



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

HEADQUARTERS

NASA Office of Education

300 E. STREET, SW

WASHINGTON, D.C. 20546-0001

**NASA Fellowship Activity
2018**

NASA Research Announcement (NRA)

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CATALOG OF FEDERAL DOMESTIC ASSISTANCE (CFDA) NUMBER: 43.008

Release Date: January 17, 2018

Proposals Due: March 20, 2018

OMB Approval Number 2700-0092

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Release Date	January 17, 2018
Due date for Proposals Phase I	Currently 03/20/2018, at 5:59 p.m. E.T. or 2:59 p.m. P.T.
Pre-proposal Teleconference: To join the meeting via the web: TBD The telecom number is 1-844-467-6272 and the passcode is 993012.	January 24, 2018, at 4:00 p.m. E.T. or 1:00 p.m. P.T. January 30, 2018, at 5:00 p.m. E.T. or 2:00 p.m. P.T. February 5, 2018, at 10:00 a.m. E.T. or 7:00 a.m. P.T.
Due date for Selected Proposals Phase II	Currently May 31, 2018, at 11:59 p.m. E.T. or 8:59 p.m. P.T.
Public announcement of awards	Approximately six months after solicitation closes

I. OVERVIEW INFORMATION

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA), titled the NASA Fellowship Activity, solicits proposal applications for the academic year 2018 – 2019. NASA may elect to support some of the proposals submitted under this NRA through the use of internal NASA funding sources such as Minority University Research Education Projects (MUREP); 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 Office of Education; to advance high-quality Science, Technology, Engineering, and Mathematics (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 to earn advanced degrees in these critical fields.

The NASA Fellowship Activity opportunity is conducted in conjunction with the Aeronautics Research Mission Directorate (ARMD), the Human Exploration and Operations Mission Directorate (HEOMD) and the NASA Science Mission Directorate (SMD). All NASA investments in postdoctoral fellows are excluded from this announcement.

II. EXECUTIVE SUMMARY

NASA's Office of Education collaborates with NASA Headquarters, NASA Mission Directorates, NASA Centers and external STEM partners to implement STEM education. NASA Office of Education provides unique opportunities to learners, educators, and institutions by providing access to NASA's mission content, people, resources, and facilities. NASA Office of 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.

The NASA Fellowship Activity 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. This announcement requests research individually conceived proposals from interested applicants to support the Fellowships component of Education.

- **The NASA Fellowship Activity provides 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.**

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 Fellowships Activity 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 Fellowship Activity

B. Purpose:

The purpose of the NASA 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 Fellowship Activity expands the reach of NASA budget by leveraging funding sources and collaborating with other Federal Agencies to support graduate student research and the educational 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. 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 Fellowship Activity applicants should focus on one or more of the above goals and objectives.

D. National and Agency-Wide Priorities:

NASA 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 Fellowship Activity will address the following long-term NASA education goals and objectives that are outlined in the 2014 NASA Strategic Plan. These measures are 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. NASA's Strategic Goals and Objectives relevant to education are outlined in the 2014 NASA Strategic Plan: https://www.nasa.gov/sites/default/files/files/FY2014_NASA_SP_508c.pdf.

The NASA 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 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, which leads 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 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 Fellowship Activity supports the following NASA's education multi-year performance goal and Annual Performance Indicator (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-17-1: 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. *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 applicants have 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 applicants need further assistance, they can contact the NASA Center POC listed in the opportunity.

III. FUNDING OPPORTUNITY DESCRIPTION

The NASA 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, institutional 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 of 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 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

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

- A. **Fellowship Stipend:** A stipend should cover a Fellow's living expenses. Stipend payments should be prorated evenly across a ten-month academic school year.
- B. **Tuition and Fees Allowance:** Permissible up to the maximum value. While the student is funded as a result of selection from the NASA Fellowship Activity solicitation, the university must exempt the student from paying the difference between the tuition and fees allowance and the actual tuition and fees.
- C. **CBRE Allowance:** This allowance is to be used to support travel and other expenses associated with the CBRE 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, and the last payment should be released after the successful completion of the 5th week of the CBRE. The NASA Training Grants reporting process requires institutions to submit receipts for all financial transactions, and organizations should require receipts for all travel-related expenses.
- D. **Health Insurance Allowance:** Permissible up to a maximum value, only to the level of the actual expected cost.
- E. **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, various research-related topics with the team and to explore additional research opportunities with NASA. Domestic travel requirements are found in Appendix F.

F. **Fellow Professional Development Allowance:** This allowance may be used in direct support of training, research, technical, scientific, and publication needs of the Fellow. This allowance can be used in concurrence with the Faculty Adviser Allowance to cover approved Fellowship Fellow domestic travel to technical and scientific meetings. Each Fellow is expected to attend at least one technical conference to present the work he or she is conducting under the awarded research proposal. All technical conferences shall follow procedures for approval by the NASA Fellowships Manager. The cost of travel is on U.S. General Services Administration rates, (<https://www.gsa.gov/travel/plan-book/per-diem-rates>).

1. Professional research, graduate student and minority-serving conferences, symposiums, and workshops:
 - a) Registration Fees
 - b) Maximum three nights in a hotel per event
 - c) Per diem 3 full days two ½ days
 - d) Travel cost to and from event
 2. Publication costs for conference presentation material, related research papers, thesis, and dissertation.
 3. Training for professional required skills such as software training.
- Equipment, including computers, may not be purchased with NASA funds. Furthermore, 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.

With the exceptions of the Faculty Advisor Allowance and the Tuition Offset and Fees, transfer of funds between budget categories is not allowed.

The NASA Fellowship Activity is a fellowship to support graduate education and does not provide funding for institutional overhead/indirect costs.

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 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 before August 31, 2018;
- Have a minimum 3.0 GPA on a 4.0 scale;
- Be enrolled in a full-time Master's or Doctoral degree program no later than September 1, 2018;
- Intend to pursue a research-based Master's or Doctoral program in a NASA STEM- relevant field (see Appendix B);
- Have a projected degree plan for continuous full-time enrollment equal to or greater than May 2021;
- Have not completed credits exceeding what is listed in the Academic Eligibility Requirements chart.

Credit and Enrollment Eligibility Requirements Chart

Degree Program	Number of graduate credits earned by May 31, 2018	The student's degree plan is continuous and full-time for a minimum of 2 years after September 1, 2018.	Is the student eligible for an award?
Master's	≤ 24 credits or 36 quarter credits	yes	Yes
Master's	≤ 24 credits or 36 quarter credits	no	No
Master's	> 24 credits or 36 quarter credits	no	No
Master's	> 24 credits or 36 quarter credits	yes	No
* Dual	≤ 24 credits or 36 quarter credits	yes	Yes
* Dual	> 24 credits or 36 quarter credits but before a Master's degree is confirmed	yes	Yes
* Dual	> 24 credits or 36 quarter credits but after a Master's degree is confirmed	yes	No
* Doctoral	≤ 24 credits or 36 quarter credits beyond a Master's degree	Yes	Yes
* Doctoral	> 24 credits or 36 quarter credits beyond a Master's degree	yes	No
* Direct Doctoral	≤ 48 credits or 72 quarter credits	yes	Yes
* Direct Doctoral	> 48 credits or 72 quarter credits	yes	No
<i>All credits including research credits are included in the overall credit count.</i>			

* A Dual degree program is defined as a program where a student works towards satisfying the academic requirements for two distinct degree types, a Master's and Doctoral, in an integrated fashion.

* A Doctoral degree program is defined as a program where a Master's confirmed student enters a Doctoral program.

* A Direct Doctoral degree program is defined as a program where a bachelor's degree student enters a Doctoral program without enrolling in a Master's program and will only be confirmed a Ph.D.

- Students are not eligible to apply if they have been awarded a Doctoral Degree in a STEM field (see Appendix B for additional information).

- Students are eligible to apply if they have been awarded a Master's and/or a Doctoral Degree in a non-STEM degree. Examples are M.A., M.A.Ed., or M.B.A.
- Meet all other eligibility requirements as set forth in the current NRA.
- Applicants are strongly encouraged to inform NASA immediately if they received/accepted a Federal fellowship or traineeship from another agency.

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 and/or the Department Chair at the prospective university in assembling and submitting a 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 a NASA-specific STEM discipline. Please refer to Appendix B for more information.

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 2018.

VI. PROPOSAL and SUBMISSION INFORMATION

No more than one NASA Fellowship Activity 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 and will not be reviewed.

Each proposal shall address a NASA Fellowship Activity research opportunity and have a NASA Center researcher's concurrence.

The NASA Fellowship Activity proposal submission process may have two phases: Phase I is the proposal submitted by the PI and/or the Authorizing Official Representative (AOR) on 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 for the selected proposers that utilized the **"NASA Ames Fellowship Proposal Submission Office"** as the AOR in phase I. 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 Fellowship Activity Page.

All information needed to apply to this solicitation is contained in the companion documents and the *NASA Guidebook for Proposers – 2017* available at <http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2017.pdf>.

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 Fellowship Activity, which includes general information about NASA or NASA assets, and may refer proposers to a specific part of Appendix D or a 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.
- As part of the proposal package, the Faculty Adviser/PI shall provide a Curriculum Vitae (CV) no longer than three pages in length, which includes the following information:
 1. Name
 2. Current position
 3. Title
 4. Department
 5. University address
 6. University phone number
 7. Principal publications (within the last three years)
 8. Relevant career experience
 9. Research
 10. Awards
 11. Scholarships
 12. 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 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 who do not have a PI or AOR:* If an applicant has not yet been accepted into the university of his or her choice and thus does not have a PI or AOR associated with the academic institution for the Phase I submission, please select the **"NASA Ames Fellowship Proposal Submission Office"** as the applicant's organization. If selected for a Phase II Submission, the 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 Fellowship Activity 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 Ames Fellowship Proposal Submission Office"** by the deadline listed. Phase I proposals shall be received by 5:59 p.m. E.T. or 2:59 p.m. P.T. on March 20, 2018. Proposals received after this deadline will not be accepted.

1. Detailed instructions for submitting electronic proposals are located at <http://nspires.nasaprs.com>.

a) Click on Solicitations

- b) Click on Open Solicitations
- c) Use any keywords to select: **NASA Education Fellowship Activity**; 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 shall 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 Modern (LaTeX) font
- the 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). The statement shall include information about the benefits of a partnership with NASA by addressing the impact of such an award on both the fellowship candidate professionally and the institutional research capacity. The statement shall have specific information on the need for NASA participation in the research due to NASA-unique facilities, personnel, and institutional knowledge. It shall not exceed two pages, 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 (limited to three pages in length).
- d) **Project Description:** This proposal section shall be titled “Project Description” and shall not exceed six (6) 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 begin with a brief abstract summarizing the scientific problem to be addressed, the proposed science plan, your methodology, and expected results. The Project Description follows the order below and contain the following technical elements:
- 1) A statement of problem to be addressed;
 - 2) A description of the science background and relevance to previous work in the field;
 - 3) General methodology (procedures to be followed, and timeline for completion of each step);
 - 4) Explanation of new or unusual techniques;
 - 5) Expected results and their significance or application;
 - 6) Literature citations, where appropriate.
- e) **Candidate’s Degree Program Schedule:** This schedule shall state the proposed start and completion dates, expected course schedule, as well as anticipated milestones of the fellowship candidate’s degree program such as Candidacy Exams. There is no standard format for this section. This section shall be titled “Degree Program Schedule” and shall not exceed two pages.
- f) **Candidate’s Curriculum Vitae (CV):** (limited to two pages in length)
- 1) Name
 - 2) Current Academic Level
 - 3) Title
 - 4) Department
 - 5) University address
 - 6) University phone number
 - 7) Relevant career experience
 - 8) Research
 - 9) Awards
 - 10) Other relevant accomplishments
- g) **Candidate’s Personal Statement:** How do you envision graduate school preparing you for a career that allows you to contribute to expanding scientific understanding and its application to NASA’s Missions? Page limit two pages

Describe your personal, educational and/or professional experiences that inspire and motivate your decision to pursue advanced study in science, technology, engineering or mathematics (STEM) in NASA-related research. Include specific examples of any research and/or professional activities in which you have participated. Present a concise description of the activities, highlight the results and discuss how these activities have prepared you to seek a graduate degree. Specify your role in the activity including the extent to which you worked independently and/or as part of a team. Describe the contributions of your activity to advancing knowledge in STEM fields as well as the potential impacts in NASA Missions.

- h) **Candidate's Transcripts:** Transcripts that cover the fellowship candidate's undergraduate and graduate years shall be included. These shall be legible and unaltered. 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) before submission. These redactions are the only permitted alterations to a transcript.
- i) **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 these letters are a critical component of the proposal, failure to submit these letters will likely negatively affect the evaluation of the proposal.
 - 1) 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.)
 - 2) 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.

NOTES:

*A Letter of Recommendation from a NASA civil servant or Jet Propulsion Laboratory (JPL) employee is not required for a successful application. There may be instances where a Letter of Recommendation from a NASA civil servant or JPL employee is appropriate (i.e., the applicant completed an internship at a NASA Center); however, no more than one letter from a NASA civil servant or JPL employee will be permitted as part

of the application package sent on for review. Moreover, NASA civil servants and JPL employees submitting Letters of Recommendation should not presume that they would be assigned as the student's NASA Technical Adviser research collaborator.

****If a NASA civil servant or Jet Propulsion Laboratory (JPL) employee provides a Letter of Recommendation they cannot provide the Letter of Concurrence for the proposal package.**

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

- j) **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 (must be a NASA civil servant or Jet Propulsion Laboratory (JPL) employee) 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.

NOTE:

* If a NASA civil servant or Jet Propulsion Laboratory (JPL) employee provides a Letter of Concurrence they cannot provide the Letter of Recommendation for the proposal package.

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

Phase I Proposal Submission Deadline: 5:59 p.m. E.T. (2:59 p.m. P.T.), currently on March 20, 2018. 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 Fellowship Activity.

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 Ames 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 for a proposal to move forward through the evaluation 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 May 31, 2018).

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:

Pre-proposal teleconferences will be held on:

- January 24, 2018, at 4:00 p.m. E.T. or 1:00 p.m. P.T
- January 30, 2018, at 5:00 p.m. E.T. or 2:00 p.m. P.T
- February 5, 2018, at 10:00 a.m. E.T. or 7:00 a.m. P.T.

During these teleconferences, 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 for the opportunity. Refer to the NASA Fellowship Activity 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 February 28, 2018, so 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 a letter of support or a letter of 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 each fellowship candidate’s proposal application:

Academic Merit and Distinction. Based upon the review of the fellowship candidate’s transcripts, impact statement, letters of recommendation and candidate’s CV, 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 panel review of Phase I proposals, NASA technical expert, and program managers will complete a technical review of proposals and make final selections for participation in this program. Selections will be based on the results of the panel review, technical review, the NASA Center’s selection and approval of the NASA Office of Education Funding Managers. For NASA Fellowship Activity 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)

Before making a Federal award with a total amount of Federal funding greater than the simplified acquisition threshold (currently \$150,000), NASA 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 a Federal awarding agency 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 2018 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 non-NASA sources.

C. Cancellation of Announcement:

NASA reserves the right to not make any awards under this NRA and to cancel any or all aspects of 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.

D. Period of Performance:

All awards are made for a one (1) year period 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 the 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 program management in May 2019.

E. 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 Fellowships Activity awards.
3. This award cannot be transferred to another institution. If Fellow transfers to a different institution during the award period, the Fellows shall reapply to the program and follow the guidelines for a new fellowship candidate, submit a proposal application, and compete for any future NASA Fellowship Activity awards.

F. 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).

G. Access to NASA Facilities

Award recipients that have individuals working under the award who require access to NASA facilities and/or systems shall promptly 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

The outcome of the NASA Fellowship activity is to foster the new generation of highly skilled scientists and engineers in the critically important area of STEM research in core competencies of NASA missions. These students are required to participate in program activities designed to help the student grow professionally.

- A. The Fellow shall participate in the Professional Development activities listed in Appendix F. If a Fellow does not participate in these activities, the fellowship will not be renewed.

- B. The Fellow will submit a detailed research report will be compiled at the end of each academic year.
- C. The Center Based Research Experience (CBRE) is a mandatory requirement of the program. If a Fellow does not to participate in the CBRE, the fellowship will not be renewed, and the stipend for the CBRE will be withheld.
- D. The Fellow must receive a positive CBRE evaluation from the NASA Technical Advisor. If not, the fellowship will not be renewed for the next year.
- E. Each Fellow shall publish one peer review paper by the end of the training grant's performance period. Presentation at a scientific conference will also be encouraged depending on the outcome of the research effort.

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 Fellowship Activity 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	TO = TECHNICAL OFFICER
IPO = INDUSTRIAL PROPERTY OFFICER	GO = NASA GRANT OFFICER
CASI = CENTER FOR AEROSPACE INFORMATION	UAO = UNIVERSITY AFFAIRS OFFICER
NTO = NEW TECHNOLOGY OFFICE	HHS/PMS = HEALTH AND HUMAN SERVICES
CC = CLOSEOUT CONTRACTOR	PAYMENT MANAGEMENT SYSTEM
PO = PATENT COUNSEL OFFICE	STIO = SCIENTIFIC & TECHNICAL INFORMATION
FMO = FINANCIAL MANAGEMENT OFFICE	OFFICE

Interim Reports	
Report	Action Required By:
Quarterly Federal Cash Transactions Report (SF 425) 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.	HHS/PMS
Progress Reports (<i>Required for all Grants and Cooperative Agreements.</i>) (Not required if performance period is less than one year.) <i>Submit with annual NASA Fellowship Activity renewal report.</i> Official transcripts are requested by the fellowship candidate and sent as part of the annual progress report. Submit to the Program Manager by the due date on the notice of award document. Report Due: Annually, 60 days prior to the anniversary date of the grant/cooperative agreement (except final year). (<i>Ref. 1800.902</i>) Submit to the Program Manager and Grants Officer.	TO, GO, NTO

Notification of Decision to Forego Patent Protection (Required for all Grants and Cooperative Agreements). 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)	PO, TO, GO
Election of Title to a Subject Invention: (Required for all Grants and Cooperative Agreements). 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 the Program Manager and Grants Officer.	PO, TO, GO
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.) Report Due: No later than October 15 of each year. NOTE: Negative reports are not required. (Ref. 1800.907)	FMO, IPO
Final Reports	
Properly Certified Final Federal Cash Transaction Report, SF 425 (Required for all Grants and Cooperative Agreements) Report Due: Within 90 days after the expiration date of the grant/cooperative agreement. (Ref. 1800.906) Submit to the Project Manager and Grants Officer.	FMO, GO
Summary of Research (Required for NASA Fellowship Activity 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 the Project Manager and Grants Officer.	CASI, TO, GO, NTO, STIO

*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, non-exclusive 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
202-479-9030 x413
NASA.Fellowships@nasaprs.com

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. Director, NASA Internships and Fellowships

- Carolyn Knowles
Director, NASA Internships and Fellowships
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

Total ESTIMATED annual budget for each NASA Fellowship Activity	\$50K (Masters)/ \$55K (Doctoral)
Number of new awards	Pending adequate proposals of merit and available funding
Start date of award (estimated)	September 1, 2018
Duration of awards	Up to 3 years depending on funding
Award type	Training Grant
Solicitation Release Date	January 17, 2018
Pre-proposal Teleconference: To join the meeting via the web: TBD The telecom number is 1-844-467-6272 and the passcode is 993012.	January 24, 2018, at 4:00 p.m. E.T. or 1:00 p.m. P.T. January 30, 2018, at 5:00 p.m. E.T. or 2:00 p.m. P.T. February 5, 2018, at 10:00 a.m. E.T. or 7:00 a.m. P.T.
Due date for Phase I Proposals	March 20, 2018, at 5:59 p.m. E.T. or 2:59 p.m. P.T.
Due date Phase II Applications	Currently, May 31, 2018, at 11:59 p.m. E.T. or 12:00 p.m. P.T.
Public announcement of awards	Estimate six months after solicitation closes
Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers 2017 Edition</i> at http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2017.pdf .
Submission medium	Electronic proposal submission is required via NSPIRES; no hard copy will be accepted. See Chapter 4 of the <i>NASA Guidebook for Proposers</i> (available at http://www.hq.nasa.gov/office/procurement/nraguidebook/).
Website 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, NASA Internships and Fellowships NASA Office of 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: Eligibility Information

Described in detail below are the eligibility requirements for the NASA Fellowship Activity:

To be eligible to receive a NASA 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 before August 31, 2018;
- 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 1, 2018.
- Intend to pursue a research-based Master's or Doctoral program in a NASA STEM- relevant field (see Appendix B for additional information);
- Have a projected degree plan for continuous full-time enrollment up to or after May 2021;
- Have completed no more credits than listed in the Academic Eligibility Requirements chart (Immediately below).

Credit and Enrollment Eligibility Requirements Chart

Degree Program	Number of graduate credits earned by May 31, 2018	The student's degree plan is continuous and full-time for a minimum of 2 years after September 1, 2018.	Is the student eligible for an award?
Master's	≤ 24 credits or 36 quarter credits	yes	Yes
Master's	≤ 24 credits or 36 quarter credits	no	No
Master's	> 24 credits or 36 quarter credits	no	No
Master's	> 24 credits or 36 quarter credits	yes	No
* Dual	≤ 24 credits or 36 quarter credits	yes	Yes
* Dual	> 24 credits or 36 quarter credits but before a Master's degree is confirmed	yes	Yes
* Dual	> 24 credits or 36 quarter credits but after a Master's degree is confirmed	yes	No
* Doctoral	≤ 24 credits or 36 quarter credits beyond a Master's degree	Yes	Yes
* Doctoral	> 24 credits or 36 quarter credits beyond a Master's degree	yes	No
* Direct Doctoral	≤ 48 credits or 72 quarter credits	yes	Yes
* Direct Doctoral	> 48 credits or 72 quarter credits	yes	No
<i>All credits including research credits are included in the overall credit count.</i>			

* A Dual degree program is defined as a program where a student works towards satisfying the academic requirements for two distinct degree types, a Master's and Doctoral, in an integrated fashion.

* A Doctoral degree program is defined as a program where a Master's confirmed student enters a Doctoral program.

* A Direct Doctoral degree program is defined as a program where a bachelor's degree student enters a Doctoral program without enrolling in a Master's program and will only be confirmed a Ph.D.

- Students are not eligible to apply if they have been awarded a Doctoral Degree in a STEM field (see Appendix B for additional information).

- Students are eligible to apply if they have been awarded a Master's and/or a Doctoral Degree in a non-STEM degree. Examples are M.A., M.A.Ed., or M.B.A.

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

Note: 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 programs that are patient-oriented research; epidemiological and behavioral studies; outcomes research; and 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 Fellowship Activity 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 Ames 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, following these steps:
 - a. Faculty Adviser logs into NSPIRES
 - b. Select "Proposals" link
 - c. Click "Create Proposal" button on right side
 - 1) Select "Solicitation" and click "Continue"
 - 2) Select "NASA Fellowship Activity" and click "Continue"
 - 3) 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"
 - 4) Link the proposal to the submitting organization, and click "Continue"
 - 5) The system will display "Submitting Organization Information" for verification. Click "Continue."
 - 6) Click "Save"
 - d. On "View Proposal" page (the Faculty Adviser is identified as the PI for the proposal.)
 - 1) Select "Business Data" link in "Proposal Cover Page"
 - 2) Click "Edit" to complete information in each field and click "Save"
 - 3) Click "OK"
 - 4) On "View Proposal" page, select "Proposal Team" link
 - a) Click "Add Team Member"
 - b) Enter Fellowship candidate's name and click "Search" for the Member (Fellowship candidate) – system will display search results.
 - c) Select the correct Fellowship candidate, and click "Continue"
 - d) On "Team Member" page, Assign Role/Privileges
 - e) Select "Graduate/Undergraduate Role" from the pull-down menu.
 - f) Grant Fellowship candidate "Edit" privileges by selecting:
 - "Proposal Summary"
 - "Program Specific Data"
 - "Proposal Attachments"
 2. Select "No" to the two questions that follow the section entitled "U.S. Government Agency & International Participation"
 3. Click "Save"
 4. Click "OK"
- Faculty Adviser MUST Logout of NSPIRES

Step 3

1. Fellowship candidate logs into NSPIRES. At initial log on, the Fellowship candidate must follow these steps:
 - a. Under “Reminders/Notifications,” click “Need Graduate/Undergraduate
 - b. Fellowship candidate Confirmation for Proposal: [proposal title] for Solicitation NASA Fellowship Activity Fellowships” link
 - c. On “Team Member: Participation Confirmation” page, Fellowship candidate should read and click “Continue”
 - d. On “Team Member Profile” page, click “Link Relationship”
 - e. On “Team Member: Organizational Relationship” page, go to “Link Proposal to a Non-SAM Organization” – enter your institution name, click button, and click “Save”
 - f. On “Team Member Profile” page, verify information and click “Continue,” which will take you to “View Proposal” page. On “View Proposal” page:
 - 1) 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”
 - 2) 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”
 - 3) Proposal Attachments
 - a) Click “Add”
 - b) Select “Proposal Document” as “Attachment Type” from the drop-down list
 - c) Browse and select your proposal document (see Note 1)
 - d) Click “Upload” and click “OK”
 - 4) Fellowship candidate MUST Logout of NSPIRES

Note 1: 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. The document must include:

Components	Maximum
• Impact Statement	2 pages
• Faculty Adviser/PI Curriculum Vitae (CV)	3 pages
• Project Description	6 pages

• Degree Program Schedule	2 page
• Candidate's Curriculum Vitae (CV)	2 pages
• Personal Statement	2 pages
• Transcripts	N/A
• Letters of Recommendation (3)	N/A
• Letter of Concurrence – NASA Technical Adviser	1 page

NOTE: “Complete Proposal” section (“Generate” button enables you to review your proposal in the 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.

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
 - a) Select the “Proposal Title” to be released
 - b) On “View Proposal” page
 - c) Click “Release to Org” button
 - d) Click “Release”
 - e) Click “OK” [If the Faculty Adviser has additional Fellowship proposals to release, repeat process]
 - f) If the Faculty Adviser has no additional Fellowship proposals to release, Logout 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 ET.

Appendix D: NASA Education AS&ASTAR Fellowship Opportunities by Center
Updated 01/17/2018

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

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

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

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

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

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

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

If you have questions about any of the following opportunities at Goddard Space Flight Center, please contact Raquel Marshall at Raquel.H.Marshall@nasa.gov or 301-286-1976.

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

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

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

If you have any questions about the following opportunities at Johnson Space Center, please contact Veronica Seyl at veronica.l.seyl@nasa.gov or 281.483.5110.

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

If you have questions about any of the following opportunities at Kennedy Space Center, please contact Priscilla Moore at priscilla.m.moore@nasa.gov or 321.867.8507.

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

If you have questions about any of the following opportunities at Langley Research Center, please contact Gina Blystone, gina.r.blystone@nasa.gov or 757.864.7855.

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

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

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

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

NASA Center	Center Code	Opportunity Title	Opportunity Description/Objective (specific student assignment)	Desired Student Academic Level	Technical Adviser	Technical Adviser's email	Technical Adviser's Phone Number	Co-Technical Adviser's	Co-Technical Adviser's email	Co-Technical Adviser's Phone Number
AFRC-000		Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor			
AFRC-001	ARMD	Active trim shape control for a low boom supersonic commercial transport aircraft	Having an accurate aeroelastic trim shape for a low-boom aircraft under cruise flight condition is essential for future low-boom aircraft design to ensure a minimum error between the computed aeroelastic trim shape and target trim shape, which the computation of sonic boom level is based on. First, the outer-mold-line configuration of an aircraft is designed for the desired aerodynamic performance. However, aerodynamic loads computed using the outer-mold-line configuration causes structural deformation due to the flexibility of the structure. Next, these structural deformations change the aircraft configuration for the aerodynamic load computation and it affects the structural deformation again. Therefore, a jig-shape optimization is used during the design of a low-boom supersonic aircraft. However, trim shapes are not matched to the target trim shapes during actual flight due to uncertainties in aeroelastic model. These trim shape errors during flight can be minimized during flight through the use of active control technique once aircraft deformations are measured. Recently, a new deformation computing technique has been developed at NASA AFRC. This technique is based on measured strain data together with Fiber-Optic-Strain-Sensor (FOSS). Therefore, objectives of the this opportunity are as follows: 1) use the aircraft deformation computation scheme in reference by C.-g. Pak. Chan-gi Pak, "Wing Shape Sensing from Measured Strain," AIAA Journal, Vol. 54, No. 3, March 2016, pp 1064 - 1073. 2) apply active trim shape control technique to a low-boom supersonic aircraft (C607 model) reference by C.-g. Pak. Chan-gi Pak, "Jig-Shape Optimization of a Low-Boom Supersonic Aircraft," AIAA SciTech 2018, Kissimmee, Florida, Jan. 8-12, 2018. 3) design a control law(simple PID, gain scheduling, optimum, and/or adaptive) for minimizing error between target and actual trim shape during flight.	Pursuing Doctoral Degree	Chan-gi Pak	Chan-gi.Pak@nasa.gov	661-276-5698			

NASA Center	Center Code	Opportunity Title	Opportunity Description/Objective (specific student assignment)	Desired Student Academic Level	Technical Adviser	Technical Adviser's email	Technical Adviser's Phone Number	Co-Technical Adviser's	Co-Technical Adviser's email	Co-Technical Adviser's Phone Number
ARC-000		Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor			
ARC-001	ARMD	Active Lift Guided Planetary Aerocapture Using Deployable Aerodynamic Decelerator	One critical aspect for future large payload delivery to Mars or human Mars mission is the necessity of employing orbital Aerocapture, followed by precision Entry, Descent and Landing, through deployable aerodynamic decelerator. The ADEPT (Adaptable Deployable Entry and Placement Technology) and HIAD (Hypersonic Inflatable Aerodynamic Decelerator) are two novel NASA planetary entry vehicle concepts, and they can be used for drag generating decelerator as well as thermal protection system. The proposed research opportunity is to develop a real-time hypersonic guidance and control system for planetary Aerocapture by utilizing the aeroshell structure as a controllable effector, thereby to achieve high precision planetary maneuvers. This control effector will enable the lift-guided entry when integrated with an actuation mechanism and real-time guidance algorithm. This research will benefit greatly the overall future planetary mission planning for Mars/Venus and beyond. The specific tasks include (and not limited to): 1) Development of robust flight trajectory planning for Aerocapture; 2) Development of active flight controllers and mechanism for lift/drag modulation; 3) Development of a real-time onboard optimal guidance and control algorithms; 4) Development of a scaled prototype model for concept demonstration.	Pursuing Doctoral Degree	Sean Swei, Ph.D.	sean.s.swei@nasa.gov	650-604-0314			
ARC-002	STMD - TA3	Additive manufacturing of ultralight and high surface area carbon materials for energy storage devices	The objective is to manufacture ultralight and high surface area carbon electrodes through 3D printing techniques, which can significantly expand the design space for fabricating high performance and fully integrable energy storage devices optimized for a broad range of applications.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Yat Li at UC Santa Cruz	yatli@ucsc.edu	
ARC-003	STMD	Additive manufacturing of ultralight and high surface area carbon materials for energy storage devices	The objective is to manufacture ultralight and high surface area carbon electrodes through 3D printing techniques, which can significantly expand the design space for fabricating high performance and fully integrable energy storage devices optimized for a broad range of applications.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Yat Li at UC Santa Cruz	yatli@ucsc.edu	
ARC-004	STMD	Automated Sequential Decision Making under Uncertainty	This opportunity involves conducting research in Automated Sequential Decision Making under Uncertainty methods that are real-time and capable of supporting complex systems operating in challenging environments. In particular, research results are expected to be applied to NASA's exploration missions. Some topics of interest include research on automated results explanation (explainable AI or xAI), decision making for degrading systems, decision making model learning, and decentralized/distributed decision-making under uncertainty.	Pursuing Master's Degree or Pursuing Doctoral Degree	Edward Balaban	edward.balaban@nasa.gov	650.604.5655			
ARC-005	RE	Autonomous Collaboration Within Small Spacecraft Swarms	There is growing interest throughout NASA in developing technologies that will enable "swarm" operations of groups of very small spacecraft operating in low Earth orbit (LEO) and beyond. The selected student will join a research team at NASA Ames Research Center that is currently studying enabling technologies in the broad area of spacecraft attitude determination and control. The student will work in the Generalized Nanosatellite Avionics Testbed (G-NAT) laboratory at NASA Ames, and will have access to two distinct CubeSat-class testbeds that are capable of three degrees of rotational motion. Research topics include: communications between members of a swarm, swarm attitude estimation/determination, and fault-tolerant operations.	Pursuing Master's Degree or Pursuing Doctoral Degree	Matt Sorgenfrei, Code TI	matthew.c.sorgenfrei@nasa.gov	650-604-5714	Jesse Fusco	jesse.c.fusco@nasa.gov	650-604-0057
ARC-006	SMD	Biomaterial Fabrication and Testing	Soliciting independently conceived research projects in the area of design, fabrication, and engineering of biogenic or partially (hybrid) biogenic materials. The primary focus of this research topic is materials which incorporate living cells or in situ biological production, rather than tissue engineering or production of raw feedstock for post-processing (e.g., bioplastics). The goals of interest are novel structural materials, self-diagnosing or self-healing materials, and reactive/tunable materials; however, proposals may focus primarily on design/fabrication technique development within this context. Examples of current areas of research include using 3D cell printing to enable microscale control of material production, fabrication of tunable biocompatible substrates, and using protein design to enhance protein/substrate interactivity.	Pursuing Master's Degree or Pursuing Doctoral Degree	Gentry, Diana M	diana.gentry@nasa.gov	650.604.5441			

NASA Center	Center Code	Opportunity Title	Opportunity Description/Objective (specific student assignment)	Desired Student Academic Level	Technical Adviser	Technical Adviser's email	Technical Adviser's Phone Number	Co-Technical Adviser's	Co-Technical Adviser's email	Co-Technical Adviser's Phone Number
ARC-007	SMD	Building an Automated Science Analysis System for Mars Surface Exploration	We have been developing science analysis systems for future planetary missions. We use innovative techniques, including Raman spectroscopy and image processing, to analyze rock and mineral samples. Resulting data is used to develop automated mineral, sediment and rock classifiers, and to identify biosignatures as part of an automated science analysis system to be used on future rover missions. Students would work to acquire images and Raman (and possibly IR spectra) spectra of our samples and perform hand sample and/or thin section analysis. Other techniques or approaches may also be included as additional instruments become available for use. Students would also work towards improving our automated classifier algorithms and towards building an integrated automated science analysis system. Background in geology, earth or planetary science, computer science, electrical engineering, and/or physics preferred. The potential candidate should have significant experience in successfully analyzing rock samples in hand and thin section, and in Raman and possibly IR spectra; and/or have significant experience in C++, Matlab, Python, and Java programming, signal processing, and machine learning.	Pursuing Masters or Doctoral Degree	Dr. Virginia Gulick	virginia.c.gulick@nasa.gov	650.604.0075			
ARC-008	STMD	Circuit and system design for self-healing electronics	The radiation-induced failure in electronics aboard a satellite and spacecraft can lead not only to mission failure but also the deorbit plan. In order to mitigate such risks, self-sustainable and self-healing electronics system have been proposed, conceptually similar to the human immune system. In this project, the candidate would design ASIC circuit, which would monitor the aging/degradation activity and then self-heal any radiation-induced damage appropriately, with no increase in size or footprint and negligible increase in weight. The proposed technology can benefit other space electronics programs including larger class of satellites. The component should include integrated heater, temperature monitor, device aging monitor, healing controller. The successful candidate may offer not only the ground test but also a flight test.	Pursuing Doctoral Degree	Jin-Woo Han	jin-woo.han@nasa.gov	650-604-3982	M. Meyyappan	m.meyyappan@nasa.gov	650-604-2616
ARC-009	SMD	Developing Collaborative Interactive online web tools for Mars Surface Science	This project aims to go beyond our original crowdsourcing websites Mars Clickworkers and HIRISE Clickworkers site to a new level of collaborative science. This project involves developing intuitive, online science analysis tools for use by both scientists and the public. Tools will have a Mars geology emphasis, so significant experience and interest in working with Mars, Earth and other planetary data sets is strongly desired. The successful candidate needs to also have significant experience in web tools development and user-friendly web design, and in programming in JAVA, PHP, Python or similar language. Students with computer science, geology, planetary science, or geography backgrounds would be preferred. However, strong web tools developer, designer and image processing skills are a must.	Pursuing Masters or Doctoral Degree	Dr. Virginia Gulick	virginia.c.gulick@nasa.gov	650.604.0781			
ARC-010	ARMD, SMD, HEOMD	Discovery of Governing Physical Laws using machine learning	We are continuously collecting more and more data of many natural and man-made systems. Nonetheless, our theoretical understanding of how these systems work is lacking. The manual modeling of such systems (e.g. using differential equations) demands a lot of human resources and more automated approaches are desirable. Data-driven discovery of governing physical laws have many applications including neuroscience, climate science, biology, and prognostics & diagnostics. We are interested in any research related to developing and utilizing data-driven approaches to discover physical laws of how these system work; the following are of special interests: (1) methods that produce models closer to what domain experts would understand (e.g., differential equations), and (2) Learning that utilizes existing physics-based models and uses machine learning to fill in the gaps, or perhaps uses a mixture-of-experts type method to improve both the physics-based models and the machine learning models, and keeps track of the regimes in which each one performs best.	Pursuing Master's Degree or Pursuing Doctoral Degree	Nikunj Oza	nikunj.c.oza@nasa.gov	(650)604-2978	Hamed Valizadegan	hamed.valizadegan@nasa.gov	(650)604-6522

NASA Center	Center Code	Opportunity Title	Opportunity Description/Objective (specific student assignment)	Desired Student Academic Level	Technical Adviser	Technical Adviser's email	Technical Adviser's Phone Number	Co-Technical Adviser's	Co-Technical Adviser's email	Co-Technical Adviser's Phone Number
ARC-011	ARMD	Distributed Robotic Fault Detection and Identification Technology for Very Large Flexible Space Structures	The expansion of future human presence into the solar system and beyond requires the creation of large-scale space structures that would provide basic operational and functional needs in space. One class of materials that has recently been considered for such application is the digital composite metamaterials. These are made of a large number of physical components, but with a small number of distinctive part types. These can be assembled into a large aerostructure that has repetitive patterns. One critical challenge in operating a large-scale flexible space structure is the ability to monitor the structural integrity and identify fault when it occurs. Therefore, the proposed research opportunity is to develop an active, distributed, robotic, reconfigurable sensing system that can be integrated with onboard autonomous fault detection, isolation and recovery algorithm, so as to ensure overall system safety and reliability, and provide a comprehensive health monitoring and maintenance solution for large space structures. The specific tasks include (and not limited to): 1) Development of embedded structural modal analysis algorithm and hardware; 2) Development of structural fault/failure detection algorithms; 3) Development of distributed robotic sensor networking; 4) Determination of proximity of influence for fault detection; 5) Development of scaled structure prototype to demonstrate the concept.	Pursuing Master or Doctoral Degree	Sean Swei, Ph.D.	sean.s.swei@nasa.gov	650-604-0314	Kenneth Cheung, Ph.D.	kenny@nasa.gov	650-604-0300
ARC-012	SHEOMD - Space Medicine	Electrochemical sensors for detection of space-flight-relevant biomarkers.	The objective is to develop electrochemical DNA sensors for detection of troponin and other biomarkers in complex fluids, which is related to the space medicine. The DNA based biosensors can potentially enable robust and highly selective detection with low power, and compact instrumentation.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Tao Ye at UC Merced	tye2@ucmerced.edu	
ARC-013	STMD - TA3	Electrolytes enable the use of energy storage devices at extreme temperatures	The objective is to develop new electrolytes that allow energy storage devices operate at extreme temperatures observed in extraterrestrial environments (from -160°C to 450 °C). The student will develop liquid based organic electrolytes with low freezing points and viscosity at low temperature ranges, as well as solid state electrolytes that can be used at high temperatures.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Yat Li at UC Santa Cruz	yatli@ucsc.edu	
ARC-014	SMD	Experimental and Directed Evolution: Top-Down Astrobiology and Bioengineering	Soliciting independently conceived research proposals using experimental and/or directed evolution to address questions in astrobiology, space biology, or related ecology-environment interactivity areas. Potential goals include identifying mechanisms of surviving or thriving in extreme environments, improving performance of bio-assisted resource extraction or recycling, and automating the simulation and measurement of microbe/microenvironment interactions. Student areas of focus may be traditional micro- and molecular biology or traditional mechanical/electrical/chemical engineering, but preference will be given to proposals incorporating background or experience in both. Current areas of active research include baseline bioscience experiments (microbial survival assays, sequencing), development of automated culture and exposure systems (sensor selection, fluidics fabrication, software control, experimental interface design), and design and implementation of biogeochemical experiments (UV irradiation, thermal stress, heat shock, freeze/thaw cycles, peroxide/pH exposure).	Pursuing Master's Degree or Pursuing Doctoral Degree	Gentry, Diana M	diana.gentry@nasa.gov	650.604.5441			
ARC-015	ARMD, SMD	Explainable Machine Learning for Autonomy	This opportunity is in the broad area of research in explainable machine learning. Machine Learning (ML) and in specific, Deep Learning has made significant progress towards human level intelligence in a variety of tasks and is an important driver in many of NASA's thrust areas. However, one of the major drawbacks of some of these powerful ML models is the black-box nature of its construction and working. To realize the true value of ML in autonomy applications such as self-driving cars, drones and air traffic management, the ML models must be able to provide adequate explanations for various aspects of the model including the learned knowledge, knowledge representations, decision making and response to adversaries. This opportunity will explore ways to develop explainable machine learning models with applications to problems that are of relevance to NASA such as path planning, scene understanding, activity recognition for aeronautics, Earth science missions and autonomous rover operations. The fellow will be expected to interact with the Data Sciences group at NASA Ames Research Center.	Pursuing Master's Degree or Pursuing Doctoral Degree	Nikunj Oza	nikunj.c.oza@nasa.gov	(650)604-2978	Vijay Janakiraman	vijaymanikandan.janakiraman@nasa.gov	(650)604-0649

NASA Center	Center Code	Opportunity Title	Opportunity Description/Objective (specific student assignment)	Desired Student Academic Level	Technical Adviser	Technical Adviser's email	Technical Adviser's Phone Number	Co-Technical Adviser's	Co-Technical Adviser's email	Co-Technical Adviser's Phone Number
ARC-016	SMD	Explaining resilience of forest ecosystems through deep learning assisted causal inferencing	Tropical forests are the largest reserves of terrestrial carbon. Therefore, it is essential to be able to forecast the future of these forests in the face of changing climate and increasingly frequent extreme weather events. Machine learning based modeling of such ecosystems have had varying levels of success in trying to capture the causal dynamics of these complicated living systems. This opportunity is in the area of developing a deep learning assisted causal inferencing engine for ecological phenotyping of tropical rainforests such as the Amazon. The fellow will be expected to work on cutting edge machine learning research in collaboration with domain scientists to come up with answers to some of the toughest questions regarding the future of the biggest ecosystems on Earth.	Pursuing Master's Degree or Pursuing Doctoral Degree	Nikunj Oza	nikunj.c.oza@nasa.gov	(650)604-2978	Kamalika Das	kamalika.das@nasa.gov	(650)604-0449
ARC-017	SMD	Fog/Cloud Water Aerobiological Investigations	Soliciting independently conceived research proposals in the topic area of the microbiology of fog water, cloud water, aerosols and the atmosphere. Student focus may be direct biological study (e.g. population identification), the relevant environment (e.g. biochemical energy availability, origin tracking by dust mineral identification), or supporting instrumentation (e.g., low-cost sterile sample collection), but proposals are encouraged to address all three sub-areas. Proposals should include at least some planned work with samples collected from above ground level (>10 m). Current areas of active research include coastal California fog population identification, testing sample collection from UAVs, and balloon flights exploring the effects of high-altitude radiation on microbial survival.	Pursuing Master's Degree or Pursuing Doctoral Degree	Gentry, Diana M	diana.gentry@nasa.gov	650.604.5441			
ARC-018	ARMD	Hybrid Rocket Motor Efficiency Test	We are exploring the utility of applying hybrid rocket motor technology to small spacecraft primary propulsion systems that have rigorous size constraints. In effect, we are looking to increase the efficiency of small, short hybrid rocket motors with large diameters. The student will be expected to come up with an idea to increase the motor efficiency, modify an experimental apparatus to conduct tests, take data with the apparatus, calculate results and determine the meaning of the results. The student must be familiar with general hybrid rocket theory, basic engineering equipment, at least one coding language, FLIR infrared cameras and FLIR's ResearchIR program.	Pursuing Master's Degree	Laura Simurda	laura.simurda@nasa.gov	6506046697			
ARC-019	STMD	Inkjet printable organic infrared photosensor	This project aims to advance a printable shortwave infrared photosensors by using a new generation of narrow bandgap conjugated polymers. The polymer semiconductors are processed by solution processing techniques and allow printing deposition to bypass the limitations of die transfer and bonding in conventional devices, which are not scalable and prohibitively expensive for wide-area deployment. The proposed research will involve fabrication of photosensors and device characterization to identify the fundamental constraints in the exciton dissociation and charge collection processes as polymer bandgaps are reduced. The resulting knowledge will be essential to theoretical efforts to rapidly predict better photo-active polymers and is applicable not only to infrared sensing applications but also to other areas including photovoltaics, with the advantages of light-weight, large-area coverage, and on-demand fabrication for space applications. If successful, the proposed research will provide understandings of the fundamental properties necessary to pioneer the utility of organics into the shortwave infrared spectrum now completely dominated by inorganic materials.	Pursuing Doctoral Degree	Jin-Woo Han	jin-woo.han@nasa.gov	650-604-3982	M. Meyyappan	m.meyyappan@nasa.gov	650-604-2616
ARC-020	ARMD	Intelligent Monitoring of the National Airspace	The National AirSpace (NAS) is getting increasingly complicated with more traffic, advanced automation, autonomy, and transformational vehicle designs. With the explosion in availability of data from the NAS from the flight level to the airspace level, machine learning and data mining based approaches promise to offer a scalable solution to aviation systems monitoring. To this end, this opportunity seeks novel ideas and approaches based on scalable machine learning and data mining that address the problems of current and future aviation monitoring for both performance and safety. Some key problems within the safety monitoring include digesting large volumes of data that are heterogeneous, multimodal, hierarchical (data at several levels such as engine, flight, flight procedures, sector space, center space and the NAS) and temporal. Some important needs include being able to digest large volumes of data, offer accurate predictions, offer novel insights, explain decision making, and be interpretable to gain the trust of operators. The project will be valuable in getting insights on some of the key risks in design and deployment of new aviation procedures and vehicles, understanding interactions of autonomous agents and drones, and designing future monitoring and decision support tools for assisting humans as well as autonomous systems in the NAS.	Pursuing Master's Degree or Pursuing Doctoral Degree	Nikunj Oza	nikunj.c.oza@nasa.gov	(650)604-2978	Vijay Janakiraman	vijaymanikandan.janakiraman@nasa.gov	(650)604-0649

NASA Center	Center Code	Opportunity Title	Opportunity Description/Objective (specific student assignment)	Desired Student Academic Level	Technical Adviser	Technical Adviser's email	Technical Adviser's Phone Number	Co-Technical Adviser's	Co-Technical Adviser's email	Co-Technical Adviser's Phone Number
ARC-021	ARMD, HEOMD	Knowledge transfer from simulations	This opportunity is about using simulators as data generators for machine learning. Simulations based on first principles are an important component of several NASA missions including aeronautics, Earth science, Space science, Biology etc. However, first-principle models do not always capture the real-world effects such as noise, environmental variability, human-machine interactions, operational procedures, and other higher order effects. In spite of this, first-principles based simulations are invaluable to concept generation, evaluation and testing of design prototypes, doing preliminary analysis, validation, etc. On the one hand, simulators can be used to generate infinite data about the system but when used to build machine learning models, the models may fail on real-world situations. On the other hand, real-world effects may be observed by similar systems in operation, but data availability may be low. This opportunity will explore ways to learn a system model for real-world operation by combining the system level data from the simulator and real-world data from similar operations. Some examples of simulators include an aircraft, airspace, a video game, a biological system etc. Relevant ideas include transfer learning and domain adaptation. The fellow will be expected to interact with the Data Sciences group at NASA Ames Research Center.	Pursuing Master's Degree or Pursuing Doctoral Degree	Nikunj Oza	nikunj.c.oza@nasa.gov	(650)604-2978	Vijay Janakiraman	vijaymanikandan.janakiraman@nasa.gov	(650)604-0649
ARC-022	ARMD, SMD, HEOMD	Learning System Operators	Several NASA-relevant systems/missions, such as space exploration missions, Earth science airborne missions, and the National Airspace (NAS), include multiple humans and systems, all with various utilities that should be jointly optimized. In case of systems there are multiple utilities involving various levels within the system (e.g., system, subsystem, and component level operations, maintenance, resource utilization) and multiple time scales (e.g., tactical, strategic, system lifetime). Current operations attempt to jointly optimize across these utilities, but not necessarily in a rigorous way. These operations are performed largely based on some combination of fixed checklists and intuition. We solicit proposals for artificial intelligence algorithms to learn from past operations and known utility measures, such as duration of operations, maintenance costs, and resource costs. These algorithms should be able to derive "controllers" that are able to specify the best actions that the humans, systems, subsystems, and components should take to jointly optimize across the known utility measures. Additionally, the algorithms should be able to use past operations to identify previously unknown utility measures that were also being optimized. Ideally, the algorithms will learn to operate the entire system in ways that achieve higher utility than current operations. The models produced by the algorithms should also allow for identification of the parts of the system and the actions that are most responsible for reducing system utilities and the positive impact that could be achieved from upgrading or augmenting parts of the system.	Pursuing Master's Degree or Pursuing Doctoral Degree	Nikunj Oza	nikunj.c.oza@nasa.gov	(650)604-2978			
ARC-023	SMD	Machine Learning-based classification of transit-like signals	Kepler and the upcoming TESS are critical missions to increase our understanding of how common earth-like planets and extra-terrestrial life are. These telescopes work based on transit photometry and their pipelines return a list of threshold crossing events (TCEs) whose light signatures resemble planets. However, not all TCEs are planets orbiting a star and they could be due to instrument noise or other astrophysical phenomena. Thus, the TCEs are subject to a vetting process in which they are classified into three categories: Planetary Candidate (PC), Astrophysical False Positive (AFP), and Non-transiting phenomena (NTP). This classification is currently being done manually and we need machine learning tools to automate it. The Kepler teams responsible for this vetting process released multiple datasets over time as they have learned how to obtain better diagnostics (features) from the light curves and how to classify the TCEs. However, the values of these diagnostics might not be perfect or representative enough and we are interested in deep learning methodology (e.g. LSTM) and other machine learning tools that work directly on the raw light curves to classify these TCEs automatically.	Pursuing Master's Degree or Pursuing Doctoral Degree	Nikunj Oza	nikunj.c.oza@nasa.gov	(650)604-2978	Hamed Valizadegan	hamed.valizadegan@nasa.gov	(650)604-6522

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ARC-024	SMD	Microbial Communities in Sedimentary Systems	Opportunity to propose an interdisciplinary geobiology project examining aspects of microbial communities distributions, metabolic activities and biogeochemical interactions in one or more sedimentary environments in response to environmental physical-chemical factors. Proposed work should support NASA Science Mission Directorate Astrobiology program elements found in the 2015 Astrobiology Roadmap. Proposal should include hypotheses and proposed experimental approaches, and cite areas of relevance to program. Potential areas of focus include Exobiology and Evolutionary Biology, Habitable Worlds and Life Detection. Collaborative facilities available include Ames Research Center Exobiology Greenhouse and associated biogeochemical and molecular analytical laboratories. Relevant program elements can be found at https://astrobiology.nasa.gov/research/astrobiology-at-nasa/ and (https://nai.nasa.gov/media/medialibrary/2016/04/NASA_Astrobiology_Strategy_2015_FINAL_041216.pdf).	Pursuing Master's Degree or Pursuing Doctoral Degree	Leslie (Lee) Bebout	leslie.e.bebout@nasa.gov	650.604.3826			
ARC-025	ARMD	Model Development and Validation of Electric Power Train in UAV's for Prognostics	In recent years, NASA researchers have developed advanced prognostics and health estimation algorithms at component and system level. Electric UAV's consists of several electric components which are integral part of the power train. Health estimate and failure prediction is the key to maintain of the asset as well as the airspace. This opportunity entails on developing first principles Models for DC-DC converters, Electronics speed controllers, motors used in electrical power train. Develop methodologies to inject faults in different components/systems based to observe cascading effects as well as component degradation. To measure and analyze data generated from the models to be used in validating models and diagnostic and prognostics algorithms.	Pursuing Doctoral Degree	Kai Goebel	kai.goebel@nasa.gov	650-604-4204	Chetan Kulkarni	chetan.s.kulkarni@nasa.gov	650-604-0493
ARC-026	ARMD	Multiscale Computational Modeling of Advanced Energy Storage Systems	One of the primary goals of NASA's Aeronautics Research Mission Directorate is the development of electric aircraft to help improve energy efficiency and reduce noise and emissions. The critical bottleneck to enable electric aviation is advanced energy storage systems including batteries. Such systems have very high requirements for specific energy, power, cycle life, safety, etc. Current Li-ion battery technology is inadequate to achieve these high performance requirements and "beyond Li-ion" technologies will be required. e.g., Li-Air, Li-S, etc. Batteries are intrinsically multiscale and multidisciplinary systems which require innovation at multiple length scales from fundamental chemistry to basic materials science to battery cell/pack designs to aeronautics systems integration. Due to this high degree of complexity, computational tool development will be critical to accelerate progress in this area. This opportunity calls for research proposals that will develop these critical computational tools for advanced battery development. Tool development will be done in collaboration with NASA researchers and it is expected the tools will be transitioned to NASA at the end of the project.	Pursuing Doctoral Degree	John Lawson	John.W.Lawson@nasa.gov	650-604-6189			

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ARC-027	STMD	NASA Ames SPHERES/Astrobee Facility	<p>The NASA Ames SPHERES/Astrobee Facility supports Assistive Free-Flyer (AFF) technology to enhance the capabilities and performance of small, free-flying robots that assist humans. AFF's can complement astronauts in space by performing tasks that are tedious, highly repetitive, dangerous or long-duration. AFF's can also provide side-by-side assistance to astronauts by carrying tools/materials, providing procedure support, etc. AFF's can potentially be applied to a wide variety of tasks including in-flight maintenance, spacecraft health- management, environmental monitoring surveys (air quality, radiation, lighting, sound levels, etc.), and automated logistics management (inventory, inspection, etc.). AFF's can be used when humans are present to off-load routine work, to increase human productivity, and to handle contingencies. AFF's can also be used when humans are not present, such as during "pre-deployment" and quiescent periods, to perform spacecraft caretaking. In particular, AFF's could be used to enable mobile monitoring, maintenance, and repair of spacecraft before, and between, crews.</p> <p>The objective of a successful proposal would be to develop technology (hardware or software) that can be integrated as payloads on assistive free-flyers (AFF).</p> <p>A key characteristic of AFFs is that they can perform assistive tasks while co-located in human environments. On the International Space Station (ISS), for example, the SPHERES robots have shown how AFF's can perform environment surveys, inspection, and crew support. During 2015-2018, NASA will develop a new AFF as part of the Human Exploration Telerobotics 2 (HET-2) project. This new robot will carry out inventory, sound monitoring, and other routine tasks on the ISS. Proposals are sought to create AFF payloads that can be integrated for application-specific functions, or that can provide general capability enhancements in several areas:</p> <ul style="list-style-type: none"> - Sensor Payloads - Compact sensors that can be used for environment monitoring, including detection of combustibles, air quality (CO2 levels), illumination (light spectrum), radiation, etc. - Appendages - Mechanisms that can be used for docking/perching, prodding/pushing, etc. This includes deployable structures and universal end-effectors (e.g., jamming granular gripper). - Algorithms – GNC software that can improve performance and robustness to unknown conditions. This can include on-line path planning or optimization in response to changing environmental 	Pursuing Master's Degree or Pursuing Doctoral Degree	Jose Benavides	Jose.v.benavides@nasa.gov	650-604-4401			
ARC-028	SMD	Observations and data analysis of transiting planets with the James Webb Space Telescope	Planets that transit their host stars are amenable to characterization of their atmospheres via transmission or emission spectroscopy. Observations with the James Webb Space Telescope (JWST) will determine the temperatures, compositions, chemical abundances, and cloud properties of exoplanets with much better precision than ones characterized to date with the Hubble and Spitzer Space Telescopes. We are seeking a researcher to reduce and analyze JWST guaranteed time observations of the infrared spectra of several warm transiting exoplanets that mostly have masses between Neptune and Jupiter. Experience in pipeline processing, systematic noise removal, and analysis of high precision time-series exoplanet data are beneficial. The successful candidate will be able to produce results quickly and efficiently and will be able to work effectively in a modest-sized team that is distributed in the US and Europe. There will be opportunities for independent research in addition to working as part of a well-organized team of scientific experts.	Pursuing Doctoral Degree	Thomas Greene	tom.greene@nasa.gov	650 539 5244			
ARC-029	HEOMD - ISRU	Oxygen generation through carbon dioxide splitting in molten salts	The objective is to generate oxygen gas through electrocatalytic reduction of carbon dioxide in molten salts (e.g., Li_2CO_3). The net reaction is $\text{CO}_2 \rightarrow \text{C} + \text{O}_2$, while Li_2CO_3 serve as a reaction medium/catalyst. The energy for carbon dioxide electrolysis can be provided by solar cells. The capability of generating oxygen from atmospheric carbon dioxide in a sustainable manner would be critical for NASA's Mars Exploration Program.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Yat Li at UC Santa Cruz	yatli@ucsc.edu	
ARC-030	STMD-TI	Real-time Sequential Decision Making Under Uncertainty	The student can submit a NASA-relevant, independently conceived research proposal falling within the opportunity topic with the concurrence of a university principal investigator and the NASA Technical Advisor. Of a particular interest are proposals for research on automated results explanation (explainable AI or xAI), decision making for degrading systems, decision making model learning, and decentralized/distributed decision-making under uncertainty.	Pursuing Master's Degree or Pursuing Doctoral Degree	Edward Balaban	edward.balaban@nasa.gov	650-604-5655			
ARC-031	HEOMD - Life Support Systems	Robust carbon nanotube sensors in high humidity environment	The objective is to extend the utility of carbon nanotube chemical sensors to high humidity or liquid environment. New strategies to stabilize the nanotubes on the sensor substrates for sensing the biomarkers or chemicals in high humidity background are needed. New encapsulation techniques need to be explored with the nanosensors in porous materials that will impact mechanical stability and allow the facile diffusion of analytes.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Tao Ye at UC Merced	tye2@ucmerced.edu	

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ARC-032	HEOMD	Robust carbon nanotube sensors in high humidity environment	The objective is to extend the utility of carbon nanotube chemical sensors to high humidity or liquid environment. New strategies to stabilize the nanotubes on the sensor substrates for sensing the biomarkers or chemicals in high humidity background are needed. New encapsulation techniques need to be explored with the nanosensors in porous materials that will impact mechanical stability and allow the facile diffusion of analytes.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Tao Ye at UC Merced	tye2@ucmerced.edu	
ARC-033	STMD	Roll-to-roll (R2R) printing low-cost wireless/distant sensors on flexible plastic film	The objectives of this project are: 1) Using low-cost nanoparticles (NPs) such as metallic TiN-NPs converted from low-cost TiO ₂ -mineral powder (see the XRD, SEM and photograph below), 2) The nitridation degree can be controlled to widely tune the band-gap/composition from insulating TiO ₂ to semimetal-like Ti(O)N, 3) Printing the piezoelectric BaTiO ₃ NWs to mass-produce the self-powered sensors on plastic film.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Ryan Tian at University of Arkansas	rtian@uark.edu	
ARC-034	STMD - TA12	Roll-to-roll (R2R) printing low-cost wireless/distant sensors on flexible plastic film	The objectives of this project are: 1) Using low-cost nanoparticles (NPs) such as metallic TiN-NPs converted from low-cost TiO ₂ -mineral powder (see the XRD, SEM and photograph below), 2) The nitridation degree can be controlled to widely tune the band-gap/composition from insulating TiO ₂ to semimetal-like Ti(O)N, 3) Printing the piezoelectric BaTiO ₃ NWs to mass-produce the self-powered sensors on plastic film.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Ryan Tian at University of Arkansas	rtian@uark.edu	
ARC-035	ARMD	Rotorcraft Aeromechanics	Research proposals can address all aspects of the rotorcraft/vertical lift aircraft which directly influence the vehicle's performance, structural, and dynamic response, external acoustics, vibration, and aeroelastic stability. The span of research also includes unmanned aerial vehicle (UAV) platforms, including quadcopters and other advanced, small remotely piloted or autonomous vertical takeoff and landing (VTOL) aircraft. Research can be either/both theoretical and experimental in nature. Advanced computational methodology research using computational fluid dynamics and multidisciplinary comprehensive analyses are welcome that attempt to understand the complete rotorcraft's operating environment and to develop analytical models to predict rotorcraft/vertical lift UAV 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.	Pursuing Master's Degree or Pursuing Doctoral Degree	William Warmbrodt	william.warmbrodt@nasa.gov	650-604-5642	Christopher Silva	christopher.silva@nasa.gov	650-604-5591
ARC-036	SMD	Studying protostars and brown dwarfs with the James Webb Space Telescope	JWST observations will determine or constrain the temperatures, surface gravities, compositions, and chemical abundances of the most embedded protostars and the coldest, least-massive brown dwarfs that have ever been observed. We are seeking a student researcher to participate in the reduction, information retrieval, and analysis of JWST observations of the infrared spectra of several protostars and brown dwarfs. Experience in data reduction and analysis of stellar, brown dwarf, protostellar, or other similar infrared spectra would be beneficial. This should include experience in applying statistical Bayesian analysis techniques to astronomical spectra. The successful candidate will be able to produce results quickly and efficiently and will be able to work effectively in a modest-sized team that is distributed in the US and Europe. There will be opportunities for independent research in addition to working as part of a well-organized GTO team of scientific experts.	Pursuing Doctoral Degree	Thomas Greene	tom.greene@nasa.gov	650 539 5244	Mark Marley	mark.s.marley@nasa.gov	
ARC-037	ARMD	Technology Simulation for Successful Training	Successful training in technology work domains often benefits from simulations of the technology and the work. Such training tools are particularly valuable when the goal is a deeper understanding of the domain that will allow the trainee to generalize to new problems and situations. Training for generalization is important for both space and aviation domains, including astronaut training for long-distance missions and pilot training for new, less understood operation concepts such as Urban Air Mobility. This research opportunity focuses on simulations of complex systems that may have multiple, interacting subsystems and processes, to be used for research on training of personnel on the operation, maintenance, and/or troubleshooting of these systems. The simulation technologies and the corresponding interfaces will be designed to help the trainees understand complex operations, and how the different subsystems may interact under a variety of operating conditions. Trainees should gain a deep understanding of the complex system, and how designed procedures may affect operations when faults and exceptions occur in the system. Student candidates should propose building or extending models, for example, to support learning to operate complex technology. Also desirable is the fellow's involvement in designing, adapting, and implementing interaction methods, for revealing and tracking system state, controlling system operation, and detecting and responding to faults and degradation in system operations.	Pursuing Master's Degree or Pursuing Doctoral Degree	Dr. Michael Feary	michael.s.feary@nasa.gov	650-6040203	Dr. Dorrit Billman	dorrit.billman@nasa.gov	650-604-5071

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ARC-038	SMD	Understanding Channel, Valley, and Gully Formation on Mars and the Implications for Mars' Paleoclimatic History	The discovery of water at or near the surface of Mars is critical to future mission planning and site selection. The potential processes forming channels, gullies, valley systems, and RSL on Mars must be understood to assess astrobiologic potential, remaining volatile reservoirs, and regional fluvial histories. This study will use mapping, spatial analyses, and terrain modeling to characterize channel, valley and gully system morphology in context with regional surroundings. We seek to identify the controls (e.g. stratigraphic, topographic, climatic, environmental) on formation and modification, and to evaluate these controls in relation to specific processes. The student should have experience working with 1) a range of Mars datasets (MOLA, HRSC, SHARAD, CTX, HiRISE), 2) relevant planetary software, such as ENVI and ArcGIS, and 3) the generation and use of advanced data products such as Digital Terrain Models to model pre-erosional surfaces and flow. This opportunity will also use analog studies, in particular terrestrial analogs, so experience working with high-resolution image, DTM, and compositional data sets would be beneficial.	Pursuing Masters or Doctoral Degree	Dr. Virginia Gulick	virginia.c.gulick@nasa.gov	650.604.0781			
ARC-039	SMD	Vertically aligned TiN-NWs and TiN-NTs on insulating TiO ₂ coated plate for gas discharging in planetary atmospheric measurement	The objective is to develop a chip-scale discharging sensor for probing planetary atmospheres by using the following approaches: 1) Using low-cost nanoparticles (NPs) such as metallic TiN-NPs converted from low-cost TiO ₂ -mineral powder, 2) The nitridation degree can be controlled to widely tune the band-gap/composition from insulating TiO ₂ to semimetal-like TiON then to metallic TiN, 3) Flocking CNTs on any substrate pre-coated with a "glue layer" of polymer(s), so to form a forest of highly oriented CNTs on the insulating polymer.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Ryan Tian at University of Arkansas	rtian@uark.edu	
ARC-040	STMD - TA5	Wireless/distant sensing of airborne pathogens on passive (no battery), low-cost (\$6c/ea.), networked RFID sensors	The objective is to develop an ultra low power RFID sensor by bonding the following materials to the most sensitive small area of the RFID surface: 1) metallic and semiconducting nanoparticles (i.e. catalysts) of all types, 2) carbon nanotubes, 3) self-assembled monolayers (SAMs) on the base-metal (e.g. Aluminum) surface to sense airborne targets of all types, including industrial hazardous gases and organic volatile compounds, 4) antibodies to detect biological targets e.g. viruses, bacteria, cancer cells, diseases, etc.	Doctoral Degree	Jing Li	jing.li-1@nasa.gov	650-604-4352	Prof. Ryan Tian at University of Arkansas	rtian@uark.edu	

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GRC-000		Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor			
GRC-001	ARMD	Additive Manufacturing of Ceramic Materials and Structures for Extreme Environments	High-temperature materials, like ceramics and ceramic matrix composites (CMCs), have wide potential application in aerospace applications ranging from heat shields to turbine engine components, due to the lower density and high-temperature capabilities of these materials compared with other conventional structural materials. However, the current inability to manufacture complex-shaped ceramics and CMCs in an economical 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 utilize an additive manufacturing process to more quickly and efficiently produce complex-shaped ceramics and/or CMCs with material properties comparable to parts prepared by other more traditional processing methods.	Pursuing Master's Degree or Pursuing Doctoral Degree	Valerie Wiesner	valerie.l.wiesner@nasa.gov	757-864-4384	Michael Halbig	michael.c.halbig@nasa.gov	216.433.2651
GRC-002	LMAO	Addressing Challenges in Shape Memory Alloy Actuators: Cycling Time and Controls	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 be integrated into flight structures, the methods in which they are used to convert the thermal energy into mechanical work must be quantified. One of the challenges in working with SMA actuators is "long actuation time". Since heat transfer is the driving mechanism during heating and cooling, it typically means long actuation times particularly for large actuators. Improving actuation times to few seconds compared to minutes is desirable and can be achieved via material design and/or mechanism design. A material can be engineered with very low hysteresis where the heating and cooling cycles can be limited to seconds (without a dead-band). Otherwise, the heating and cooling cycles can be decoupled via mechanisms. The goal of this opportunity is to come up with methods to speed the actuation times of large form SMA devices. This entails determining the mechanical work efficiency compared to convention motors (electric, hydraulic, pneumatic) as a function of load capacity (e.g., normalized energy density), and determining the thermal energy required to transform an actuator and hold it in position throughout a simulated mission (e.g., flight conditions, deployment...).	Pursuing Master's Degree or Pursuing Doctoral Degree	Othmane Benafan	othmane.benafan@nasa.gov	216-433-8538			
GRC-003	ARMD	Advanced Modelling for Adhesively Bonded Joints	The student will research and develop methods for analyzing adhesively bonded aerospace structures under 3-D loading conditions. Of particular importance will be finite element integration, computational efficiency, and experimental validation.	Pursuing Master's Degree or Pursuing Doctoral Degree	Dr. Brett A. Bednarczyk	Brett.A.Bednarczyk@nasa.gov	216-433-2012	Dr. Evan J. Pineda	Evan.J.Pineda@nasa.gov	216-433-5563
GRC-004	ARMD	Advanced Process Modeling and Development for Complex Materials	The student will research and develop methods and tools for computational modeling of advanced manufacturing techniques for complex material systems. These method and tools are to be characterized and validated against experimental data and utilized to improve existing, and/or develop, novel manufacturing technologies. Target applications are components in hybrid electric aircraft and large space launch vehicle structures.	Pursuing Master's Degree or Pursuing Doctoral Degree	Dr. Evan J. Pineda	Evan.J.Pineda@nasa.gov	216-433-5563	Dr. Brett A. Bednarczyk	Brett.A.Bednarczyk@nasa.gov	216-433-2012
GRC-005	ARMD	Aerogels For High Temperature Applications	NASA has demonstrated an aluminosilicate aerogel syem that can be used at temperatures to 1200°C for periods of up to 24 hours. We are soliciting proposals investigating alternative chemistries which can prodduce aerogels which maintain a mesoporous structure above 1000°C. systems might include routes to yttria stabilized zirconia or to aerogels which can be synthesized using non-aqueous techniques.	Pursuing Master's Degree or Pursuing Doctoral Degree	Francs Hurwitz	frances.hurwitz@nasa.gov	216-433-5503			
GRC-006	ARMD	Airframe and Engine Icing Physics	Airframe and engine icing research at NASA is supported under Aeronautics Research Mission Directorate (ARMD) programs. A key goal for both airframe and engine icing is to develop improved computational and experimental simulation tools for civil transport airplane airframes and engines operating in atmospheric icing including freezing drizzle, freezing rain, mixed-phase conditions and ice-crystal icing. The objective of this research is to develop improved models for the multi-phase, multi-scale physical phenomena associated with: surface water transport; ice-roughness heat transfer; two-way air and water coupling; ice erosion; ice adhesion and shedding that occur during ice build-up. Experimental and computational studies are needed to further elucidate these complex phenomena and contribute to the current modeling efforts.	Pursuing Master's Degree or Pursuing Doctoral Degree	Andy Broeren	abroeren@nasa.gov	216-433-5338	Mark Potapczuk	mark.g.potapczuk@nasa.gov	216-433-3919

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GRC-007	HEOMD	Analysis of airborne particulate matter sampled from the International Space Station to characterize air quality and potential impact on crew health	Astronauts routinely vacuum airborne particulate matter debris which collects on the filter faces within the International Space Station (ISS). The return of these vacuum bags to Earth offers a unique opportunity to perform a variety of analysis techniques to understand the nature of indoor aerosols on ISS. The outcomes of such testing could include health-relevant data such as microbial diversity, quantities of metals/organic contaminants/etc., identifying debris origins, or estimates of aerosol deposition in the respiratory tracts of astronauts, among others. Students with access to specialized equipment are encouraged to apply.	Pursuing Doctoral Degree	Marit Meyer	marit.meyer@nasa.gov	216-433-6399	Juan Agui	juan.h.agui@nasa.gov	216.433.5409
GRC-008	ARMD	Bio-inspired flexible structures for low pressure ratio fans.	We seek proposals involving strategies for distortion tolerant fan designs for distributed propulsion inspired by nature. Insect wing folding is of interest. We seek data and tools that may be used to enhance an in-house developed design tool for nature-inspired design called PeTaL. More information may be found at https://www.grc.nasa.gov/vine/about/what-is-petal/ .	Pursuing doctoral degree	Vikram Shyam	vikram.shyam-1@nasa.gov	216.433.3511			
GRC-009	ARMD	Blowoff extinction limits of select aerospace materials under normoxic atmospheres	The student will screen aerospace materials for applicability and will then conduct 1g and drop tower testing of blowoff extinction of select aerospace materials at normoxic atmospheres. The goal of the experiments is to determine the 1g O2-flow-pressure flammability boundary and estimate the shift in the boundary in microgravity prior to testing aboard ISS in the SoFIE flight hardware.	pursuing MS degree or pursuing PhD	Sandra Olson	sandra.olson@nasa.gov	216-433-6399	Juan Agui	juan.h.agui@nasa.gov	216.433.5409
GRC-010	ARMD	Blowoff extinction limits of select aerospace materials under normoxic atmospheres	The student will screen aerospace materials for applicability and will then conduct 1g and drop tower testing of blowoff extinction of select aerospace materials at normoxic atmospheres. The goal of the experiments is to determine the 1g O2-flow-pressure flammability boundary and estimate the shift in the boundary in microgravity prior to testing aboard ISS in the SoFIE flight hardware.	pursuing MS degree or pursuing PhD	Sandra Olson	sandra.olson@nasa.gov	216-433-6399	Juan Agui	juan.h.agui@nasa.gov	216.433.5409
GRC-011	HEOMD	Computational modeling to enhance human health and performance during spaceflight	Multidisciplinary computational models, data analyses or analytical systems that inform human spaceflight requirement specification and countermeasure development that address critical human spaceflight risks. Proposed approaches include, but are not limited to, probabilistic models to predict medical risk, neural and genetic algorithms to inform data enhanced medical decision making or predict performance (cognitive, physiological) decrements, and data trained physiological models to address space adaptation and recovery, especially in the ocular, cardiovascular and sensorimotor areas.	Pursuing Doctoral Degree	Beth Lewandowski	Beth.E.Lewandowski@nasa.gov	216-433-8873	Jerry Myers	Jerry.G.Myers@nasa.gov	216-433-2864
GRC-012	ARMD	Design of High Temperature Seal Flow Test Rig	Future high speed vehicles will require high temperature seals and thermal barriers to minimize the ingestion of hot gases through various interfaces and protect underlying temperature-sensitive structures. The seals must operate in high heat flux, oxidizing environments and restrict the flow of hot gases at extreme temperatures that can exceed 2000 °F. In some locations pressure differentials across the sealed interface can be on the order of 100 psid. As advanced seal and thermal barrier designs are developed, it is important to characterize the amount of air flow that leaks past them under representative operating conditions. The objective of this opportunity is to design a new test rig that is capable of measuring seal flow/leak rates at elevated temperatures and pressures. Engineering calculations and analyses will need to be performed to ensure that the test rig can operate safely and achieve the desired test conditions. Final design details will be shared with NASA so the test rig can be fabricated, assembled, and installed on-site at NASA.	Pursuing Master's Degree or Pursuing Doctoral Degree	Patrick H. Dunlap	patrick.h.dunlap@nasa.gov	216-433-3017			
GRC-013	ARMD	Development of High Temperature Elastomer for Use in Seal Applications at 700+°F	Future high speed vehicles will require high temperature, low leakage seals to minimize the ingestion of hot gases through sealed interfaces and protect underlying temperature-sensitive structures. Low leakage seals such as O-rings are often made of elastomers because these materials exhibit little plastic flow and rapid, nearly complete recovery from an extending or compressing force. However, even the most heat-resistant elastomers have maximum continuous use temperature limits of about 600°F. The objective of this opportunity is to identify and/or develop a high temperature elastomer that can be formed (e.g., molded, extruded) into various seal geometries for use at temperatures of 700°F or greater. Upon successful identification/development of the elastomer, test specimens will be fabricated and evaluated under representative operating conditions.	Pursuing Master's Degree or Pursuing Doctoral Degree	Patrick H. Dunlap	patrick.h.dunlap@nasa.gov	216-433-3017			

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GRC-014	ARMD	Development of High Temperature, Wear-Resistant Coatings for Seals and Thermal Barriers	Future high speed vehicles will require high temperature, dynamic seals and thermal barriers around the edges and along the hinge lines of movable control surfaces (e.g., flaps, rudders) and doors to minimize the ingestion of hot gases through these interfaces and protect underlying temperature-sensitive structures. The seals must operate in high heat flux, oxidizing environments and restrict the flow of hot gases at extreme temperatures that can exceed 2000 °F. They must be flexible enough to accommodate distorted sealing surfaces while remaining in contact with them to create an effective seal. In some locations, they may also have to limit applied loads against sealing surfaces that are fragile or covered with delicate protective coatings. The seals must also be sufficiently durable to meet required life goals. They must resist damage as they are rubbed over rough, distorted sealing surfaces without incurring excessive increases in leakage due to wear. In some locations the seals may have to seal against rough thermal protection system (TPS) materials without sticking to their surfaces. Previous testing has shown that coatings on flexible fabrics can improve seal durability by holding fibers together during scrubbing and possibly reducing friction against rough surfaces. The objective of this opportunity is to identify and/or develop high temperature, wear-resistant coatings for seals and thermal barriers and evaluate their durability under representative operating conditions.	Pursuing Master's Degree or Pursuing Doctoral Degree	Patrick H. Dunlap	patrick.h.dunlap@nasa.gov	216-433-3017			
GRC-015	LMSO	Development of Progressive Failure Analysis Tools for Large Sandwich Structures	The student will research and develop methods and tools for progressive failure analysis of large sandwich structures with complex geometry subjected primarily to compressive loading. Modeling should focus on predicting damage nucleation and growth resulting from impact, compression after impact, and/or fatigue for novel facesheet and core concepts.	Pursuing Master's Degree or Pursuing Doctoral Degree	Dr. Evan J. Pineda	Evan.J.Pineda@nasa.gov	216-433-2012	Dr. Andrew C. Bergan	Andrew.C.Bergan@nasa.gov	757-864-3744
GRC-016	ARMD	High Pressure Combustion at Near-Critical and Supercritical Conditions	In the desire to enhance engine efficiencies by operating at increasingly higher pressures, liquid fuels are being injected into combustion chambers at near-critical and supercritical conditions. Liquid atomization and the resultant reactant mixing is often compromised because of changes in the thermophysical properties of the liquid fuel as it approaches, and transitions through, its critical point. A zero gravity high pressure combustion facility is currently being built that will allow research into critical phase transition behavior by deploying single droplets or low velocity injection streams in a supercritical ambient. The absence of buoyant forces will allow for observations of liquid/gas-phase interactions at easily observable length and time scales.	Pursuing Doctoral Degree	Michael C. Hicks	mhicks@nasa.gov	216-433-6576	David L. Urban	david.urban@nasa.gov	216-433-2835
GRC-017	ARMD	High-Speed Inlet Computational Design and Analysis Method Development	The research opportunity involves the development of computational methods for the aerodynamic design and analysis of inlets for the propulsion system of flight vehicles operating up to speeds of Mach 5. The design aspect involves establishing the ideal shape of the inlet based on a set of design factors and performance objectives for one or more inlet operating points. The analysis aspect involves establishing the aerodynamic performance of the inlet at design, as well as, off-design operating conditions. The computational methods for design and analysis include geometry modeling, empirical-based models, compressible flow dynamics, method-of-characteristics, and optimization. Of interest is the development of time-dependent, computational fluid dynamics (CFD) methods for the solution of the viscous, turbulent flow through the inlets. The methods would be implemented into the SUPIN Inlet Design and Analysis Tool.	Pursuing Master's Degree or Pursuing Doctoral Degree	Dr. John W. Slater	John.W.Slater@nasa.gov	216-433-8513			
GRC-018	ARMD	Impact/Dynamic Modeling of Advanced Composite Aerospace Components	Analysis methods to enable the impact and transient dynamic analysis of aerospace components composed of polymer matrix composite materials with complex material architectures, structural geometries and loading conditions are a research area of interest. Specific application areas of interest include 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. Specific research problems of interest include improving analysis methods for simulating the impact/dynamic response of composites with complex fiber architectures and incorporating effects such as the temperature rises due to dynamic loading and the changes in the matrix fracture response due to dynamic loading into the analysis. Accounting for the effects of local material irregularities such as fiber angle changes and local design discontinuities such as ply drops into the analysis is also of interest. The research is expected to utilize commercially available transient dynamic finite element codes, and to employ material models and methods either currently available within the codes or under development.	Pursuing Master's Degree or Pursuing Doctoral Degree	Robert K. Goldberg	Robert.K.Goldberg@nasa.gov	216-433-3330			
GRC-019	LEXO	ISRU: Lunar solar cells	The potential for a semi-permanent lunar habitat is predicated upon the electrolysis of water and available power. Fabricating solar cells from abundant lunar silicon makes sense since a source of oxygen may already be the reduction of lunar silicates, leaving behind a low grade silicon. Utilizing lessons-learned from the terrestrial photovoltaic sector we will explore the tradeoffs in development of modest efficiency silicon solar cells from lunar material using purchase-able "metallurgical grade" silicon and the deposition of material from silane vapor.	Pursuing Master's or Doctoral Degree	Jeremiah McNatt	jmcnatt@nasa.gov	216-433-3297	Timothy Peshek, PhD	timothy.j.peshek@nasa.gov	216-433-2386

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GRC-020	ARMED	Lightweight and compact Heat pipe /Heat exchangers for aircraft engines	We are looking for research proposals that involve innovative use of lightweight and compact heat pipes/ heat exchangers for aircraft engines. Proposals that involve machine learning and data mining to assist with structures for additive manufacturing are also welcome as is detailed design of customized heat pipe heat exchangers that are integrated into the engine/airframe.	Pursuing doctoral degree or Master's degree	Vikram Shyam	vikram.shyam-1@nasa.gov	216.433.3511			
GRC-021	ARMED	Microstructural and Mechanical Evaluation of Additively Manufactured Metallic Parts	NASA is considering several promising methods for producing additively manufactured aerospace parts for future launch vehicles. The applicant's work would focus on those materials suited for high-temperature applications for the hot sections of the vehicle. The proposed work would include additive manufacturing parameter development, post-production heat treatments, microstructural evaluation, and mechanical property testing to determine optimal processing and develop a suitable database of material properties to guide both the additive manufacturing process and the design of parts.	Pursuing Doctoral Degree	Dr. David L. Ellis	david.l.ellis@nasa.gov	216-433-8736			
GRC-022	LMsO	Multiscale modeling of lightweight and multifunctional materials and structures	The student will develop and apply multiscale modeling techniques for novel multifunctional material systems for aerospace applications. Multifunctionality can include, but is not limited to, energy storage, energy absorption, thermal management, electrical conduction, sensing/actuating, extreme environmental protection, diffusion, metamaterials, damping, and acoustics, in addition to the structural function of the material.	Pursuing Master's Degree or Pursuing Doctoral Degree	Dr. Brett A. Bednarczyk	Brett.A.Bednarczyk@nasa.gov	216-433-2012	Dr. Evan J. Pineda	Evan.J.Pineda@nasa.gov	216-433-5563
GRC-023	LT10	Roughness Effects on Icephobic Properties in Biomimicry Systems with application to In-Flight ice	The candidate will study roughness formation, characterization and effect in Biomimicry systems that exhibit icephobic properties. Study how roughness affects the adhesion of ice to a substrate. Extend the gained understanding of roughness effects in Biomimicry systems to in-flight ice.	Pursuing Doctoral Degree	Mario Vargas	Mario.Vargas-1@nasa.gov	216-433-3943	Professor Ali Dhinojwala	ali4@uakron.edu	330-972-6246
GRC-024	ARMED	Ultra Lightweight EMI Shielding for High Voltage Power Transmission on Electrified Aircraft. Student Proposed with Concurrence of NASA Technical Mentor	Materials research in the development of ultra-lightweight EMI shielding material for high voltage (>1kV), variable frequency (Hz to KHz) power transmission systems on future hybrid electric aircraft. The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Doctoral Degree	Maricela Lizcano	maricela.lizcano@nasa.gov	216-433-3637	Fred Dynys	frederick.w.dynys@nasa.gov	216.433.2404
GRC-025	LEXO	Ultra low cost perovskite solar cells for space applications	New perovskite solar cells can be processed with inexpensive wet chemical techniques and lead to devices at >20% efficiency. These devices have generated plenty of interest from researchers seeking clean, renewable energy however they are highly susceptible to moisture-related degradation; degradation that would vanish in space applications. These materials could be highly useful as a disruptive design for next generation space power decreasing the cost per watt by a factor of 100 over current technologies. However, significantly more development and testing needs to be performed including repeatability and durability testing with a focus on space applications.	Pursuing Master's or Doctoral Degree	Timothy Peshek, PhD	timothy.j.peshek@nasa.gov	216-433-2386	Jeremiah Mcnatt	jmcnatt@nasa.gov	216-433-3297

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GSFC-000		Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor			
GSFC-001	SMD	End-2-End Simulation Model (Including Electromagnetic Scattering Model for Earth Surface) Development for Space Born Bi-Static Radar Operating over VHF Band (250-300MHz)	This research work focuses on the development of Electromagnetic scattering model of Earth surface that includes subsurface layers up to 0.1~0.5 meter depth and biomass above the earth surface at VHF frequencies covering 250-300 MHz band. Using this scattering model, a researcher will develop End-2-End simulator (using Matlab Code) for the bi-static radar configuration, where the transmitter may be located in a GEO location and the receiver may be located on a high tower on the ground. The transmitter is assumed to be radiating a communication signal using either BPSK/QPSK modulated signal. Finally such End-2-End simulator will be validated with experimental data collected on a agriculture field around GSFC.	Pursuing Master's Degree or Pursuing Doctoral Degree	Dr. Manohar Deshpande	manohar.d.deshpande@nasa.gov	301-286-2435			
GSFC-002	SMD	Calibration of Sensor Constellations	Although small satellites are low-cost and carry power efficient instruments, one of the main challenges in utilizing constellations of small satellites is to obtain stable and accurate calibration of individual sensors in the constellation, as well as precise and accurate calibration of the entire constellation to ensure uniform, consistent, and spatiotemporally continuous observations with high revisit times. This opportunity aims to develop the mathematical basis and simulation capability for calibrating a constellation of sensors.	Pursuing Master's Degree or Pursuing Doctoral Degree	Paul Racette	Paul.E.Racette@nasa.gov	301-286-4756	Jeff Piepmeier	jeffrey.r.piepmeier@nasa.gov	301-286-5597
GSFC-003	HEOMD (ScAN)	Direction Finding Using Single Antenna and Receiver Channel	Wideband antennas may be designed to have an impulse response that is direction dependent. The student will design/develop an antenna exhibiting strong direction dependent waveform effects and the signal processing system to demonstrate that waveform information can be inverted to accurately obtain direction-of-arrival. Maturing this revolutionary concept will significantly improve communication and navigation systems, in that, the angle-of-arrival of a signal is determined using a single fixed antenna and single receiver channel, without the need for antenna rotation, and a physically or electronically steerable antenna array. This research opportunity will provide experiential learning experiences while increasing capabilities for NASA's future missions. To provide high data rates for space communications, antenna directive gain and high pointing accuracy are among the desired factors. Antenna misalignment errors can cause severe link degradation, subsequently limiting the achievable throughput. The success of this research will directly be applicable to (1) Locating communication relays in an ad hoc, cognitive, or autonomous space communication networks, (2) Mutual radiolocation of members of satellite clusters engaged in formation flying, (3) Platform orientation recovery - if for any reason, attitude control is temporarily lost, this system could be used to deduce the platform orientation, and (4) Sensing on ground systems to locate on-orbit platforms without the need for a phased array.	Pursuing Master's Degree or Pursuing Doctoral Degree	Kegege, Obadiah	obadiah.o.kegege@nasa.gov	301.286.7768			
GSFC-004	SMD	Exploration and Development of Orbital Angular Momentum of Radio Waves Concept for Microwave Remote Sensing	It has been shown that an EM wave not only carries energy but also momentum (linear as well as angular). The presence of this momentum in EM waves is evident from the radiation pressure experienced by an object illuminated by such EM waves. In addition to the linear momentum EM waves also carry angular momentum which has two components. The first component (known as Spin Angular Moment (SAM) which is responsible for yielding circular/elliptical polarization) is associated with the dynamical rotation of the electric and magnetic fields around the propagation direction. The second component (known as Orbital Angular Momentum (OAM)) is associated with the spatial phase distribution. It has also been established that the OAM has unbounded orthogonal modes which can be independently generated and detected. These unbounded orthogonal Eigen states of the OAM offer game changing applications for radars and wireless communication systems. Actual demonstration of use of these orthogonal OAM modes for establishing multichannel communication links at RF wavelengths and also at optical wave lengths has been well documented by many researchers. However, its applications for remote sensing at RF wave lengths have not been fully explored. In this work the researcher will explore feasibility of OAM modes for active and passive RF remote sensing through EM simulations and experimentations.	Pursuing Doctoral Degree	Dr. Manohar Deshpande	manohar.d.deshpande@nasa.gov	301-286-2435			

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GSFC-005	SMD	Exploring the influence of local environments on star formation histories of galaxies in the nearby Universe	What drives star formation activity in galaxies? One hypothesis is that galaxy interactions and mergers could funnel fresh gas into the centers of galaxies, which could fuel star formation. Yet, are the star formation rates in galaxies determined completely by gas infall rates, or are there additional stochastic processes that must be understood? One way to determine this is to measure the level of "conformity" seen in star formation histories for galaxies located near each other, and for regions within galaxies that are likely to share the same gas accretion history. In this program, we aim to explore when and where galaxies experience episodes of star formation. We will use publicly available multi-wavelength data with state-of-the-art spectral energy distribution (SED) model fitting techniques to measure spatially resolved star formation histories for galaxies located in different galaxy clustering environments (i.e. field galaxies, within close pairs or groups of galaxies).	Pursuing Doctoral Degree	Dr. Antara Basu-Zych	antara.r.basu-zych@nasa.gov	301-286-1155			
GSFC-006	SMD	Galaxy Evolution Studies with NASA data	The student will use NASA data archives as well as ground-based telescope data if applicable to conduct studies on galaxy evolution, including star formation, galaxy morphologies, AGN growth, and other relevant topics.	Pursuing Doctoral Degree	Amber Straughn	amber.n.straughn@nasa.gov	301-286-7098	Jonathan Gardner	jonathan.p.gardner@nasa.gov	301-286-3938
GSFC-007	GISS - SMD	Improved Observations to Evaluate Dust and Ice Nucleating Particles in ModelE3	Seasonal dust is an important factor for climate prediction. In-situ data provide evidence that dust is associated with biological material, which is in turn associated with warmest-temperature cloud ice formation. In situ field data is sought on dust number and mass size distribution, as well as ice nucleating efficiency in the immersion mode over a wide range of temperatures, suitable to help evaluate NASA's ModelE3 climate model. Measurements should advance capability to measure throughout the coarse mode, where size distributions are commonly poorly measured and immersion mode ice nucleating particles are expected to be concentrated. A project objective should be to compare measurements in a methodologically sound manner with high-time-frequency output from ModelE3 that will be provided by the technical advisor.	Pursuing Master's Degree	Ann Fridlind	ann.fridlind@nasa.gov	212-678-5674	Susanne Bauer	susanne.e.bauer@nasa.gov	212-678-5666
GSFC-008	GISS - SMD	Improved Observations to Evaluate Seasonal Trends in Aerosol Loading in ModelE3	Ground-based radiometers and in situ measurements are well suited to studying aerosol loading trends over decade timescales but are commonly challenged in terms of data quality and station density. Long-term data sets are sought to expand a measurement database suitable to evaluate aerosol trends predicted by NASA's ModelE3 climate model. Ideally, long-term and high-density surface data will be combined with aerosol number concentration, size distribution and optical properties to allow for expanded investigations of trends in aerosol loading. A suitable project objective would be to compare aerosol loading trends with changes in emission sources in observations and in ModelE3 output that will be provided by the technical advisor.	Pursuing Doctoral Degree	Susanne Bauer	susanne.e.bauer@nasa.gov	212-678-5666	Ann Fridlind	ann.fridlind@nasa.gov	212-678-5674
GSFC-009	GISS - SMD	Improvements to Interactive Emission Components within the GISS Earth System Model	Research at the NASA Goddard Institute for Space Studies (GISS) emphasizes a broad study of global change, which is an interdisciplinary initiative addressing natural and man-made changes in our environment. We are developing a coupled atmosphere-ocean-composition climate model for simulating the earth system. Our model version includes detailed processes of atmospheric chemistry, aerosol and cloud microphysics. This project will offer the ability to work with the GISS model development team build a component that eventually will become part of the GISS model. Thus far interactive emissions are considered for deserts (dust), oceans (sea salt, DMS) and fires. Projects are encouraged that will allow further development of interactive emission parameterizations for gases and aerosols. This could involve, but is not limited to the following examples: improvements to the existing schemes, new additions such as emission fluxes from dynamic vegetation, soils, volcanoes (other than SO ₂), chemistry of oceanic emissions, or emissions from any other natural or anthropogenic activity that can interactively be simulated within an earth system model.	Pursuing Doctoral Degree	Susanne Bauer	susanne.e.bauer@nasa.gov	212-678-5666	Kostas Tsigaridis	kostas.tsigaridis@nasa.gov	212-678-5668

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GSFC-010	SMD	Remote sensing of aerosol/cloud interfaces for climate studies.	Atmospheric aerosols, also known as particulate matter, are uncertain drivers to our climate. Aerosol impacts include the process of directly perturbing the radiation field (scattering and absorbing sunlight) within our atmosphere, known as the aerosol direct radiative effect (ADRE), as well as indirect effects such as modulating cloud microphysical properties via entrainment. The ADRE is relatively easy to comprehend, as long as aerosols are being separated from, and then measured in "clear" sky areas far from clouds. Thus, using popular remote sensing datasets (e.g. aerosol and cloud retrievals from MODIS), estimates of clear-sky ADRE are converging. Close to cloud (next to, above and below), however, aerosol/cloud interactions (microphysical, radiative, etc) are difficult to assess and complicate our interpretation of clear sky ADRE. Since global cloud fraction is ~70%, and most clear sky is within a few kilometers of cloud, we know that any observationally based estimate of ADRE must be biased. In addition, we lack observational information on aerosols in the vicinity of clouds, important for assessing aerosol/cloud interactions. NASA Goddard Space Flight Center is home to one of the largest concentrations of aerosol and cloud scientists in the world, and we have new capabilities to study aerosols within and around cloud fields. We welcome research that uses long-term (e.g. MODIS) and/or other remote sensing (satellite, airborne or ground-based) datasets to study aerosols and their radiative effects (direct and/or indirect) within a cloudy atmosphere. This includes theoretical studies that would lead to new retrieval techniques.	Pursuing Master's Degree or Pursuing Doctoral Degree	Robert Levy	Robert.c.levy@nasa.gov	(301)614-6123	Kerry Meyer	kerry.meyer@nasa.gov	301.614.6186
GSFC-011	SMD	Retrodirective Transceiver System for Communication Needs of Formation Flying (Swarm) CubeSats	<p>Swarms of small satellites or cubesats offer a new sensor configuration/ architecture for Earth science remote sensing from space as well as for planetary observations. With such swarm, it is possible to realize: 1) synthetic aperture radars for Earth sensing system, 2) large aperture for space telescope, 3) space borne phased array system. To implement such configuration adaptively without external commands, it is essential that each satellite in a swarm to be equipped with a robust communication system that will allow all the time in contact with other members of the swarm. To be able to establish communication link under this scenario, omnidirectional antennas are preferred solution. However, this reduce the power in desired direction, causes low data rate and such system is prone to external interference.</p> <p>Main goal of this work is to design and validate a communication system based on retrodirective array concept that will enable a cubesat to adaptively establish communication link between itself and other members of swarm. Furthermore, the proposed communication protocol will be able to established communication links using time multiplexing. To address this challenge, the retro-directive array concept has been of particular interest due to its cost effectiveness and compactness. A retrodirective array transmits a signal back to the interrogator's position without any a priori knowledge of the incoming angle or relying on sophisticated digital signal processing algorithms. Furthermore, the retrodirective transceiver does not need complex phased array architecture to achieve the above mentioned functionality.</p>	Pursuing Master's Degree or Pursuing Doctoral Degree	Manohar Deshpande	manohar.d.deshpande@nasa.gov	301-286-2435			

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

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JSC-000		Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor			
JSC-001	HEOMD	Efficient Damage Simulation in Composites	Development of NASA's "AF-Shell" composite damage simulation software tool: The goal is to mature AF-Shell from its current state to make it more general and useful in implementation of fracture control requirements for composites including durability and damage tolerance. In this opportunity, the focus is on extending numerical damage simulation techniques for composites within an enriched shell element framework. There is a heavy emphasis on coding, but also a need for finite element analysis and experimental model validation.	Doctoral Degree	Dr. Mack McElroy (JSC)	mark.w.mcelroy@nasa.gov	281-244-6668	Dr. John Thesken (GRC)	john.c.thesken@nasa.gov	216-433-3012
JSC-002	HEOMD	Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived waste water recovery research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Doctoral Degree	John Graf	john.c.graf@nasa.gov	281 483 9226			

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KSC-000		Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor			
KSC-001	STMD	Waste processing in microgravity	NASA has an interest in advancing technologies that can thermochemically convert waste materials into useful gases such as water or propellant. Terrestrial applications of thermochemical waste processing include biomass to fuels. A key difference between terrestrial and space application is the nature of the waste. In space, waste that would be processed is mainly a mixture of polymers from food packaging, used clothing, and human metabolic waste. Multiple thermochemical processes such as gasification, steam reforming, incineration, pyrolysis and plasma-arc gasification have been or are planned to be evaluated with this waste stream. In order to advance waste processing technology so that it can be used in space, these processes need to be evaluated under microgravity conditions. There is a current NASA effort that will perform microgravity testing of waste processing over the next two years. A student is desired to conduct theoretical and experimental work that provides information that can be used in the design of a microgravity compatible waste processing reactor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Paul Hintze	Paul.E.Hintze@nasa.gov	321-867-3751			

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LaRC-000		Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor			
LaRC-001	ARMD	Additive Manufacturing of Multimaterial Aerospace Components	Additive manufacturing (AM) is making it possible to tailor functionality in components through customized placement of multiple materials through the built up part. Despite this apparent advantage, there are many barriers that prevent the easy application of AM in aerospace parts. These include issues such as interfacial compatibility between disparate materials that need to be addressed in the timescale experienced during the print. A fundamental science understanding of the interaction between materials that can be used in structural engineering applications will advance the potential for applying AM in aerospace applications, especially as it allows the fabrication of multifunctional parts. NASA is soliciting independently conceived research proposals that address these challenges.	Pursuing Master's Degree or Pursuing Doctoral Degree	Emilie J. Siochi	emilie.j.siochi@nasa.gov	757-864-4279	Godfrey Sauti	godfrey.sauti-1@nasa.gov	757-864-8174
LaRC-002	ARMD	Advanced Modeling of Turbulence for Combustion Applications	One of the most challenging problems preventing accurate predictive simulations of turbulent reacting flows is the complexity associated with the modeling of the chemical reaction source terms in the governing transport equations. These terms are in highly non-linear, and depend on both aero- and thermo-dynamic flow properties. Flow turbulence further introduces a wide range of interacting flow scales over which these source terms must be accurately evaluated. All models to date have largely failed to demonstrate accurate and robust prediction of turbulent combustion, except under limited range of flow conditions. This problem is further aggravated in simulations of supersonic combustion, where the flow and chemistry time scales could be on the same order. The objective of the current opportunity is to investigate and further develop for supersonic combustion a class of probabilistic models for turbulent combustion simulations. These models use stochastic approaches to describe the physical interactions that are not accessible to typical conventional combustion models. Also, computational affordability is of primary concern and must be considered in the proposed work.	Pursuing Doctoral Degree	Tomasz Drozda	tomasz.g.drozda@nasa.gov	757-864-2298			
LaRC-003	HYP	Advances in Boundary-Layer High-Frequency Measurement Capabilities and Supporting Analysis	Advancements are sought which will develop experimental expertise in high-frequency measurement capabilities, inclusive of other supplemental test techniques, with the goal of advancing the state-of-the-art in boundary-layer transition and stability predictive methods. Experiments are envisioned to be conducted in both NASA and university facilities. Also, companion computational work is envisioned to involve generating both mean flow and stability calculations using multiple state-of-the-art computational codes.	Pursuing Doctoral Degree	Shann Rufer	shann.j.rufer@nasa.gov	757-864-1005	Scott Berry	scott.a.berry@nasa.gov	757-864-5231
LaRC-004	HYP	Advances in Fluid-Thermal-Structural Interactions Analysis Methods Using Massively Parallel Computational Environments	Fluid-Thermal-Structure Interactions (FTSI) have proven to be an important technology area for supersonic combustion ramjet (scramjet) engines. The scramjet engine is particularly susceptible to thermal growth and structural deformations due to the extreme heat loads present in the engine, and these changes to the geometry can lead to significant performance decrements. The NASA Hypersonics Technology Project, which addresses hypersonic system research endeavors, seeks high-fidelity tools which will efficiently couple thermal/structural finite element solvers with existing hypersonic computational fluid dynamics tools. The research tool(s) developed for this effort must also be formulated to take advantage of massively parallel computational environments, that ultimately, will enable FTSI analysis to be performed at a significantly higher-level of fidelity.	Pursuing Doctoral Degree	Robert Baurle	robert.a.baurle@nasa.gov	757-864-9016	Jeffery White	jeffery.a.white@nasa.gov	520-308-4258

NASA Center	Center Code	Opportunity Title	Opportunity Description/Objective (specific student assignment)	Desired Student Academic Level	Technical Adviser	Technical Adviser's email	Technical Adviser's Phone Number	Co-Technical Adviser's	Co-Technical Adviser's email	Co-Technical Adviser's Phone Number
LaRC-005	ARMD	Development of a quadcopter-based platform for evaluation of the Space Launch System and Mars Science Laboratory Sky Crane control system designs	<p>The Space Launch System (SLS) and Mars Science Laboratory (MSL) Sky Crane control system designs are challenging given uncertainties in the dynamics such as vehicle bending and fuel sloshing. Considering the enormous costs associated with each mission, the flight certification process relies heavily on analytical models, simulations, and historical flight data. Hardware-in-the-loop tests are difficult and costly to perform. Often due to a lack of testing, conservative bounds on these complex dynamics leads to lower vehicle performance and payload reduction.</p> <p>The objective of the fellowship research is the development of a quadcopter test bed that closely mimics the fundamental dynamics of the SLS and MSL Sky Crane systems which would allow vigorous testing of the associated Guidance, Navigation, and Control (GN&C) algorithms.</p> <p>All 4 systems are naturally unstable and requires active feedback control for stabilization. The quadcopter based setups would offers a simple platform that's dynamically similar to SLS and MSL Sky Crane which would allow the GN&C team to test out algorithms on actual hardware systems hence gain further confidence in the designs. This work would be performed at the NASA Langley Research Center Autonomy and Robotics Laboratory.</p>	pursuing Master's or Doctoral Degree	Jing Pei	Jing.Pei-1@nasa.gov	(757) 864 - 9335			
LaRC-006	ARMD	Emerging Energy Storage Materials and Related Architectures for Electric Aircraft and Space Exploration	<p>Requirements for energy storage systems (fuel cells, batteries, supercapacitors, hybrid devices, etc.) for future electric aviation are much more demanding than for ground vehicles in safety, energy density, power density, and rate performance. Energy storage systems for various space exploration missions also have extraordinary challenges and require more focused, mission-specific considerations. Revolutionary developments are needed in energy storage science and engineering for future NASA electric aircraft technology and space exploration mission applications. This opportunity has particular interest in the emerging materials and their architectural design and integration in order to advance this technology to meet demanding applications in aircraft and space exploration. The focus is on the improvement of materials at the atomic level, architectural design and integration, and incorporation into energy storage devices to enable substantial performance improvements. Carbon nanomaterials, nanoscale electrochemical catalysts, porous electrode architectures, stable electrolytes, and solid-state electrolytes and combinations thereof are among the interested topics.</p> <p>The student is expected to be trained in a multidisciplinary environment rather than a specific discipline. Students with backgrounds in chemistry, physics, materials, and chemical and electrical engineering are particularly encouraged to apply. Other majors can be considered if the proposed study is relevant.</p>	Pursuing Master's Degree or Pursuing Doctoral Degree	John W. Connell	john.w.connell@nasa.gov	757-864-4264	Yi Lin	yi.lin-1@nasa.gov	757-864-2219

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LaRC-007	ARMD	Enabling Precision Landing of Large Payloads on Mars via Morphing HIADS	Conventional rigid aeroshells used for entry are coming to the edge of their operational limits in terms of allowable mass and size. Mars Science Laboratory (MSL) had a rigid heatshield with a diameter of 4.5 meters utilizing Viking-era technology to deliver a 950-kilogram payload. Current Mars rovers have a landing uncertainty ellipse on the order of hundreds of kilometers, in order to land humans on Mars the landing accuracy needs to be improved by several orders of magnitude. There is a necessity for a technology transformation in order to land large mass systems and humans on Mars. Current research focuses on supersonic retropropulsion (SRP) and inflatable decelerators to land large mass systems on distant planets. However, these concepts have significant drawbacks: 1) SRP and inflatable decelerators require a large amount of propellant mass, decreasing the overall mass that could be landed on the surface. 2) Current inflatable decelerators only allow for downrange and crossrange control of the entry vehicle through a center of gravity (CG) offset and bank angle control via RCS jets, limiting the ability to land the vehicle accurately. Morphing Hypersonic Inflatable Decelerators (HIADs) occurs potentially significant improvements in landing footprint accuracy compare to conventional bank angle control in addition to other advantages such as packing, scalability, and need for large ballast mass. Currently, there is limited knowledge on how to properly model and simulate re-entry vehicles whose shape morphs during flight. This research aims to mature the modeling and simulation capabilities of shape changing re-entry systems. Specific aims are: development of reliable aerodynamic and aerothermal databases for morphing HIADs, improving current state of the art flight trajectory codes, and development of guidance and control algorithms that enables precision landing of morphing HIADs. This technology is expected to advance the current Entry, Descent, and Landing (EDL) capabilities for Transformable Entry Systems highlighted on NASA Technology Roadmaps.	Pursuing Master's or Doctoral Degree	Jing Pei	Jing.Pei-1@nasa.gov	(757) 864 - 9335			
LaRC-008	HYP	Enhanced Injection and Mixing Techniques with Application to Hypervelocity Scramjet Propulsion Systems	Advance are sought for novel and innovative fuel injection and mixing techniques for scramjet propulsion systems operating at flight Mach numbers of 8 or greater. This solicitation is focussed on the advancement the state-of-the-art in design strategies that improve injector performance; namely, increased mixing efficiency and reduced losses. The outcomes of the research should increase the knowledge and understanding of the fundamental physics governing scramjet fuel-air mixing relevant to the hypervelocity flight regime, by addressing functional relationships between mixing efficiency and losses/drag. Concepts may potentially be tested in the NASA Langley Arc-Heated Scramjet Test facility for experimental evaluation using downstream gas sampling and flow visualization, or other innovative diagnostic methods.	Pursuing Doctoral Degree	Karen Cabel	karen.f.cabel@nasa.gov	757-864-6267	Tomasz Drozda	tomasz.g.drozda@nasa.gov	757-864-2298
LaRC-009	ARMD	High-Order Unstructured Discontinuous Galerkin Schemes for Smooth Solution Gradients Predictions for High-Speed Compressible Flows	Soliciting independently conceived research proposals in the area of high order compact unstructured schemes for an accurate solution gradients (e.g., shear stresses and/or surface heat flux) prediction for compressible flows on purely unstructured simplex elements (e.g., Triangles, Tetrahedra). Areas including, but not limited to, high order compact discontinuity capturing schemes for discontinuous Galerkin (DG) schemes for compressible Euler and Navier-Stokes equations with strong shocks, grid adaptations for high order and nonlinear elements, high-order visualization, and fully symmetrizable first-order system models for compressible flows.	Pursuing Doctoral Degree	Alireza Mazaheri	ali.r.mazaheri@nasa.gov	757-864-7013			
LaRC-010	ARMD	Machine Learning for Turbulence Modeling in Mixing and Combustion Applications	Improving numerical modeling and prediction of fuel-and-air mixing is of critical importance for energy and propulsion applications of interest to NASA. Recent advances in machine learning technologies have the potential to significantly impact turbulence modeling efforts via both model-form and model-coefficient selections for a specific class, or combination of classes, of turbulent flows that will enhance the development of new models with superior performance. The objective of the proposed opportunity is to demonstrate the use of machine learning tools to develop improved models, and/or model coefficients, for turbulent mixing of fuel and air in a canonical flow such as shear layers, as well as other practical applications.	Pursuing Doctoral Degree	Tomasz Drozda	tomasz.g.drozda@nasa.gov	757-864-2298			

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LaRC-011	ARMD	Multifunctional Lightweight Tough Nanocomposites for Aerospace Applications in Extreme Environments	Future NASA missions for space exploration require key technological elements that must provide sustainability, survivability, and operational envelope in extreme environments, such as the high and low extremes in pressures, temperatures, ionizing radiations, chemical and/or physical corrosion, and hypervelocity particles. Multifunctional advanced materials can enable revolutionary design schemes for future aerospace vehicles and structures for the extreme environment NASA missions. Recent studies of nanocomposite materials have shown the potential for both structural integrity and multifunctional capabilities, such as sensing, actuating, health monitoring, radiation shielding, energy harvesting, thermal management, and thermal protection in extreme environments. Boron Nitride Nanotube (BNNT) is a structural analogue of carbon nanotube. Having extraordinary mechanical properties, BNNTs also offer unique high thermal stability (> 900°C in air), chemical stability, corrosion resistance, high dielectric strength, neutron radiation shielding, and piezoelectricity. To explore all-around BNNTs for future NASA missions, new BNNT based composites, fibers, and yarns will be developed using polymers, metals, and ceramics as matrices to study their mechanical, thermal, electrical, sensing/actuation, and radiation shielding properties systematically. A gifted student is sought to research and develop new multifunctional lightweight tough nanocomposites that will be used for real-world aerospace applications in extreme environments.	Pursuing Master's Degree or Pursuing Doctoral Degree	Cheol Park	cheol.park-1@nasa.gov	757-864-8360	Sang-hyon Chu,	sang-hyon.chu-1@nasa.gov	757.864.8215
LaRC-012	HEOMD	Space Radiation Risk modeling	Understanding and mitigating the health risks of space radiation, including cancer, cardiovascular disease, and effects on the central nervous systems, is essential to successful human exploration beyond low earth orbit. Models will be needed to estimate these effects as well as the impact of potential biomedical countermeasures. This opportunity covers the development and validation of more accurate models to predict these effects	pursuing Master's Degree or Pursuing Doctoral Degree	Steve Blattnig	steve.r.blattnig@nasa.gov	757 864-1421	Ryan Norman	ryan.b.norman@nasa.gov	757 864-2185

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MSFC-000		Student Proposed with Concurrence of NASA Technical Mentor	The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Advisor.	Pursuing Master's Degree or Pursuing Doctoral Degree	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor	Student identified NASA Technical Advisor			
MSFC-001	ST12	Astrophysics: Transients in High-Energy Astronomy	Opportunities for research in high-energy astronomy emphasize the study of transient hard x-ray and gamma-ray sources using a variety of space-borne instruments. Extensive investigations are based around the Fermi Gamma-ray Burst Monitor (GBM), which was developed by the Huntsville team in collaboration with the German MPE, and launched in 2008. GBM's primary scientific objective is the study of Gamma Ray Bursts; it also provides observations of solar flares, pulsars, accreting neutron stars and black holes, soft-gamma repeaters, and terrestrial gamma-ray flashes from thunderstorms. Recently, the first gamma ray burst associated with gravitational waves was discovered with GBM, GRB 170817A/GW170817. Considerable research is underway to improve counterpart searches along with improved analysis of the LIGO gravitational wave data. Data from GBM is synergistic with current and past gamma and X-ray missions, for example, the Neutron star Interior Composition Explorer (NICER) launched to ISS in 2017, Swift launched in 2004, INTEGRAL, a European gamma-ray satellite launched in 2002, the Large Area Telescope on Fermi, and high-energy ground-based facilities such as HAWC and VERITAS. Future mission concept development within the team includes MoonBEAM, a follow-on mission to GBM, on a smallsat, and the Large Area Polarimeter (LEAP), a gamma-ray burst polarimeter under study and the Spectroscopic Time-resolved Observatory for Broadband X-rays (STROBE-X), a probe-class mission under study. MSFC scientists have extensive external collaborations, including those with GBM partner institutions: MPE, University of Alabama in Huntsville, Universities Space Research Association, and University College Dublin.	Pursuing Doctoral Degree	Colleen A. Wilson-Hodge	colleen.wilson@nasa.gov	256-961-7624	C. Michelle Hui	c.m.hui@nasa.gov	256-961-7768
MSFC-002	ST13	Astrophysics: X-Ray Astrophysics Analysis and Technology Development, and Mission Concept Development	This topic refers to research related to high-energy X-ray Astrophysics concepts for the next large flagship X-ray mission. Specifically, support of the Lynx mission concept development and related technologies is sought. Lynx is a large NASA mission concept study being funded by NASA HQ in preparation for the 2020 Astrophysics Decadal Survey. The mission will include a large area, high angular resolution telescope with orders of magnitude leap in sensitivity over Chandra and ATHENA, and the ability to provide better understanding of the origins and underlying physics of the cosmos. It is anticipated that the Decadal Survey Committee will use this study, that MSFC was selected to lead, as part of its process in formulating their recommendation for prioritizing NASA's large strategic missions following JWST and WFIRST. The final study report is due to the Decadal Survey in the summer of 2019. Research topics might include X-ray optics development, X-ray instrument technology assessment, and Study Office internal and outreach activities.	Pursuing Doctoral Degree	Jessica Gaskin	jessica.gaskin@nasa.gov	256-961-7818	Karen Gelmis	karen.e.gelmis@nasa.gov	256-961-7854
MSFC-003	SMD	Dynamic Structural Thermal Optical Performance (STOP) Design and Modeling for Space Telescopes	Space telescope have a wide range of mechanical challenges. Stable optical performance in dynamic thermal and mechanical environments is a critical factor to high-contrast imaging. Options need to be explored to increase stiffness, reduce mass, and improve optical performance. Current analysis tools for ultra-stable telescopes need additional development. Design innovations will need to be analyzed with new methods to ensure this high level of performance. Also, maybe freeform optics can enable more compact designs. Technical challenges can include: how optical performance of freeform optics is affected when scaling to large space telescopes; how to deploy in space a large-aperture mechanically/thermally-stable optically-precise telescopes; model and control the dynamic stability/jitter of large telescope systems to maintain milli-arc-second pointing stability and diffraction limited wavefront; model and characterize the thermal response of large telescope systems to changing slew and role attitude.	Pursuing Master's Degree or Pursuing Doctoral Degree	H Philip Stahl	h.philip.stahl@nasa.gov;	256.544.0445	Brooks, Thomas Garcia, Jay C.	thomas.brooks@nasa.gov; jay.c.garcia@nasa.gov	256.544.5596 256.961.4331
MSFC-004	HOEMD	Enivronmental Control and Life Support Technology for Space and/or Earth Applications	Environmental Control and Life Support (ECLS) is an essential function of long-duration manned space flight. Technology development to identify the best technologies to ensure crew survival is ongoing. These technologies can occasionally be modified and implemented on Earth to solve terrestrial challenges. This opportunity will involve support in the development of one or more of these technologies for Space application, Earth application, or a combination of both.	Pursuing Master's Degree or Pursuing Doctoral Degree	Morgan B. Abney, Ph.D.	morgan.b.abney@nasa.gov	256.961.4758			

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MSFC-005	HOEMD	Graph Theoretic Methods for Model Based Systems Engineering	Research will explore the application of graph theoretic metrics developed for software engineering to systems engineering. Graph theoretic metrics have been developed and successfully applied to help manage complexity in software engineering, leading to software projects that are more efficiently developed and validated. Three metrics in particular, McCabe cyclomatic complexity, Halstead complexity, and lexicographic complexity, have been determined from UML diagrams per the research literature. Since SysML is an extension of UML, these metrics hold promise for systems engineering application, enabling systems models to yield information to guide the effective and efficient realization of complex engineering systems. Research proposed will develop methods for evaluating the metrics and assessing them for scalar independence, determination of needed adaptations for the metrics to apply to apply in a general systems context, correlation of metrics to program success for selected case studies, and develop algorithms for their determination real-time from SysML diagrams.	Pursuing Master's Degree or Pursuing Doctoral Degree	Joe Hale	joe.hale@nasa.gov	256-544-2193			
MSFC-006	HOEMD	Information Models and Ontologies for NASA Mission System Multi-domain Modeling	The multiplicity and complexity of interactions in NASA mission systems, along with the need of tight timing and spatial constraints make them prone to uncertainty and emergent behaviors that are hard to uncover and characterize in a systematic way. Research proposed will develop semantic modeling foundations for NASA mission systems. Research proposed will (1) analyze representative NASA mission systems to create a conceptual model family which can be extended for ground, low Earth orbit, cislunar, and deep space information models of such systems, (2) create ontologies to support the formal description of the domains involved in the multi-domain effort and support consistency and completeness verification of the information models for the families of NASA mission systems identified, and (3) develop a handful of simple domain rules to support and demonstrate in-domain reasoning.	Pursuing Master's Degree or Pursuing Doctoral Degree	Joe Hale	joe.hale@nasa.gov	256-544-2193			
MSFC-007	ST13	Lunar and Planetary Science: Planetary Seismology	In order to advance our knowledge on the formation and evolution of planetary bodies, a detailed picture of their interiors is required. A variety of geophysical data have been collected for many bodies in our solar system, yet seismic recordings offer the most detailed information on their interior structure. Until InSight lands on Mars in late 2018, the Moon is the only body besides the Earth for which we have seismic recordings. Analysis of the lunar seismic data gathered during the Apollo missions continues to reveal new information, including the structure of the crust and mantle, the state of the deepest interior, and the presence of a core. However, considerable uncertainties remain as to the overall internal structure and seismicity of the Moon. This project focuses on original research in the field of lunar and planetary seismology, including (but not limited to): seismic instrumentation development, Apollo seismic data re-analyses, theoretical waveform modeling, shallow and deep structure determination, surface image analysis as it relates to seismology and tectonism, and modeling in support of site selection and science return for future planetary seismometers. Requirements: familiarity with MATLAB and a UNIX-based programming language (C, FORTRAN, Python, etc.)	Pursuing Doctoral Degree	Renee Weber	renee.c.weber@nasa.gov	256.961.7705			

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MSFC-008	HEOMD	Modeling investigation of cooling and transfer physics and operations in a cryogenic propellant receiver tank	Cryogenic propellants are essential to NASA's mission for in-space exploration, providing higher overall propulsion-system performance than can be achieved with solids or hypergolic systems. Typical propellants are hydrogen, oxygen and methane, which are stored as sub-critical liquids at high density in large, low-pressure propellant tanks. For long duration missions, and in the case of landers and nuclear thermal propulsion systems, the ability to refill these systems is attractive, as it allows the vehicle to be reused. The in-space transfer of cryogenic propellants is problematic and hardware and operations need to be devised to minimize losses due to venting, chill-down, and tanking, while maintaining operational simplicity. The focus of this research would involve system-level fluid modeling and analyses to investigate the chill-down and injection of cryogenic fluid into a propellant tank. The research should consider strategic venting (i.e. minimal mass vented) while cooling the tank system, followed by no-vent fill scenarios to transfer the bulk fluid into the propellant tank. The cool down of the transfer lines can also be examined. Investigations would include modeling of spray condensation and evaporation coupled with fluid thermodynamics and heat transfer for both normal gravity and micro-gravity conditions. Packages such as MSFC's Generalized Fluid Systems Simulation Program (GFSSP) as well as a 2-D or 3-D CFD program would be used to develop scaling relations for chill and fill processes over a range of propellant tank sizes. Liquid nitrogen is a convenient and useful simulant for cryogenic propellants. Tests with LN2 may be used to anchor numerical models and simulations which can then be applied to other cryogenic propellants. MSFC has a small experimental facility that has been used to generate liquid nitrogen vented chill/no-vent fill data, which can be used to validate models under specific conditions.	Pursuing Master's Degree or Pursuing Doctoral Degree	Adam Martin, MSFC ER24	Adam.K.Martin@nasa.gov	(256) 544-5296	Jonathan Stephens, MSFC ER24	Jonathan.R.Stephens@nasa.gov	(256) 544-3769
MSFC-009	STMD	NanoLaunch Component Development	NASA is recognizing a growing demand for dedicated, responsive small spacecraft launch systems and seeks to facilitate the establishment of a robust launch service provider market sector. The movement toward small spacecraft missions is largely driven by rising development/launch costs associated with conventional spacecraft, which poses severe threats to future science/commercial mission cadence, and by rapidly evolving miniaturization innovations that are revolutionizing small spacecraft platform capabilities. This opportunity seeks innovative technologies, subsystems, and efficient streamlined processes that will support the development of affordable small spacecraft launch systems having a 5-180 kg payload delivery capacity to 350 to 700 km at inclinations between 28 to 98.2 degrees to support both CONUS and sun synchronous operations. Affordability objectives are focused on reducing launch costs below \$1.5M/launch for payloads ranging up to 50 kg or below \$30,000/kg for payloads in excess of 50 kg. It is recognized that no single enabling technology is likely to achieve this goal and that a combination of multiple technologies and production practices are likely to be needed. Therefore, it is highly desirable that disparate but complementary technologies formulate and use standardized plug-and-play interfaces to better allow for transition and integration into small spacecraft launch systems. This opportunity seeks to mature innovative ideas providing a pipeline of components, processes, technologies, propellants, and materials that enhance propulsive performance or that enable adequate propulsive performance at a significant cost savings. Innovations submitted under this opportunity must focus on meeting the affordability objectives. Each innovation must be linked to an existing or proposed launch architecture and operational paradigm. A develop path must be outlined that defines the current development state of the innovation(s) and outlines the improvements sought that will enable a launch system to meet the affordability objectives.	Pursuing Master's Degree or Pursuing Doctoral Degree	Jonathan E. Jones	jonathan.e.jones@nasa.gov	256-544-1043	Tim Kibbey	tim.kibbey@nasa.gov	256-961-2247
MSFC-010	SMD Earth	Remote Sensing of Energy and Water Cycle Variability	The objective of supported research is to use satellite-based datasets to better understand the Earth's hydrologic and energy cycles. Particular emphasis is placed on measurement and analysis of integrated hydrologic variability in the earth system from global to regional scales to include interannual to subseasonal spatial and temporal variability of water and energy cycle components. An ideal candidate is one whom is capable of using both satellite — passive and active instruments — and modelling assets to perform integrated, diagnostic analyses of atmospheric mass, energy and/or moisture budgets.	Pursuing Doctoral Degree	J. Brent Roberts	jason.b.roberts@nasa.gov	(256)-961-7477	Pete Robertson	pete.robertson@nasa.gov	256-961-7836

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

Appendix E: Appendix E: Professional Development Requirements

The goals of the Professional Development activities is to broaden the Fellow's skills and prepare for the workforce. These include skills, beyond core research skills, that will position the student for success in a variety of career paths. Knowledge about career options, educational requirements, and advanced professional skills and soft skills significantly enhance the likelihood of successfully navigating and job into the STEM workforce. The Professional Development activities are designed to develop skills in areas such as research and career planning, communication, presentation, project management, and leadership.

I. Fellow Professional Development Allowance

This allowance (\$1,500) may be used in direct support of training, research, technical, scientific, and publication needs of the Fellow. This allowance can be used in concurrence with the Faculty Adviser Allowance to cover approved Fellowship Fellow domestic travel to technical and scientific meetings. Each Fellow is expected to attend at least one technical conference to present the work he or she is conducting under the awarded research proposal. All technical conferences shall follow procedures for approval by the NASA Fellowships Manager. The cost of travel is on U.S. General Services Administration rates, (<https://www.gsa.gov/travel/plan-book/per-diem-rates>).

- A. Professional research, graduate student and minority-serving conferences, symposiums, and workshops
 - 1. Registration Fees
 - 2. Maximum three nights in a hotel per event
 - 3. Per diem 3 full days two ½ days
 - 4. Travel cost to and from event
- B. Publication costs for conference presentation material, related research papers, thesis, and dissertation.
- C. Training for professional required skills such as software training.

II. Individual Development Plan (IDP)

The Fellow will create and maintain an individual development plan (IDP) at <http://myidp.sciencecareers.org/>. The goal of an Individual Development Plan (IDP) is to help you evaluate progress toward both short-term and long-term career goals and to identify areas that require additional attention and effort. An IDP is a living document that can serve as a guiding document for mentor/mentee discussions. Importantly, an IDP should be a roadmap for developing new skills and address concrete steps for the transition to the next stage of an individual's career.

III. Professional Development Activities

A. Fellowship Program Year 1

September – conference call

- The Fellows and the Faculty Adviser (PI) are required to participate in a conference call with the program management to review the grant requirements, funding requirements, and to answer questions that they might have.

October – webinar

- Pre-planning for the Center Based Research Experience (CBRE)
 - Fall/Winter meeting greet with the NASA Technical Adviser at the NASA Center
 - Summer research plan requirements
 - Answer any additional questions that have arisen
- Jenkins Fellows (MUREP funded) are required to attend the **Institute on Teaching and Mentoring** conference during the last weekend of October each year. **Paid with funds from MUREP.**

November – webinar

- Driving Your Success - Don't assume that a profession anchored in technical excellence will advance your career. Mastery of a discipline only accounts for 15% of what is needed to excel in the workforce. What accounts for the other 80%? This discussion provides an overview of soft skills and why they are essential to your professional and personal life.

December – webinar

- Mapping Career Path to Success - The Individual Development Plan (IDP)
(<http://www.sciencemag.org/careers/2012/09/you-need-game-plan>)
 - Step 1 <http://myidp.sciencecareers.org/>

January – webinar

- NASA Onboarding and the CBRE – Review the process for onboarding and the preparation for the CBRE.

February – webinar

- Successfully Navigating your Career Path: Missing the Pitfalls, Obstacles, and Barriers - Your career path may have obstacles and barriers that may derail, distract or delay your journey. This workshop provides strategies and tools to navigate your environment both professionally and personally.

March – webinar

- The Fellowship Renewal Process – This session explains Fellowship Renewal process that required for each year.

April – webinar

- Responsibilities and Ethics in the Conduct of Research: This session focus on different aspects of the responsibilities and ethics in the conduct of research, such as recognizing and approaching ethical problems, mentoring, conflicts of interest and commitment, avoiding plagiarism, intellectual property, research misconduct, human subject research, and animal research and lab safety.

May - webinar

- The NASA Way – NASA Project Management: This session is a high-level overview of NASA program and project management and the life cycle of the process.

June – August

- Center Based Research Experience (CBRE): Fellows participation is required. The Fellow is expected to participate fully in the NASA Center's summer program. The fellow is required to submit their summer deliverable to program management by August 31st.

B. Fellowship Program Year 2

September – conference call

- The Fellows and the Faculty Adviser (PI) are required to participate in a conference call with the program management to revisit and review the grant requirements, funding requirements, and to answer questions that they might have.
- *The Fellow is expected to attend a professional conference during the academic years.*

October – webinar

- Made to Stick: Keys to Giving Effective Presentations: This session will provide insights on how to give a powerful presentation and how to avoid common mistakes.
- Jenkins Fellows (MUREP funded) are required to attend the **Institute on Teaching and Mentoring** conference during the last weekend of October each year. **Paid with funds from MUREP.**

November – webinar

- Center Based Research Experience Presentations: This session Fellows will present their research from the summer experience to the cohort.

December – webinar

- Mapping Career Path to Success - Planning and Organizing Your Research: This session is about how to narrow your project's topic and focused your research goals, and how to effectively manage your research notes to enable success.

January – webinar

- Writing a Dissertation or Thesis: Getting Started - Getting Done: This session will provide you with the tools needed to get started or to make more efficient progress and get done! We will discuss practical strategies for writing your dissertation/thesis including tactics for time management and organization, stages in the writing process, strategies for integrating material from sources, and techniques of maintaining momentum and a positive attitude.

February – webinar

- Quick Review - NASA Onboarding the CBRE: Year 2
- Publishing - Getting Started to Getting Done Part 1: This session will provide you with the tools needed to publish including tactics for time management and organization, stages in the writing process, strategies for integrating material from sources, and techniques of maintaining momentum and a positive attitude.

March – webinar

- Quick Review - The Fellowship Renewal Process - Year 2

- Publishing - Getting Started to Getting Done Part 2: This session will provide you with the information about the legal issues with publishing and processing a document through the NASA Center ITAR and Center's Export Compliance Office.

April – webinar

- Responsible Conduct of Research: This session is a high-level overview of the Responsible Conduct of Research (RCR) defined as "the practice of scientific investigation with integrity." It involves the awareness and application of established professional norms and ethical principles in the performance of all activities related to scientific research.

May - webinar

- The Individual Development Plan (IDP)
 - Step 3 <http://myidp.sciencecareers.org/>
- The NASA Way – NASA Project Management Going Further: This session is about developing strong project management skills to complete your training and achieve your career goals.

June – August

- Center Based Research Experience (CBRE): Fellows participation is required. The Fellow is expected to participate fully in the NASA Center's summer program. The fellow is required to submit their summer deliverable to program management by August 31st.

C. Fellowship Program Year 3

September – conference call

- The Fellows and the Faculty Adviser (PI) are required to participate in a conference call with the program management to revisit and review the grant requirements, funding requirements, and to answer questions that they might have.
- *The Fellow is expected to present their research at a professional conference during the academic years.*
- Leaders for the Future: This session will provide information on training in leadership and business communication skills.

October – webinar

- The Individual Development Plan (IDP)
 - Step 4 <http://myidp.sciencecareers.org/>
- The Job Search –USA Jobs, The Federal Pathways Program, C.A.R. Resume and Cover Letter: This session will provide information on the process to hunting down a Federal employment.
- Jenkins Fellows (MUREP funded) are required to attend the **Institute on Teaching and Mentoring** conference during the last weekend of October each year. **Paid with funds from MUREP.**

November – webinar

- Finding the Money: This session will provide information on the Federal solicitation cycle, the funding search, and application process.

December – webinar

- The Peer Reviewer - Peer-Review Techniques for Novices: This session will provide information on the role of a Peer Reviewer and techniques succeed in this role.

January and February – webinar

- **Becoming an Entrepreneur**: This two-part session introduces the student to the core concepts and resources of entrepreneurship. Topics include recognizing the need for innovation, how to develop a business plan, building an effective team, intellectual property, patent and trademark strategy, marketing strategy and cultivating funding sources

March, April, and May – webinar

- The Fellowship Closeout Process - Year 3: This session will
- STEM Outreach – Giving Back
 - The Fellow must participate in a STEM outreach activity such as talking to school children about STEM careers, judging a STEM competition, etc.

June – August

- CBRE participation is required. The Fellow is expected to participate fully in the NASA Center's summer program. The Fellow is required to submit their summer deliverable to program management by August 31st.

Appendix F: Fellowship/Scholarship Travel Funds Procedure

All travel funds shall be used in support of a grant awarded by NASA for the fellowship/scholar program. All steps shall be completed before approval for travel will be given. Travel funds are for domestic travel only. The Travel Request is completed by Fellow/Scholar with the PI's assistance of:

Before Travel:

1. A written statement and request must be submitted by the Fellow's/Scholar's PI 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 of the invitation to present from the conference administrators
2. Complete the NASA Fellowship/Scholarship Travel Request Budget Form
3. If the Fellow is presenting research (presentation, research paper, and or poster) at the conference, then an International Traffic in Arms Regulations (ITAR) review must be completed with the assistance of the NASA Technical Advisor:
 - a. If the presentation, research paper, and or poster does not require an ITAR review, an email from the NASA Technical Advisor shall be submitted with the request.
 - b. If the NASA Technical Advisor determines the presentation, research paper, and or poster needs to be reviewed by the Center's Export Compliance Office, then the NASA Technical Adviser will assist in completing the review at the NASA Center. The approval document shall be submitted.
4. Submit approval documents to Fellowship/Scholarship Program Management.

After Travel:

1. The Fellow/Scholar shall complete a **Travel Follow-up Report** within two weeks of the end of travel. The report shall 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 the fellow/scholar 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 events
 - 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 Fellowship Activity awards are made initially for a one year period of performance and may be renewed for an additional two years contingent upon satisfactory progress, as reflected in the academic performance, research progress, a recommendation by the faculty advisor, NASA Technical Adviser and the availability of funds. Fellows/Scholars seeking renewal shall submit a Renewal Proposal Applications Package to program management for the Academic Year 2019-2020. The Renewal Proposal Applications Package includes the Annual Progress Reports that are a comprehensive summary of significant accomplishments during the reporting period or for 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 the Renewal Proposal Applications Package is required before the Program Officers can release funding for additional years. The responsible parties for submitting the documentation for renewal are the Fellow and the Faculty PI to program management.