesis in an engineering or science graduate department.
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<tr>
<th>Desired Student Academic Level</th>
<th>Pursuing Master's; Pursuing Doctorate</th>
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<tr>
<td>Opportunity By</td>
<td>David E. Glass, Ph. D.</td>
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<tr>
<td>Contact Information</td>
<td><a href="mailto:david.e.glass@nasa.gov">david.e.glass@nasa.gov</a>;</td>
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<td>757-864-5423</td>
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Opportunity Number: MSFC-000

Host Center: Marshall Space Flight Center

Opportunity Title: Student Proposed with Concurrence of NASA Technical Mentor

Opportunity Description/Objective (specific student assignment): The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.

Expected opportunity outcome: The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Student, PI and NASA Technical Advisor

Contact Information: NASA Advisor
Cloud Detection with Satellite Data

The presence of clouds over a region have a controlling effect on many atmospheric and climate processes. A “cloud mask” which delineates cloudy from clear regions is an important component in the process of deriving important land, ocean, and atmospheric parameters to study these processes. Scientists in the Earth Science Office at MSFC have refined a two-channel technique (see reference below) for the detection of clouds from a variety of satellite sensors for the generation of products supporting the Short-term Prediction Research and Transition (SPoRT) program (http://weather.msfc.nasa.gov/spor...). The Bispectral Composite Threshold (BCT) approach uses spatially and temporally varying thresholds with two infrared channels to create a yes / no cloud mask. Preliminary comparisons of BCT algorithm show good agreement with a more complex NOAA operation cloud mask algorithm for a limited case study period. The objective of the graduate fellowship would be to extend the comparison to a large number of case studies during different periods of time and over different regions in order to more fully understand the algorithms performance as compared to the NESDIS operational approach. It is envisioned that this fellowship could become the student’s thesis research project.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Pursuing Master’s; Pursuing Doctorate

Dr. Gary Jedlovec
http://weather.msfc.nasa.gov/sport
gary.jedlovec@nasa.gov;
256-961-7966
Opportunity Number: MSFC-002

Host Center: Marshall Space Flight Center

Opportunity Title: Modern Control Techniques for Mitigating Launch Vehicle Bending Modes

Description/Objective (specific student assignment): This topic considers the situation where an unmodeled bending mode appears during flight that is either at a lower frequency or higher amplitude than can be effectively filtered out by the on-board flight control system. Research topic would be to identify one or more modern control techniques that can effectively mitigate control-structure interaction. The proposed techniques should be an add-on (not replacement for) the existing control design architecture, and should be algorithmically simple. Approaches which depart minimally from linear control techniques or are rooted in nonlinear stability analysis are most favorable. The student researcher should evaluate the stability and performance of the design in the time and frequency domain for sensitivity to control parameter variations, dynamic coupling, changing vehicle parameters, and uncertainty in flexible mode frequency and amplitude. Any risks that the algorithm would introduce should be clearly identified, and the inclusion of a stability proof or analysis indicating stability bounds is highly encouraged. A simple Matlab-based launch vehicle model and control system will be provided to facilitate time and frequency-domain evaluation of the proposed modern control techniques and its sensitivities through simulation. PLEASE CONTACT THE NASA TECHNICAL LEAD PRIOR TO SUBMITTING YOUR APPLICATION IF YOU PLAN TO WRITE A PROPOSAL IN SUPPORT OF THIS TOPIC.

Turbo-electric and hybrid electric propulsion systems have the potential to enable distributed propulsion for advanced air vehicles with significant improvements in fuel efficiency, noise reduction, and emissions. The use of advanced electric technologies to enable distributed propulsion include superconducting and high specific power electric machines, cryogenic power electronics, dc and high frequency ac power distribution, high specific energy storage, and advanced protection and power system control methods. Electric propulsion systems dominated by electric machines used for power generation, and
electric motors driving ducted fans or propellers to produce thrust is very unique. Based on terrestrial power system experience with distributed wind turbine generators causing instabilities in the power system, even with low levels of wind generation, the distributed electric propulsion system will be significantly more challenging. To provide stable and robust electric power system operation for the distributed electric propulsion will require new control methods that provide an integrated and dynamic control involving the turbine engine driven generator, power distribution and protection system, electric propulsor motor and propeller/ducted fan pitch control, and vehicle flight control. New and novel control involving dynamic and adaptive methods for the electric power system control are being sought in this announcement.

<table>
<thead>
<tr>
<th><strong>Expected opportunity outcome</strong></th>
<th>The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.</th>
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<td><strong>(i.e. research, final report, poster presentation, etc.):</strong></td>
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<tr>
<td><strong>Desired Student Academic Level</strong></td>
<td>Pursuing Master’s; Pursuing Doctorate</td>
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<tr>
<td><strong>Opportunity By</strong></td>
<td>Tannen S. VanZwieten, Ph.D., NESC C-103</td>
</tr>
<tr>
<td><strong>Contact Information</strong></td>
<td><a href="mailto:tannen.vanzwieten@nasa.gov">tannen.vanzwieten@nasa.gov</a>, 256.961.1509</td>
</tr>
</tbody>
</table>
Urban Heat Wave Hazard and Risk Mapping

Heat waves are one of the largest causes of environmentally-related deaths globally. While elevated summertime temperatures are the main driver for this hazard, the amplification of heat waves by the heat island in urban areas and elevated humidity (apparent temperature), combined with urban demographics, are key elements leading to these potential disasters. The most recent Intergovernmental Panel on Climate Change (IPCC) report indicates that temperature extremes are likely to increase under a global warming scenario. This project uses moderate resolution thermal data from NASA satellites to derive apparent temperature (heat index) over urban regions to produce a heat wave hazard map. The hazard map is combined with urban demographic information to produce a daily heat wave risk assessment for selected cities. The product is being developed in a research mode with the prototype product being initially delivered via mobile “app” for the summer of 2016. Validation of the products will be supported through citizen scientist reports of local temperature variations. The objective of the graduate fellowship would be to participate in the development of the remote sensing products, their delivery to end users, data collection and validation. It is envisioned that this fellowship could become the student’s thesis research project.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.
Huntsville, Alabama 35805
http://weather.msfc.nasa.gov/sport
gary.jedlovec@nasa.gov
256-961-7966
Opportunity Number: MSFC-004

Host Center: Marshall Space Flight Center

Opportunity Title: Development of Conceptual Models of the Friction Stir Welding Process

Description/Objective (specific student assignment): In the friction stir welding process a rotating threaded pin seized in a weld seam is moved along the seam stirring the sides of the seam together into a weld as it goes. Friction stir welds are strong and reliable and are increasingly used in the aerospace industry in general and by NASA in particular. The process was invented in 1991 at The Welding Institute in the United Kingdom. The solid-state process was taken up by NASA in 1995 as a means to circumvent fusion-welding problems with a new alloy. The process seems to have been conceived originally as chaotic mixing. Subsequently process models incorporating a liquid layer at the tool-weld metal surface or conceiving the process as an extrusion of heat-softened metal past a friction-heating pin were put forward. Fluid finite element analysis models seem to be popular today, although they miss important flow aspects like the discontinuous structural change at the "shear surface". Studies undertaken at NASA have decomposed the friction stir flow field into simpler components and produced a model reproducing microstructural features and relating features to boundary conditions at the tool surface. The object of this study is to document the progression of concepts of the friction stir welding process, to make better understood the concept of friction stir welding developed at NASA, which would seem to have advantages over previous and some extant concepts, and to see if somewhere we have missed a still more useful model. A publication of the results in a widely read journal is to be aimed at.

Expected opportunity outcome: Research study documented by a publication.

(i.e. research, final report, poster presentation, etc.):

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate
<table>
<thead>
<tr>
<th><strong>Opportunity By</strong></th>
<th>Arthur Nunes</th>
</tr>
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<tr>
<td><strong>Contact Information</strong></td>
<td><a href="mailto:arthur.c.nunes@nasa.gov">arthur.c.nunes@nasa.gov</a>; 256-544-2699</td>
</tr>
</tbody>
</table>
Opportunity Number: MSFC-005

Host Center: Marshall Space Flight Center

Opportunity Title: Weld Seam Trace Defects in Friction Stir Welds

Description/Objective (specific student assignment): In the friction stir welding process a rotating threaded pin seized in a weld seam is moved along the seam stirring the sides of the seam together into a weld as it goes. Friction stir welds are strong and reliable and are increasingly used in the aerospace industry in general and by NASA in particular. The friction stir welding action takes place along the weld seam, the trace of which is a suspect source for defects that reduce the strength of a weld. A number of concepts that clarify the processes taking place within a friction stir weld have been developed at this laboratory. The condition of the weld seam trace is affected by weld parameter settings, tool geometry, weld material, and seam surface preparation. The intermediary between weld process and weld properties is structure. The objective of this study is to observe weld structures resulting from varied weld processes, focusing on seam trace defects, to observe the effects of defects on strength, and to interpret defect formation and strength consequences in terms of fundamental physical models. The results of this study will have consequences for design of friction stir tools, optimization of parameter choices and joint preparation techniques, and diagnosis and correction of weld problems.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): Research study documented by Thesis (masters or doctoral). A publication is expected from doctoral fellow.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Arthur Nunes

Contact Information: arthur.c.nunes@nasa.gov; 256-544-2699
Opportunity Number: MSFC-006

Host Center: Marshall Space Flight Center

Opportunity Title: High Temperature Thermoelectrics

Opportunity Description/Objective (specific student assignment):
Student will follow a design of experiments approach to fabricate high temperature thermoelectrics using a direct current sintering furnace. Analysis of the thermoelectrics will include measuring Seebeck Coefficient and thermal conductivity as well as SEM/EDS analysis of the samples.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.):
It is expected that this research will lead to a refereed journal paper and it is possible for a Master's Thesis to be obtained using this work.

Desired Student Academic Level:
Pursuing Master's; Pursuing Doctorate

Opportunity By:
Dennis Tucker
dennis.tucker@nasa.gov;
256-544-7022
Opportunity Number: MSFC-007

Host Center: Marshall Space Flight Center

Opportunity Title: Structural Dynamics of Rocket Engine Turbomachinery

Opportunity Description/Objective (specific student assignment): A number of issues prevent the accurate prediction and measurement of dynamic response of critical components in the flow-path of rocket engine turbomachinery. Opportunities exist to pursue research to address these issues. The research areas include incorporating the complex spatial and temporal Fourier fields beyond the typical single frequency, single spatial field analysis typically performed; compiling a physics-based methodology for calculating the probability of failure; measuring the response of turbine blades in an actual rocket turbopump environment; and incorporating new white-light scanning techniques in bladed-disk geometric mistuning techniques.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expected outcome of the research is a reproducible methodology for generating the accurate prediction or measurement under investigation. Documentation of this technique in a peer-reviewed journal article would also be expected.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Andrew Brown

Contact Information: andy.brown@nasa.gov; 256-544-1584
Opportunity Number: MSFC-008

Host Center: Marshall Space Flight Center

Opportunity Title: Additive Manufacture In-Situ Process Monitoring (ISPM) Development

Description/Objective (specific student assignment): The proposed task is for design, development, and implementation of an In-Situ Process Monitoring (ISPM) system to aid in quality control of full-scale additively manufactured metal builds. This task involves autonomous optical image capture during the build process followed by image processing to identify potential flaws. Virtual build models are generated and compared to design models to evaluate critical flaws to determine whether to scrap a build or continue with subsequent post-processing steps (e.g. stress relieve, scanning, HIP, surface modification, machining, etc.). Preliminary efforts are to develop a prototype system to undergo verification using a mock-up build platform then integrated into an AM machine. Additional efforts could include gathering real-time IR thermography data to aid model developers in prediction of microstructure and properties.

Expected opportunity outcome: Collaborative completion of a project leading to an operational system, with results culminating in an MS thesis or PhD dissertation.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Omar Mireles

Contact Information: omar.r.mireles@nasa.gov; 256-544-6327
Opportunity Number          SSC-000

Host Center                Stennis Space Center

Opportunity Title:         Student Proposed with Concurrence of NASA Technical Mentor

Opportunity Description/Objective (specific student assignment): The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Student, PI and NASA Technical Advisor

Contact Information: NASA Advisor
Opportunity Title: Rocket Propulsion Test Design and Analysis

Description/Objective (specific student assignment): A wide range of rocket propulsion test work occurs at NASA SSC including full-scale liquid-propellant engine test activities at test facilities A-1, A-2, B-1 and B-2 as well as combustion device research and development activities at the E-Complex (E-1, E-2, E-3 and E-4) test facilities. Rigorous test campaigns are pursued to ensure rocket engine and rocket engine component systems satisfy their design requirements and to allow for an understanding of the system/component operational envelope. The testing also allows for the development and validation of accurate simulation models. SSC is interested in new, innovative ground-test techniques to conduct a variety of required developmental and certification tests for space systems, stages/vehicles, subsystems, and components. Examples include better coupling and integration of computational fluid dynamics and heat transfer modeling tools focused on cryogenic fluids at high flow and high pressure conditions and on rocket exhaust plumes; advanced control strategies for non-linear multi-variable systems; structural modeling tools for ground-test programs; low-cost, variable altitude simulation techniques; and uncertainty analysis modeling of test systems.

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Opportunity By: Harry Ryan
Lead, Systems Analysis and Modeling

Contact Information: harry.m.ryan@nasa.gov; thomas.e.jacks@nasa.gov 228-688-2757
Opportunity Title: Enhanced Development of a Balanced Isolation Valve

Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master’s; Pursuing Doctorate

Contact Information: gigi.h.savona@nasa.gov
228.688.3605

Opportunity By: Gigi Savona
Intellectual Property Manager
Rocket engine propulsion development is both enabled and validated by rigorous ground testing. Testing is conducted to mitigate and reduce propulsion system risks that are inherently associated with in space flight. Correspondingly, all space vehicle propulsive devices/articles, including liquid and solid rocket propulsion, chemical and non-chemical propulsion, boost stage and in-space propulsion are subject to risk with use. Therefore, a combination of component-level and engine-level ground testing that demonstrate the propulsion devices were designed to meet the specified requirements for a specified operational envelope and over robust margins, as well as shown to be sufficiently reliable, prior to its first flight, is required. In addition, new technologies need to be developed that focus on near-term products that augment and/or enhance proven, state-of-the-art propulsion ground test facilities that could be used for advanced propulsion capability development. An enabling technology for manned spaceflight beyond LEO is nuclear thermal propulsion (NTP). NTP engines are comparable to that of a chemical rocket engine (e.g. produce multi-g acceleration), but double the specific impulse and has a simpler propulsive hot gas generation cycle that eliminates the hazards and risk associated with real-time combustion of propellants; a nuclear rocket engine is significantly more fuel efficient than a chemical rocket engine. As a result, an NTP rocket engines would have the potential to travel twice as fast as chemical-driven space vehicles. Condensed trip times would help reduce harmful exposure of instrument, equipment and astronauts to radiation emitted from the cosmic rays, solar radiation that permeate interplanetary space and deep space gamma radiation. However, to ground test a NTP engine, there are specific technologies that still need to be developed, which include some of the following: (1) advanced instrumentation and monitoring systems capable of operating in extreme temperature and radiation environment; (2) advanced material development that resist
Expected opportunity outcome (i.e. research, final report, poster presentation, etc.): The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Desired Student Academic Level: Pursuing Master's; Pursuing Doctorate

Opportunity By: Lauren W. Underwood, Ph.D.
NASA SSC Technology Development & Transfer

Contact Information: lauren.w.underwood@nasa.gov
228.688.2096
NASA’s intellectual property (IP) portfolio includes patents and software that can stimulate economic development and address societal issues. However, in order to optimize utility of these assets, NASA needs better tools to manage this portfolio and simplify discovery of relevant IP. Currently, each NASA patent is assigned to one of fifteen categories. The current patent classification can be viewed at http://technology.nasa.gov/patents. Similarly, each piece of software is assigned to one of fifteen similar, but not identical, categories. That classification can be viewed at https://software.nasa.gov/. However, these classifications do not reflect the relationships with other IP nor the strength of those relationships. Currently, there is no connection between the patent and software classifications.

For this fellowship opportunity, the student will develop and deploy a robust text analytics framework for hierarchical text classification and clustering, as well as a recommendation engine to identify related IP that utilizes the results of the classification/clustering processes. These efforts may incorporate the use of tools and techniques from fields such as, but not limited to, machine learning, natural language processing, data mining, statistical signal processing, and fuzzy set theory. Both supervised and unsupervised techniques are acceptable. The existing NASA patent database (exported as csv), the patent text (from USPTO), and brief text descriptions of each piece of software are available for input.

The expectation is that the research will culminate in a peer-reviewed journal publication. At a minimum a detailed research report will be compiled at the end of each year. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

Pursuing Master’s; Pursuing Doctorate
Opportunity By
Lauren W. Underwood, Ph.D.
NASA SSC Technology Development & Transfer

Contact Information
lauren.w.underwood@nasa.gov
228.688.2096
Appendix F: Fellowship/Scholarship Travel Funds Procedure

All travel funds must be used in support of a grant awarded by NASA for the fellowship/scholar program. All steps must be complete before approval will be given. Travel funds are for domestic travel only.

Travel Package is completed by fellow/scholar with the assistance of PI:

1. A written statement and request must be submitted by the fellow/scholar’s principal investigator that includes the following documents:
   a. Fellow’s/Scholar’s Name;
   b. Fellow’s/Scholar’s Institution;
   c. Grant Number;
   d. Principal Investigator;
   e. NASA Mentor’s Name;
   f. NASA Center;
   g. Professional Development Opportunity or Conference Title;
   h. Venue;
   i. Dates attended;
   j. The goals of attendance;
   k. Expected impact on the fellow/scholar;
      ❖ If the fellow/scholar is presenting at the conference, provide a copy of the submitted abstract to the conference administrators;
      ❖ A copy invitation to present from the conference administrators

2. Complete the NASA Fellowship/Scholarship Travel Request Budget Form

Submit the completed Travel Package to the Fellowship/Scholarship Program Management.

3. Complete ITAR review with the assistance of the NASA Technical Mentor and the fellow’s/scholar’s NASA Center’s Office of Education:
   a. The presentation, research paper, and or poster must be reviewed by fellow’s/scholar’s NASA Technical Adviser, NASA Center ITAR and/or Center’s Export Compliance Office for approval.
   b. Submit approval documents to Fellowship/Scholarship Program Management.
      ❖ The Fellowship/Scholarship Program COTR or Technical Officer will give an official approval or rejection.

4. The fellow/scholar must complete a Travel Follow-up Report within 2 weeks of the end of travel. The report must include the following:
   A. Fellow and Development Opportunity or Conference Information:
      1) Fellow’s/Scholar’s Name
      2) Fellow’s/Scholar’s Institution
      3) Grant Number
      4) Principal Investigator
      5) NASA Mentor’s Name
      6) NASA Center
      7) Development Opportunity or Conference Title
      8) Venue
      9) Dates attended
   B. If you presented a poster or presentation:
      1) Title of Presentation/Poster
      2) Short summary of audience response
3) Lessons Learned

C. Development Opportunity or Conference Events Attended:

1) List of attended
   a) Oral presentations
   b) Poster presentations
   c) Workshops
   d) Professional networking events

2) Goals of Attendance at the Development Opportunity or Conference:
   a) Pre-conference Goals
   b) Outcomes of the Development Opportunity or Conference:
      i. Were the goals met?
      ii. Unexpected outcomes
      iii. Highlights
Appendix G: Annual Renewal Process

NASA Education Aeronautics Scholarship and Advanced STEM Training and Research (AS&ASTAR) Fellowship are made initially for one year and may be renewed additional two years contingent upon satisfactory progress, as reflected in the academic performance, research progress, recommendation by the faculty advisor, NASA Technical Mentor and the availability of funds. Fellows seeking renewal shall submit a Renewal Proposal Applications Package to the NASA Education NRA: Aeronautics Scholarship and Advanced STEM Training and Research (AS&STAR-Renewal) Fellowship Renewal for Academic Year 2017-2018. The NRA shall be posted on NASA NSPIRE in the winter of 2017. Renewal Proposal Applications Package included the Annual Progress Reports that are a comprehensive summary of significant accomplishments during the reporting period or the duration of the grant. The purpose of the Annual Report is to provide an update on the progress of your research and or degree progression. The submission of Renewal Proposal Applications Package is required before the Program Officers can release additional years funding. The responsible parties for submitting the documentations for renewal are Fellow/Scholar and the Faculty PI to NASA Education NRA: Aeronautics Scholarship and Advanced STEM Training and Research (AS&STAR-Renewal) Fellowship Renewal for Academic Year 2017-2018.