NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
HEADQUARTERS
NASA Office of STEM Engagement
300 E STREET, SW
WASHINGTON, D.C. 20546-0001

NASA Fellowship Activity
for Fiscal Years (FY) 2020, 2021, and 2022

NASA Research Announcement (NRA)

NNH20ZHA001N

CATALOG OF FEDERAL DOMESTIC ASSISTANCE (CFDA) NUMBER: 43.008
Important Information

1. This is a multi-year solicitation covering fiscal years (FY) 2020, 2021, and 2022.

2. Proposals for specific FYs must be submitted by the dates and times listed below.

3. All proposals are due at 5 pm ET, 4pm CT, and 2pm PT.

<table>
<thead>
<tr>
<th>2020 Deadline</th>
<th>2021 Deadline</th>
<th>2022 Deadline</th>
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<tbody>
<tr>
<td>Release Date</td>
<td>December 23, 2019</td>
<td>Currently scheduled for October 2020</td>
</tr>
<tr>
<td>Proposal Due (Phase 1)</td>
<td>February 21, 2020 (60 days after the release date)</td>
<td>Currently scheduled for January 2020</td>
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4. Pre-proposal teleconference

<table>
<thead>
<tr>
<th>2020</th>
<th>2021</th>
<th>2022</th>
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<tr>
<td>January 8, 2020</td>
<td>TBD</td>
<td>TBD</td>
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<tr>
<td>February 5, 2020</td>
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<td></td>
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</table>

Teleconference number: 1-844-467-6272 Passcode: 549325
Times will be announced on the NASA Fellowships Website: [https://www.nasa.gov/education/fellowships-scholarships/index.html](https://www.nasa.gov/education/fellowships-scholarships/index.html) or NSPIRES: [http://nspires.nasaprs.com](http://nspires.nasaprs.com)

5. Awards will be announced approximately six (6) months after the solicitation closes.

OMB Approval Number 2700-0092
Expires - 09/30/2022
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EXECUTIVE SUMMARY

The National Aeronautics and Space Administration (NASA) journeys have propelled technological breakthroughs, pushed the frontiers of scientific research, and expanded our understanding of the universe. These accomplishments, and those to come, share a common genesis: education in science, technology, engineering, and mathematics (STEM).

The following statutory language authorizes NASA to initiate this Fellowship Activity which speaks to strengthen the research capability at U.S academic institutions:

2. The National Aeronautics and Space Act [51 U.S.C. § 20101 et seq.] and;

Through the National Science and Technology Council’s (NSTC) Committee on STEM Education (CoSTEM), federal agencies, including NASA, coordinate their investments in STEM education to magnify the impact of their work.

NASA’s Office of STEM Engagement (OSTEM) seeks to leverage NASA’s unique mission activities to enhance and increase the capabilities, diversity, and size of the nation’s next generation STEM workforce needed to enable future NASA discoveries, including NASA’s Artemis Program that begins the next era of exploration. Through its internal collaboration with NASA Mission Directorates (MD), NASA Centers, the Jet Propulsion Laboratory (JPL), and external STEM partners, OSTEM aims to bring unique opportunities to learners, educators, and institutions by providing access to NASA’s mission content, people, resources, and facilities.

This NASA Research Announcement (NRA), titled the NASA Fellowship Activity, solicits proposals from accredited U.S. institutions for research training grants to begin in the 2020-2021 Academic Year. This NRA is designed to support independently conceived research projects by highly qualified graduate students, in disciplines needed to help advance NASA’s mission, thus affording these 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. NASA strongly encourages the submission of applications from Minority-Serving Institutions (MSIs), historically underrepresented groups and underserved populations, such as women, minorities, persons with disabilities, LGBTQs and veterans.

The NASA Fellowship Activity opportunity is administered by NASA’s OSTEM. The NASA Headquarters OSTEM’s Minority University Research and Education Program (MUREP) intends to award a total of $1.6 million in training grants in FY 2020 for up to 25 Fellows.

MUREP investments enhance the research, academic, and technology capabilities of MSIs through multi-year awards. These awards assist faculty and students in research and provide authentic STEM engagement related to NASA missions.
There may be additional awards provided by NASA Centers and JPL with projects funds associated with the Aeronautics Research Mission Directorate (ARMD), Science Mission Directorate (SMD), Science Technology Mission Directorates (STMD) and /or the Human Exploration and Operations Mission Directorate (HEOMD). This NASA Fellowship Activity NRA provides flexibility so that each funding source may have its unique expectations and selection criteria. Additionally, this NRA demonstrates NASA’s commitment to an integrated, Agency approach of STEM Engagement activities. Contingent upon available federal funding, NASA will administer the Fellowship until closeout, thereby fulfilling NASA responsibilities to NASA Fellows.

Unique to this research and development fellowship, OSTEM’s programmatic structure establishes a Professional Learning Community (PLC) consisting of active NASA Fellowship cohorts, institutional faculty advisers as the grant Principal Investigators (PIs), NASA researchers, scientists, program managers and subject matter experts (SMEs) from industry and other federal agencies. The PLC is designed to provide a network of mentors committed to the successful completion of the proposed research.

1. OVERVIEW OF SOLICITATION

1.1 Purpose of Fellowship
The NASA Fellowship Activity is designed to provide academic institutions the ability to enhance graduate-level learning and development. Institutions are provided funds that support graduate students at a level that allows the students to fully concentrate on academic and research proficiency without the need to seek employment.

NASA STEM Engagement delivers tools for American students and educators to learn and succeed. The objectives are:

- Create unique opportunities for students and the public to contribute to NASA’s work in exploration and discovery;
- Build a diverse future STEM workforce by engaging students in authentic learning experiences with NASA people, content, and facilities; and
- Strengthen public understanding by enabling powerful connections to NASA’s mission and work.

To achieve fellowship goals, NASA STEM Engagement strives to enhance higher education, support underrepresented communities, and strengthen online education. The intended outcome is a generation prepared to code, calculate, design, and discover its way to a new era of American innovation.
1.2 NASA Fellowship Program Description

The NASA Fellowship Activity is an institutional award that provides financial support towards the development and training of graduate researchers. It leverages the capabilities of academic research institutions and professional development components, designed to provide experiences that enhance the fellows with NASA’s best and promising practices for STEM workforce development. This includes the following:

Proposed Research
The Institution’s candidate independently conceives the research hypothesis or engineering design project concept in response to the NASA graduate research opportunities listed in the NRA (See Appendix E for NASA Research Opportunities). The Faculty Adviser and the institution’s candidate develop the proposal in collaboration with the NASA Technical Adviser in order to assure institutional capability and capacity, ensure relevance to Mission Directorate priorities, and secure NASA’s technical support for use of its unique facilities, content and/or SMEs. The institution submits the proposal for support of a graduate student. If a NASA Training Grant is awarded, the Faculty Adviser serves as the PI under the awarded grant.

On-Site Experience
If the proposal is selected and awarded as a grant, the NASA Technical Adviser becomes an integral part of the team and an additional member of the research cohort community. The NASA Technical Adviser promotes NASA’s innovation-oriented culture and provides entry into NASA-unique facilities; access to specialized equipment, and exposure to NASA’s partners and collaborators. NASA Fellows will be mentored by the NASA Technical Adviser at a host NASA Center or at JPL during an annual 10-week Center-Based Research Experience (CBRE). The CBRE occurs in the summer months, in order to receive exposure to the dynamic Federal research and development (R&D) environment and additional professional development activities. The CBRE is a mandatory requirement since it offers exposure to the fellows that isn’t easily replicated in academia. Through the CBRE, fellows will advance their STEM education, gain relevant research experience, expand their professional network, learn best practices, develop and strengthen research ethics, and cultivate an understanding of specific research processes.

Additional Year Extension
The NASA Fellowship Activity is a multiyear award designed to provide an optional third year of support for a Master’s Fellow and a fourth year of funding for a Doctoral Fellow for merit-based supplemental experience. Teams with a fellow in a doctoral program are offered the prospect to expand their research allowing for a possible additional year of funding. During this time a team can build upon discoveries from previous years. The objective of the extension is to offer the most innovative investigators an extended opportunity to pursue enterprising opportunities in the same research field of study that was not covered by the original proposal. Teams are encouraged to leverage the research/engineering experience gained from NASA’s original investment and embark upon entrepreneurial, technology advancement or technology transfer pathways. Directions for applying for an additional year extension can be found in Appendix I.
Professional Networking Opportunity

NASA MUREP funded Fellows will have the ability to participate in the Southern Regional Education Board (SREB) prestigious conference each year, where they will have the opportunity to network with the Fellows, meet prospective recruiters, participate in professional development sessions and attend graduation ceremony. The SREB conference is a mandatory requirement for the MUREP-funded Fellows upon invitation.

Requirement to Notify NASA of Other Funding Selections

When a PI submits a proposal to NASA with overlapping participant support funding at the same time as the NASA Fellowship Activity, the PI shall notify the NASA Fellowship Activity project manager of this fact. A proposal that overlaps with a previously-submitted proposal that is still under consideration shall acknowledge (e.g., in the budget justification), that funds have also been requested elsewhere. If NASA selects both a NASA Fellowship Activity and a non-NASA Fellowship Activity proposal, the AOR/PI shall inform the NASA managers of this fact so that appropriate budget negotiations/adjustments occur.

1.3 Agency-wide Priorities

NASA engages the public and students in its mission through a portfolio of STEM programs and activities. The 2018 Strategic Plan outlines the direction for the National Aeronautics and Space Administration (NASA) through 2021 and beyond. The 2018 NASA Strategic Plan (https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf) reinforces the Agency’s commitment to inspiring an informed society; engaging the public in science, technology, discovery and exploration; and providing unique STEM opportunities for diverse stakeholders. NASA’s investments in these areas are guided by Strategic Goal 3: Address national challenges and catalyze economic growth, and Strategic Objective 3.3 Inspire and Engage the Public in Aeronautics, Space, and Science.

TABLE 1.4 NASA’s Strategic Goals

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<tr>
<td>1.</td>
<td>Discover</td>
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<tr>
<td>2.</td>
<td>Explore</td>
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<tr>
<td>3.</td>
<td>Develop</td>
</tr>
<tr>
<td>4.</td>
<td>Enable</td>
</tr>
</tbody>
</table>
**NASA Strategic Objective 3.3: Inspire and Engage the Public in Aeronautics, Space, and Science.**

Inspire, engage, educate, and employ the next generation of explorers through NASA-unique Science, Technology, Engineering and Mathematics learning opportunities.

NASA’s STEM engagement function will play a critical role in achieving Strategic Objective 3.3 by implementing activities within three focus areas: 1) Create unique opportunities for students and the public to contribute to NASA’s work in exploration and discovery; 2) Build a diverse future STEM workforce by engaging students in authentic learning experiences with NASA’s people, content and facilities; and 3) Strengthen public understanding by enabling powerful connections to NASA’s mission and work. The goals and objectives for NASA STEM Engagement are:

**Goal 1.0: Enabling contributions to NASA’s work**

- **Objective 1.1:** Students contribute to NASA’s endeavors in exploration and discovery.
- **Objective 1.2:** Research and development capacity of educational institutions is enhanced, enabling broad and diverse contributions that directly address NASA priorities.

**Goal 2.0: Building a Diverse, Skilled Future STEM Workforce.**

- **Objective 2.1:** A broad and diverse set of students are attracted to STEM through NASA opportunities.
- **Objective 2.2:** Students, including those from underrepresented and underserved communities, explore and pursue STEM pathways through authentic learning experiences and research opportunities with NASA’s people and work.
- **Objective 2.3:** The portfolio of NASA STEM engagement opportunities meets agency workforce requirements and serves the nation’s aerospace and relevant STEM needs.
- **Objective 2.4:** Strategic partnerships with industry, academia, non-profit organizations and educational institutions enhance and extend the impact of NASA’s efforts in STEM engagement.

**Goal 3.0: Strengthen Understanding of STEM through Powerful Connections to NASA.**

- **Objective 3.1:** Youth are introduced to STEM concepts and content through readily available NASA STEM engagement resources and content.
- **Objective 3.2:** Students gain exposure to STEM careers through direct and virtual experiences with NASA’s people and work.

NASA’s multi-year Performance Goals (PGs) and Annual Performance Indicators (APIs) are outlined in the NASA Volume of Integrated Performance (VIPer) report found on the NASA Budget website (https://www.nasa.gov/news/budget/index.html). The NASA Fellowship Activity supports the following NASA STEM Engagement multi-year PG and API.

| Multi-year Performance Goal | Provide opportunities for students, especially those underrepresented in STEM fields to engage with NASA’s aeronautics, space, and science people, content, and facilities in support of a diverse future NASA and aerospace industry workforce. |
**Success Criteria**

Meet or exceed the national average in two of the four categories of student diversity for NASA STEM enrollees in internships, fellowships, or other student engagement opportunities. Diversity Categories: (1) students across all institutional categories and levels (as defined by the U.S. Department of Education), (2) racially or ethnically underrepresented students (Hispanics and Latinos, African Americans, American Indians, Alaska Native, Native Hawaiians and Pacific Islanders), (3) women, and (4) persons with disabilities at percentages that meet or exceed national averages for science and engineering enrollees, as determined by the most recent, publicly available data from the U.S. Department of Education’s National Center for Education Statistics.

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**1.5 Performance and Evaluation**

NASA is implementing a process to collect demographic data from grant applicants for the purpose of analyzing demographic differences associated with its award processes. Information collected will include name, gender, race, ethnicity, disability status, and citizenship status. Submission of the information is voluntary and is not a precondition of award.


In 2018, NASA’s OSTEM completed a redesign of its Performance Assessment and Evaluation Strategy. As a means to advance annual performance reporting from an output-focus to an outcomes-focus, the OSTEM led an iterative, stakeholder-engaged process, which resulted in the development of an OSTEM-specific learning agenda. As a result of this effort, the learning agenda includes:

- Comprehensive performance assessment and evaluation strategy;
- Internal and external performance measures that track progress toward the Agency’s strategic objectives and program goals;
- Strategic assessment questions, success criteria and data collection processes, and tools supporting agency evaluation evidence-building capacity; and
- Processes for structuring independent studies conducted by third party vendors and for program-level evidence-based decision-making.

NASA identifies evidence of effective practices in its STEM Engagement investments through program evaluation. Evidence is a key criterion in NASA’s competitive processes for allocating resources, ensuring that the most effective STEM engagement activities are supported. Program evaluations are planned studies using research methods to collect and analyze data to assess to what extent activities/programs are being implemented and what, if any, impact can be measured. Evaluations answer specific questions about performance and may focus on assessing activity/program process and outcomes. NASA utilizes the Office of Education Performance Measurement System (OEPM) for analyzing performance data. To facilitate data input into the OEPM system, the NASA Fellowship Activity Project Manager will collect institutional data via
required reports (see section 8. Reporting Requirements). NASA award recipients shall provide and verify performance data for the awarded activity with the NASA Fellowships Activity Program Manager. Award recipients may also be required to respond to data calls and/or participate in future program evaluation data collection efforts at NASA OSTEM’s request. The NASA Fellowship Activity Project Manager will provide additional communications and guidance regarding data calls, future program evaluation efforts, and timelines.

1.6 NASA Relevance

Each proposed research/engineering 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 the Center’s or JPL’s support of the proposal and willingness to serve as a NASA Technical Adviser. In addition, the NASA Technical Adviser shall document the agreed collaboration including a communication plan, specific equipment, and/or facility use and other investments. Both the Faculty Adviser and the NASA Technical Adviser’s proposed collaboration shall be included, and identify areas of interests for collaboration and potential outcomes. Coordination with the potential NASA Technical Adviser is mandatory. If applicants have questions about a research opportunity, they are instructed to 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 Institution’s candidate; and
- How the work will increase the capacity of executing cutting-edge research at the institution.

The websites below can be reviewed to access information about the NASA Mission Directorates:

- Aeronautics Research (http://www.nasa.gov/aeroresearch)
- Space Technology (http://www.nasa.gov/directorates/spacetech/home/index.html)
- Science Mission Directorate (https://science.nasa.gov/about-us)
2. AWARD INFORMATION

TABLE 2.1 Award Information

<table>
<thead>
<tr>
<th>Anticipated Type of Award</th>
<th>Fellowship (Training Grant)</th>
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</thead>
<tbody>
<tr>
<td>Number of Years of Support</td>
<td>3 to 4 years (3 years with a possibility of a fourth year for doctoral Fellows)</td>
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<tr>
<td></td>
<td>NASA Fellowship is a multiyear award designed to provide an optional third year of support for a master’s fellow and a fourth year of funding for a doctoral fellow for merit-based supplemental experience.</td>
</tr>
<tr>
<td>Estimated Number of Awards</td>
<td>NASA’s OSTEM anticipates awarding up to 25 Graduate Research Fellows per fiscal year under this project/solicitation, pending the availability of funds.</td>
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<td>NOTE: Should funds become available and sufficient quality proposals are received, non-MUREP funding at NASA may be used to increase this estimate.</td>
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TABLE 2.2 Funding Information

The NASA Fellowship Activity will be awarded as a non-portable training grant to accredited U.S. institutions on behalf of Fellows selected under this NRA. As such, this award cannot be transferred to another institution. If a Fellow transfers to a different institution during the award period, the Fellow shall reapply to the program and follow the guidelines for a new Institution’s candidate, submit a new proposal, and compete for any future NASA Fellowship Activity awards. If the PI transfers to another institution, the award remains with the institution that received the initial award funding. For each Fellow, his or her institution receives up to a $55,000 annual award ($50,000 for Master’s student and $55,000 for Doctoral student), with the following annual maximums per budget category*:

<table>
<thead>
<tr>
<th>TYPE OF FUNDING</th>
<th>FUNDING AMOUNT</th>
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<tbody>
<tr>
<td>Fellowship Stipend</td>
<td>$25,000 (Master’s)</td>
</tr>
<tr>
<td></td>
<td>$30,000 (Doctoral)</td>
</tr>
<tr>
<td>Tuition Offset and Fees</td>
<td>$8,000**</td>
</tr>
<tr>
<td>Center Based Research Experience (CBRE) Allowance</td>
<td>$8,000</td>
</tr>
<tr>
<td>Health Insurance Allowance</td>
<td>$3,000</td>
</tr>
<tr>
<td>Funding Category</td>
<td>Amount</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Faculty Adviser Allowance</td>
<td>$4,500</td>
</tr>
<tr>
<td>Fellow Professional Development Allowance</td>
<td>$1,500</td>
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*Refer to Appendix J for detailed information on each of the above funding categories.
** Allowed to transfer Tuition Offset and Fees funds to health insurance and professional development allowance, upon approval from the NASA Project Manager and NASA Grants Officer.

2.3 Funding Sources

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/or the NASA Mission Directorates, NASA Centers, and JPL.

This 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 all contingent on available Congressional funding.

2.4 Cost Sharing

NASA may consider accepting cost sharing when voluntarily offered. Submitting institutions shall describe in their proposals any such cost-sharing that is offered.
3. ELIGIBILITY REQUIREMENTS

TABLE 3.1 Eligibility Requirement

<table>
<thead>
<tr>
<th>To be eligible to receive a NASA Fellowship, the Institution’s candidate shall satisfy all of the following criteria:</th>
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<tr>
<td>Be a U.S. citizen or a U.S. national on the date of proposal submission.</td>
</tr>
<tr>
<td>Hold a Bachelor’s degree in a STEM field earned before August 31 of the fiscal year for the grant award.</td>
</tr>
<tr>
<td>Have a minimum GPA of 3.0 on a 4.0 scale. (All college level transcripts are required. However, only GPA from the most recent institution requires a minimum GPA of 3.0 on a 4.0 scale. Unofficial transcripts are acceptable at the time of proposal submission. However, if students are selected, then official transcripts must be submitted.)</td>
</tr>
<tr>
<td>Be enrolled in a full-time Master’s or Doctoral degree program no later than September 1 of the fiscal year for the grant award.</td>
</tr>
<tr>
<td>Intend to pursue a research-based Master’s or Doctoral program in a NASA STEM-relevant field (Refer to Appendix C).</td>
</tr>
<tr>
<td>Have a projected degree plan for continuous full-time enrollment equating to the period of performance of the grant award and be no later than in the first academic year of their Master’s degree program, or no later than in the second academic year of their doctoral degree program. (Students should not plan to graduate before the end of the period of performance of the grant award or request extensions based on their graduation date.)</td>
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</table>

Refer to Appendix B for other details of eligibility requirements.

3.2 Degree and/or Field of Study

Fellowships are awarded for graduate studies leading to research-based Master’s and Doctoral degrees in a NASA-specific STEM discipline. Please refer to Appendix C for more information.

3.3 Institutional Eligibility

The institution shall be one of higher education with U.S. accreditation and a physical campus located in the United States or its territories.

The institution shall offer graduate level degrees in eligible STEM fields. Refer to Appendix B for more eligibility information.
Proposals involving bilateral participation, collaboration, or coordination in any way with China or any Chinese-owned company, whether funded or performed under a no-exchange-of-funds arrangement, may be determined to be ineligible for award.

3.4 MUREP Funding Eligibility Criteria – Minority Serving Institutions (MSIs)

To be eligible for MUREP funding, all proposals shall originate from a minority-serving U.S. college or university, currently designated and listed by the U.S. Department of Education as a MSI. The following [MSI link](#) leads you to the Department of Education’s Eligibility Matrix for their MSIs. MSIs include Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Asian American and Native American Pacific Islander-Serving Institutions (AANAPISIs), Tribal Colleges and Universities (TCUs), Alaska Native and Native Hawaiian-Serving Institutions (ANNHs), Native American Serving Nontribal Institutions (NASNTIs), and Predominantly Black Institutions (PBIs). If a proposer’s institution is not listed as an MSI by the proposal due date, the institution’s AOR must provide confirmation of MSI status to us via email at NASA.fellowships@nasaprs.com within 24 hours of the proposal due date.
4. PROPOSAL SUBMISSION INFORMATION

A prerequisite for registering an organization in NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) is registration in System for Award Management (SAM). Note that if the submitting organization is not registered in SAM, it may take 15 business days or more to complete the registration, so proposers are advised to start the SAM and NSPIRES registration processes well in advance of the proposal deadline in order to complete organization registration in SAM and then complete organization registration and proposer affiliation in NSPIRES before the proposal due date.

In general, the process to register an organization in NSPIRES requires the following steps:

1) An Employer Identification Number (EIN) for the organization. The EIN number is also commonly called the Tax Identification Number (TIN). The TIN/EIN can be obtained from the IRS website.

2) A Data Universal Numbering System (DUNS) number: Information regarding obtaining a DUNS number may be found at http://www.dnb.com/.

3) If the organization is a non-U.S. organization, a valid NATO Commercial and Government Entity (NCAGE) code: Information regarding obtaining an NCAGE number may be found at https://eportal.nspa.nato.int/AC135Public/scage/CageList.aspx

4) A valid login.gov account: Information regarding login.gov may be found at https://login.gov/.

5) A valid registration with the SAM: Information regarding SAM may be found at https://www.sam.gov/. As part of SAM registration, U.S. organizations will receive a Commercial and Government Entity (CAGE) code.

6) A valid registration with NSPIRES.

The institution’s candidate is the principal author of the submitted research proposal. By submitting the proposal for consideration, the institution’s candidate and the Faculty Adviser/Principal Investigator (PI) certify that the institution’s candidate is the principal author of the proposal. NASA civil servants listed in Appendix E as either points of contact (POCs) and/or potential Technical Advisers 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, any NASA civil servants who will serve as proposal reviewers for this solicitation shall not “pre-read” any proposals nor provide a letter of support or a letter of recommendation to an entity that plans to submit a proposal. However, submitters shall contact the potential NASA Technical Advisers (as identified in Appendix E, the Research Opportunities by Center) for information regarding a review of the work currently being performed in the respective lab. The research idea shall align with the research opportunity listed in Appendix E and must be approved by the NASA Technical Adviser for that specific research opportunity. The NASA Technical Adviser will provide a letter of support for the applicant.

Institutions’ candidates and their respective PIs (Faculty Advisers) shall access the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) well in advance of the proposal
due date to familiarize themselves with its structure, register for an account, activate their accounts, and enter the requested information. See Appendix D for detailed submission instructions in NSPIRES.

An institution may submit proposals on behalf of multiple candidates; however, an individual candidate is permitted to have only one proposal submitted on his or her behalf.

NOTE: Entities shall not submit duplicate proposals. If more than one proposal is submitted on behalf of an institution’s candidate, then all proposals will be deemed ineligible for that student and will not be reviewed.

Proposals shall respond to one of the research opportunities listed in Appendix E and shall include a letter of support from the NASA Technical Adviser associated with the given opportunity. Proposals that do not comply with these requirements will be deemed ineligible for award.

4.1 Phases of Fellowship Proposal Submission

The NASA Fellowship Activity proposal submission process may have two phases:

4.1.1. Phase I is the initial process used by all proposal teams in which the PI and the Authorizing Official Representative (AOR) submit the proposal on behalf of the institution’s candidate.

All proposals shall be submitted via NSPIRES in electronic format only. No mailed-in materials or hard copies will be accepted. NASA Fellowship Activity proposals shall be submitted electronically by each institution’s AOR (see Appendix D in this NRA or Step-by-Step Submission Instructions under “Other Documents” in NSPIRES for more information) or using the “NASA Fellowship Proposal Submission Office” by the deadline listed. Phase I proposals shall be received by 5 pm ET/4 pm CT/2 pm PT on the due dates listed on page 2 of this solicitation. Proposals received after this deadline will not be accepted. Extensions will not be given to accommodate either late or partial submissions.

Proposers are strongly encouraged to access the NSPIRES electronic proposal submitting system well in advance of the proposal due date. They are also required to coordinate all submission steps with the institution’s AOR to ensure timely submissions.

Detailed instructions for submitting electronic proposals include the following steps and are located at http://nspires.nasaprs.com.

a) Click on “Solicitations”
b) Click on “Open Solicitations”
c) Use any keywords to select: NASA Fellowship Activity
d) For submission instructions, select Phase I Proposal Submission Instructions under “Other Documents.”

NOTE: Applicants who have not yet selected a graduate institution at the time of application and thus do not have a PI or AOR associated with an institution for the Phase I submission, should select the “NASA Fellowship Proposal Submission Office” as the applicant’s organization. If the proposal is selected for an award, the applicant will be invited to Phase II to link their proposal to their chosen graduate university.
Phase I proposals shall include all the items listed below, appropriately labeled, in the exact order specified. These items will be discussed further in Section 4.2.2 of this solicitation.

1. Proposal Cover Page (including Project Summary)
2. Impact Statement
3. Faculty Adviser/PI Curriculum Vitae (CV)
4. Project Description
5. Candidate’s Degree Program Schedule
6. Candidate’s Curriculum Vitae (CV)
7. Personal Statement
8. Candidate’s Transcripts
9. Letters of Recommendation
10. Letter of Support

Proposals shall not include extraneous information nor materials that were 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 submitted using the following format:

- Standard 8.5" x 11" page size
- 12-point, Times New Roman font
- 10-point font may be used for citations, references, footnotes, figure captions, and text within figures
- 1" margins on all sides
- Single spaced

4.1.2. Phase II is the final submission process for applicants who, during Phase I, had not yet selected a graduate institution at the time of application and instead selected the “NASA Fellowship Proposal Submission Office” as the applicant’s organization.

If an applicant is selected for a Phase II submission, the applicant will be notified and the proposal application shall be re-submitted by the PI and the AOR from the current institution where the applicant has been admitted and enrolled.

Phase II is required for a proposal to complete the evaluation process and for NASA to assign funds to the correct institution. Phase II will require re-submission of a proposal, via NSPIRES, by an identified Faculty Adviser serving as a PI and the institution’s AOR. The PI on the training grant award will be the Faculty Adviser. The selected institution’s applicant shall work with the Faculty Adviser and AOR to ensure that all of the following components are submitted by the Phase II deadline (TBD):

1. NSPIRES Proposal Cover Page including Program Specific Data Questions;
2. Unrevised, except as specified below, components 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 Personal Statement
   e) The selected institution’s candidate’s transcripts, with updates as available
3. Curriculum Vitae (CV) for the Faculty Adviser - see Section: 4.2.2 (c).

4. Statement from the Faculty Adviser on the planned use of funds outlined in budget categories funded (TABLE 2.2 – Funding Information), and a brief description of any ongoing or pending research awards from NASA that are related in any way to the selected institution’s applicant’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). Incomplete packages will be deemed non-compliant and ineligible to receive funding.

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 – 2018 edition, which is available at:


A listing of available research opportunities throughout NASA is included in this solicitation (see Appendix E). Institutions’ representatives and student applicants shall review the opportunities and discuss with their NASA Technical Adviser the viability and relevance of the applicant’s research concept to the selected opportunity of interest.

4.2 Proposal Submission

4.2.1. NSPIRES Registration Information

<table>
<thead>
<tr>
<th>NSPIRES Registration Information: The institution shall be registered with NSPIRES through the Electronic Business Point of Contact (EBPOC) listed in the System for Award Management (SAM) database (<a href="https://www.sam.gov/">https://www.sam.gov/</a>).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step-by-step instructions for Proposal Submission can be found in NSPIRES in “Other Documents” under the NASA Fellowship Activity. For additional information, please visit the User Guide on NSPIRES (<a href="https://nspires.nasaprs.com/tutorials/pdf/userGuide_registration_2019.pdf">https://nspires.nasaprs.com/tutorials/pdf/userGuide_registration_2019.pdf</a>)</td>
</tr>
<tr>
<td>AOR</td>
</tr>
<tr>
<td>PI</td>
</tr>
<tr>
<td>Institution’s Candidate</td>
</tr>
</tbody>
</table>
and activate his/her account. The institution’s candidate shall be affiliated with the graduate institution that is submitting a proposal on his/her behalf. (Please see “NOTE” in section 4.1.1. Phase I if the applicant has not yet selected a graduate institution at the time of application.)

**Deadline**

| Phase I Proposal Submission Deadline is February 21, 2020. Extensisons will not be granted to accommodate late proposals or partial proposal submissions. |

### 4.2.2 Proposal Application Package

a) **NSPIRES-generated Proposal Cover Page:** The cover page to be completed online includes a **Project Summary.** This summary shall be a clear, concise, cohesive paragraph of approximately 1,000 characters. The summary shall be a complete synopsis of the proposed project description, which states the purpose, methodology, findings and the conclusion or expected outcome of the project. The cover page also includes responses to the **Program Specific Data Questions.**

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

b) **Impact Statement:** This proposal section shall be titled “Impact Statement,” which shall not exceed two pages in length. The “Impact Statement” shall be jointly written by the institution’s candidate and Faculty Adviser (PI) and address the following:

1. State the research gap and identify how an individual’s research proposal addresses the research gap within their STEM field in the scientific literature;
2. Discuss the impact of NASA partnership on the institution’s capacity and capabilities;
3. Explore the potential for commercialization - possible technology transfer;
4. Consider the scientific impact of the proposed effort on NASA and the larger scientific society, with a focus on the candidate’s specific field of study.
5. The statement shall have specific information on the need for NASA participation in the research due to NASA-unique facilities, personnel, and institutional knowledge. To expand on the impact statement, the proposal shall include a description of how the candidate’s prior research experience will enhance the candidate’s current NASA research, to include a brief description on the Center Based Research Experience (CBRE).

c) **Faculty Adviser/PI Curriculum Vitae (CV):** As part of the proposal package, the Faculty Adviser/PI shall provide a **Curriculum Vitae (CV) that shall not exceed three pages in length to include the following information:**

1. Name
2. Current position
3. Title
4. Department
5. Institution address
6. Institution phone number
7. Principal publications (within the last three years)
8. Relevant career experience
9. Research
10. Awards
11. Scholarships
12. Other relevant accomplishments

All proposals shall have a Faculty Adviser identified (who will also serve as the PI of the training grant) from the proposing institution. 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 instead shall submit a letter of commitment to comply with the rule that any proposed change to the PI under the agreement is subject to NASA’s written approval. 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.

NOTE: Applicants who have not yet selected a graduate institution at the time of proposal submission and thus do not have a PI associated with the academic institution for the Phase I submission will themselves serve as a PI for Phase I. They will be responsible for releasing their proposal to the NASA Fellowship Submission Office for submission by the proposal deadline.

d) **Project Description**: This proposal section shall be titled “Project Description” and it shall not exceed six pages in length. The “Project Description” shall provide a clear description of the applicant’s proposed research and shall be written in response to a specific research opportunity listed in Appendix E and with the support of a NASA Technical Adviser. The “Project Description” shall begin with a brief abstract summarizing the scientific problem to be addressed, the proposed science plan, the applicant’s methodology, and expected results. The “Project Description” follows the order below and shall contain all 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
4. Project Schedule / Timeline
5. Explanation of new or novel techniques
6. Expected results and their significance or application
7. Literature citations, where appropriate

e) **Candidate’s Degree Program Schedule**: This section shall be titled “Degree Program Schedule” and shall not exceed two pages in length. The schedule shall state the proposed start and completion dates, expected course schedule, as well as anticipated milestones of the institution’s candidate’s degree program, such as Candidacy Exams. There is no standard format for this section.

f) **Candidate’s Curriculum Vitae (CV)**: This proposal section shall be titled “Candidate’s Curriculum Vitae” and shall not exceed two pages in length. It should include all of the following information:
1. Name
2. Current Academic Level
3. Department
4. Institution address
5. Institution phone number
6. Relevant career or Academic experience
7. Research or Significant Projects
8. Awards and Recognition
9. Other relevant accomplishments

g) **Candidate’s Personal Statement:** This section shall be titled “Personal Statement” and shall not exceed two pages in length. The Personal Statement shall respond to the prompt: *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 mission?*

Describe your personal, educational and/or professional experiences that inspire and motivate your decision to pursue advanced studies in science, technology, engineering or mathematics (STEM) and 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:** Official or unofficial transcripts that cover the institution’s candidate’s undergraduate and graduate years shall be included. These shall be legible and unaltered. Please fully redact the candidate’s social security number and date of birth, if they appear on the transcript, prior to proposal submission. These two redactions are the only permitted alterations to a transcript.

Transcripts from institutions outside of the United States also have the option to be accompanied by an international credential evaluation from a third party, such as, but not limited to, the World Education Services (WES). Explanatory statements regarding transcripts are optional and shall be used to explain special cases, such as non-English Language transcripts. Adding a simple reference/link to an institution’s website in order to explain the credit allocation and conversion of grades to the U.S. system or websites that translate from foreign languages into English is not an explanatory statement since websites may not be working. The necessary explanatory text shall be fully contained within the supplemental transcript explanation.

i) **Letters of Recommendation:** Each institution’s candidate shall submit three current letters of recommendation as part of the proposal by the proposal deadline. Recommenders shall not be family members of the candidate. Each letter shall contain
the recommender’s contact information.

1) One letter shall be from (and signed by) the 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. Also, it shall include a statement indicating the level of assistance provided to the candidate during the preparation of the project description. (NOTE: If a candidate has not yet been accepted into his or her institution 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 (e.g., teachers, professors, STEM professionals, advisers, mentors, work supervisors) with detailed knowledge of the candidate’s abilities.

NOTES:
*A Letter of Recommendation from a NASA civil servant or a 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 or JPL); however, no more than one letter from a NASA civil servant or JPL employee is permitted as part of the proposal that is forwarded for review. Moreover, NASA civil servants and JPL employees submitting Letters of Recommendation must not presume that they will be assigned as the student’s NASA Technical Adviser research collaborator.
**If a NASA civil servant or JPL employee provides a Letter of Recommendation, then they cannot provide the Letter of Support for the proposal.
***All letters of recommendations shall be submitted as part of the proposal by the proposal deadline.

j) Letter of Support: The NASA Center to be utilized as part of the proposal effort shall provide a one page letter stating its support with the proposal and its willingness to serve as a NASA Technical Adviser (must be a NASA civil servant or JPL employee) for the candidate 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 JPL employee provides a Letter of Support, then they cannot provide the Letter of Recommendation for the proposal. Proposals not meeting the requirements as outlined in sections 2.a through 2.j will be deemed non-compliant and eliminated from further award consideration.

Phase I Proposal Submission Deadline is February 21, 2020.
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.
4.3 Checklist for Proposal Submission

This list only applies to Phase I proposals.

<table>
<thead>
<tr>
<th>✔️ NSPIRES Registration Information: The institution shall be registered with NSPIRES through the Electronic Business Point of Contact (EBPOC) listed in the System for Award Management (SAM) database (<a href="https://www.sam.gov/">https://www.sam.gov/</a>). Step-by-step instructions for Proposal Submission can be found in NSPIRES in “Other Documents” under the NASA Fellowship Activity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOR</td>
</tr>
<tr>
<td>PI</td>
</tr>
<tr>
<td>Institution’s Candidate</td>
</tr>
<tr>
<td>Deadline</td>
</tr>
</tbody>
</table>

**NSPIRES-generated Proposal Cover Page:** The cover page to be completed online includes a Project Summary. This proposal section shall be titled “Project Summary.” The summary shall be a clear, concise, cohesive paragraph of approximately 1,000 characters. The summary shall be a complete synopsis of the proposed project description stating the purpose, methodology, findings and the conclusion or expected outcome of the project. The cover page also includes responses to the Program Specific Data Questions.

The following elements are not part of the NSPIRES Proposal Cover Page form and shall be combined into a single PDF document and uploaded on NSPIRES for submission.

| Format |  
|---|---|
| • Standard 8.5" x 11" page size  
• 12-point, Times New Roman font  
• 10-point font may be used for references, footnotes, figure captions, and text within figures  
• 1" margins on all sides  
• Single spaced |
**Impact Statement:** This proposal section shall be titled “Impact Statement” and shall be jointly written by the Institution’s candidate and Faculty Adviser (PI).

The Impact statement shall address the following:

<table>
<thead>
<tr>
<th>Format</th>
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<tbody>
<tr>
<td>Shall not exceed two pages in length.</td>
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</table>

<table>
<thead>
<tr>
<th>Content</th>
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</thead>
<tbody>
<tr>
<td>1. State the research gap and identify how the candidate’s research proposal addresses the research gap within their STEM field in the scientific literature.</td>
</tr>
<tr>
<td>2. Discuss the impact of NASA partnership on the institution’s capacity and capabilities.</td>
</tr>
<tr>
<td>3. Explore the potential for commercialization - possible technology transfer.</td>
</tr>
<tr>
<td>4. Consider scientific impact of the proposed effort on NASA and the larger scientific society with a focus on the candidate’s specific field of study.</td>
</tr>
<tr>
<td>5. The statement shall have specific information on the need for NASA participation in the research due to NASA-unique facilities, personnel, and institutional knowledge. To expand on the impact statement, the candidate shall state how their prior research experience will enhance the proposed NASA research.</td>
</tr>
</tbody>
</table>

**Faculty Adviser/PI Curriculum Vitae (CV)**

<table>
<thead>
<tr>
<th>PI</th>
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<tbody>
<tr>
<td>• The PI shall be a tenured or tenure-track faculty member at an eligible institution (if a tenure system is established).</td>
</tr>
<tr>
<td>• Eligible institutions that do not have a tenure track shall 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.</td>
</tr>
<tr>
<td>• 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.</td>
</tr>
<tr>
<td>• US Citizens and Legal Permanent Residents who are employed by a university can serve as PI/Co-I. The Faculty Adviser shall be affiliated with the registered university. For further clarification regarding your eligibility to create an obligation for your institution, please consult your institution’s Authorized Official Representative (AOR).</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Format</th>
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</thead>
<tbody>
<tr>
<td>Shall not exceed three pages in length</td>
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</table>

<table>
<thead>
<tr>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Name</td>
</tr>
<tr>
<td>2) Current position</td>
</tr>
<tr>
<td>3) Title</td>
</tr>
<tr>
<td>4) Department</td>
</tr>
<tr>
<td>5) Institution address</td>
</tr>
<tr>
<td>6) Institution phone number</td>
</tr>
</tbody>
</table>
Project Description: This proposal section shall be titled “Project Description.” The Project Description shall provide a clear description of the candidate’s proposed research and shall be written in response to a specific Research Opportunity listed under “Other Documents” and with the support of a NASA Technical Adviser. The Project Description shall begin with a brief abstract summarizing the scientific problem to be addressed, the proposed research plan, methodology, and expected results.

The Project Description follows the order below and contain all the following technical elements:

<table>
<thead>
<tr>
<th>Format</th>
<th>Content</th>
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</thead>
<tbody>
<tr>
<td>• Shall not exceed six single-spaced pages in length</td>
<td>1. A statement of the problem to be addressed</td>
</tr>
<tr>
<td>• 12-point font</td>
<td>2. A description of the science background and relevance to previous work in the field</td>
</tr>
<tr>
<td>• 1&quot; margins on all sides</td>
<td>3. General methodology</td>
</tr>
<tr>
<td></td>
<td>4. Project Schedule / Timeline</td>
</tr>
<tr>
<td></td>
<td>5. Explanation of new or novel techniques</td>
</tr>
<tr>
<td></td>
<td>6. Expected results and their significance or application</td>
</tr>
<tr>
<td></td>
<td>7. Literature citations, where appropriate</td>
</tr>
</tbody>
</table>

Candidate’s Degree Program Schedule: This section shall be titled “Degree Program Schedule,” and shall include the following information:

<table>
<thead>
<tr>
<th>Format</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shall not exceed two pages in length.</td>
<td>1) Proposed start and completion dates</td>
</tr>
<tr>
<td></td>
<td>2) Anticipated milestones of the Institution’s candidate’s degree program, such as candidacy exams</td>
</tr>
</tbody>
</table>

Candidate’s Curriculum Vitae (CV)

<table>
<thead>
<tr>
<th>Format</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shall not exceed two pages in length</td>
<td>1. Name</td>
</tr>
<tr>
<td></td>
<td>2. Current Academic Level</td>
</tr>
<tr>
<td></td>
<td>3. Title</td>
</tr>
<tr>
<td></td>
<td>4. Department</td>
</tr>
<tr>
<td></td>
<td>5. Institution address</td>
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<td>---</td>
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</tr>
<tr>
<td>6.</td>
<td>Institution phone number</td>
</tr>
<tr>
<td>7.</td>
<td>Relevant career or Academic experience</td>
</tr>
<tr>
<td>8.</td>
<td>Research or Significant Projects</td>
</tr>
<tr>
<td>9.</td>
<td>Awards and Recognition</td>
</tr>
<tr>
<td>10.</td>
<td>Other relevant accomplishments</td>
</tr>
</tbody>
</table>

**Institutional Candidate’s Personal Statement:** How do you envision graduate school will prepare you for a career that allows you to contribute to expanding scientific understanding and its application to NASA’s Missions?

**Format**

Shall not exceed two pages in length.

**Content**

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

**Candidate’s Transcripts:** Transcripts that cover the Institution’s candidate’s undergraduate and graduate years shall be included. The candidate shall have a minimum GPA of 3.0 on a 4.0 scale on his or her most recent official transcript.

(All college level transcripts are required, however only the GPA from the most recent institution is required to be a minimum GPA of 3.0 on a 4.0 scale. Official and unofficial transcripts are acceptable at the time of the application process. However, if students are selected, then official transcripts must be submitted.)

**Format**

Shall be legible and unaltered

**Content**

Redact the candidate’s social security number and date of birth, if they appear on the transcript, prior to submission (These two redactions are the only permitted alterations to a transcript.)

**Letters of Recommendation**
<table>
<thead>
<tr>
<th><strong>Content</strong></th>
<th>Each institution’s candidate shall submit three current letters of recommendation as part of the proposal by the proposal deadline on official letterhead.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Restrictions</strong></td>
<td>Recommenders shall not be family members of the candidate.</td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td>Each letter shall contain the recommender’s contact information.</td>
</tr>
<tr>
<td><strong>PI</strong></td>
<td>One letter shall be from (and signed by) the 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 candidate during the preparation of the project description. (NOTE: If a candidate has not yet been accepted into his or her institution of choice, then he or she shall submit a letter of recommendation from his or her current academic adviser.) *The identified PI is not permitted to be a family member.</td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td>The other two letters should come from individuals (teachers, professors, STEM professionals, advisers, mentors, work supervisors, etc.) with detailed knowledge of the candidate’s abilities.</td>
</tr>
<tr>
<td><strong>Restriction</strong></td>
<td>If a NASA civil servant or JPL employee provides a Letter of Recommendation, then they cannot provide the Letter of Support for the proposal.</td>
</tr>
<tr>
<td><strong>Requirement</strong></td>
<td>All letters of recommendations shall be submitted as part of the proposal by the proposal deadline.</td>
</tr>
</tbody>
</table>

**Letter of Support**

| **Technical Adviser** | The NASA Center to be utilized as part of the proposal effort shall provide a letter on official letterhead stating its support of the proposal and its willingness to serve as a NASA Technical Adviser (must be a NASA civil servant or JPL employee) for the candidate if the proposal is awarded a training grant. |
| **Content** | 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. |
| **Restriction** | If a NASA civil servant or JPL employee provides a Letter of Support, then they are not permitted to provide the Letter of Recommendation for the proposal. *The identified NASA Technical Adviser is not permitted to be a family member. |
4.4. Pre-proposal Questions and Answers

<table>
<thead>
<tr>
<th>Teleconference number: 1-844-467-6272 Passcode: 549325</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times will be announced on the NASA Fellowships Website:</td>
<td>January 8, 2020</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td><a href="https://www.nasa.gov/education/fellowships-scholarships/index.html">https://www.nasa.gov/education/fellowships-scholarships/index.html</a></td>
<td>February 5, 2020</td>
<td></td>
<td></td>
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<tr>
<td>or NSPIRES: <a href="http://nspires.nasaprs.com">http://nspires.nasaprs.com</a></td>
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<td></td>
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</tbody>
</table>

The Pre-proposal teleconference will outline critical deadlines, eligibility requirements, frequently asked questions, and other details of the Fellowship program. Institutions’ candidates and Faculty Advisers (PI) are encouraged to attend. Refer to the NASA Fellowship Activity on NSPIRES for connection details.

For clarifications related to Fellowship program, prospective institutions’ candidates and Faculty Advisers are asked to submit their questions in writing to the NASA Fellowship Program Manager, Carolyn Knowles at NASA.Fellowships@nasaprs.com. Every attempt will be made to provide responses to the submitted questions during next scheduled teleconference. Responses to the submitted questions will also be posted on NSPIRES as FAQ under the “Other Documents” section. The list will be updated periodically during the open period of the opportunity.
5. APPLICATION REVIEW AND EVALUATION INFORMATION

A. Proposal Review and Selection

All eligible proposals will be reviewed by NASA and non-NASA subject matter experts (SMEs) via online and/or Face to Face panel reviews. These reviewers will be identified by NASA ensuring that they are experts in the STEM subjects closely related to the candidate’s field of study (See Appendix C). As part of the selection process, the NASA project managers will ensure that panel reviewers have no conflict of interest with the submitting institution, the institution’s candidate, and/or the proposal team. Panel reviewers will be required to sign a nondisclosure/ conflict of interest form prior to being granted access to the proposals. NASA technical experts and project managers will complete a technical review of proposals and submit to the selection officials for final decisions.

The following criteria will be used to evaluate proposal applications: Academic Merit and Distinction; Broader Impact; and Scientific Merit. The weights and a description of these areas are provided below.

1. **Academic Merit and Distinction (30%)**. Based upon the review of the Institution’s candidate’s transcripts, degree program schedule, personal statement, 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. **Broader Impact (10%)**. Based upon the review of the applicant’s “Project Description,” reviewers will analyze the proposed research’s potential to benefit society or advance desired societal outcomes. These include activities that are directly related to the specific research projects or activities that are supported by, however complimentary to, the project. For instance, participation by an under-represented and underserved community, enhancement of STEM education and educator development, improved well-being of individuals, increased partnership between the academia and industry, and improved national security.

3. **Scientific Merit of the Proposed Research (60%)**. 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:
   a. The proposal’s ability to address research 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 Institution’s candidate is pursuing;

d. The proposal’s ability to clearly describe the uniqueness of their proposal against the goals described in the Fellowship solicitation.

After the panel review of Phase I proposals, NASA technical experts 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, unique programmatic requirements, and approval of the NASA Office of STEM Engagement Funding Managers.

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 $250,000), 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 their 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.
6. 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 NASA’s receipt of proposals of adequate merit and to Congressional appropriation in Fiscal Years 2020 and beyond. NASA expects to select up to 25 proposals for award. Total award values will range from $50,000 to $55,000 each year, for a total potential award value of $150,000 to $220,000. The period of performance for the awards will be up to three years for a Master’s fellowship and up to four years for a Doctoral fellowship. NASA may elect to support some of the proposals submitted under this NRA through the use of non-MUREP funds, if funds are available from other 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 this 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-year period and may be renewed annually for up to three years for a Master’s fellowship and up to four years for a Doctoral fellowship, pending availability of Congressional funds and a successful annual review of the effort. Fellows are required to provide justification as to why period of performance should be extended to a third or fourth year. 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 deferent of awards are not encouraged and will only be considered in emergency situations. Approvals for deferments are not guaranteed.

Institutions seeking renewal shall submit a Renewal Proposal Applications Package to NASA Program Managers in May of each fiscal year. Specific details will be released to Fellowship awardees upon acceptance of the award.

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 the Fellow withdraws within the first half of the award year, the institution may submit a request for replacement of a graduate student 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 have 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 Institution’s candidate, submit a new proposal, and compete for future NASA Fellowships Activity awards.

3. This award is not permitted to be transferred to another institution. If a Fellow transfers to a different institution during the award period, the Fellow shall reapply to the program and follow the guidelines for a new Institution’s candidate, submit a new proposal, and compete for any future NASA Fellowship Activity awards. If the PI transfers to another institution the award remains with the institution that received the initial award/funding.

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).

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).

H. Post Proposal Review and Process for Appeal

All proposers will be notified via NSPIRES and provided with a written review after online and face-to-face panel evaluation. Proposers may contact the Technical Officer for a "debriefing" to gain a better understanding of the evaluation process. Reconsideration may be requested if the PI is unsatisfied with the justifications provided. (See Appendix K for more details on appeal process).

I. Research Terms and Conditions

Awards from this funding announcement that are issued under 2 CFR 1800 are subject to the Federal Research Terms and Conditions (RTC) located at http://www.nsf.gov/awards/managing/rtc.jsp. In addition to the RTC and NASA-specific
guidance, three companion resources can also be found on the website: Appendix A—Prior Approval Matrix, Appendix B—Subaward Requirements Matrix, and Appendix C—National Policy Requirements Matrix.
7. 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. Students are required to participate in these program activities designed to help the student grow professionally:

1. 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.

2. The Fellow shall submit a detailed research report compiled at the end of each academic year.

3. The Center Based Research Experience (CBRE) is a mandatory requirement of the program. If a Fellow does not participate in the CBRE, the Fellowship will not be renewed, and the stipend for the CBRE will be withheld.

4. The Fellow shall receive a positive CBRE evaluation indicating successful completion of research activities during the ten-week period from the NASA Technical Adviser. If this does not occur, the Fellowship will not be renewed for the next year.

5. Each Fellow shall publish one peer reviewed 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.

NOTE:

Research collaboration with "international entities" may or may not be considered.

U.S citizenship is required for individuals who need access to NASA Centers for participation in the mandatory CBRE. It is strongly encouraged that Fellows participate in the mandatory 10 weeks CBRE experience from the awardee institution.
8. REPORTING REQUIREMENTS

The reporting requirements for awards made through this NRA will be consistent with 2 CFR 1800.902. Award recipients may also be subject to reporting requirements under the NASA Plan for Increasing Access to Results of Federally Funded Research. Such requirements include reporting of final peer-reviewed manuscripts in annual and final progress reports. In other words, award recipients should report on progress in archiving of data and manuscripts in their progress reports and especially in the final report. All requirements will be identified in the Notice of Award. If the total value of the recipient’s currently active grants, cooperative agreements, and procurement contracts from all Federal awarding agencies exceeds $10,000,000 for any period during performance of this Federal award, additional reporting requirements will apply. See 2 CFR 200 Appendix XII—Award Term and Condition for Recipient Integrity and Performance Matters.

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.
9. 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.”
10. NASA's SAFETY POLICY

All proposals shall take into consideration NASA’s priority emphasis on safety.

Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA’s safety priority is to protect: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including employees working under NASA award instruments), and (4) high-value equipment and property.

Proposers shall have a written safety policy. Fellowship awardees shall notify the NASA Shared Services Center (NSSC) of any mishaps and close calls related to award implementation within two business days of the occurrence of the close call or mishap. The following NASA procedural requirement applies to NASA entities and may be useful to non-NASA entities for benchmarking purposes:

NPR 8621.1C: NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping:
https://nodis3.gsfc.nasa.gov/npg_img/N_PR_8621_001C_/N_PR_8621_001C_.pdf

Responsible Office: Office of Safety and Mission Assurance
http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=8621&s=1C

For additional information on the NASA Safety and Mission Assurance Program see:
http://sma.nasa.gov

Awards of proposals related to this solicitation must comply with the National Environmental Policy Act (NEPA); thus, proposers are encouraged to plan and budget for any anticipated environmental impacts. While most research awards will not trigger action-specific NEPA review, some activities (including international actions) will. The majority of grant related activities are categorically excluded as research and development (R&D) projects that do not pose any adverse environmental impact. A blanket NASA Grants Record of Environmental Consideration (REC) provides NEPA coverage for these anticipated activities. Section VIII includes a questionnaire to determine whether a specific proposal falls within the Grants REC and must be completed as part of the solicitation process. Activities outside of the bounding conditions of the Grants REC will require additional NEPA analysis. Examples of actions that will likely require NEPA analysis include but are not limited to: suborbital-class flights not conducted by a NASA Program Office (see Section V); activities involving ground-breaking construction/fieldwork; and certain payload activities such as the use of dropsondes. Questions concerning environmental compliance may be addressed to Tina Norwood, NASA NEPA Manager, at tina.norwood-1@nasa.gov or (202) 358-7324.
11. 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 Point of Contact:
   • Vandhana Lal
     Fellowships Activity Manager
     NASA Ames Research Center
     Office of STEM Engagement
     Mountain View, CA 94035
     650-604-4709
     Email: Vandhana.lal@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
     Email: NASA.Fellowships@nasaprs.com

C. Management Contact and Technical Officer:
   • Carolyn Knowles
     Manager, NASA Fellowships and International Internships
     NASA Headquarters Washington, DC 20546
     Email: NASA.Fellowships@nasaprs.com

D. Proposal Submission Help Desk (NSPIRES):
   • NSPIRES Help Desk
     202-479-9376 from 8 am to 6 pm Eastern Time, Monday to Friday (except on federal holidays).
     Email: nspires-help@nasaprs.com

E. NASA Shared Service Center (NSSC)
   • NSSC Customer Contact Center
     1-877-677-2123 (1-877-NSSC123)
     Email: nssc-contactcenter@nasa.gov
## Appendix A: Summary of Key Information

<table>
<thead>
<tr>
<th><strong>Key Information</strong></th>
<th><strong>Summary</strong></th>
</tr>
</thead>
</table>
| Total ESTIMATED annual budget for each NASA Fellowship Activity | $50K (Master’s)  
$55K (Doctoral) |
| Number of new awards | Up to 25 awards pending adequate proposals of merit and available funding |
| Start date of award (estimated) | August 19, 2020 |
| Duration of awards | Up to 3 years for a Master’s student and 4 years for a Doctoral student |
| Award type | Training Grant |
| Solicitation Release Date | December 23, 2019 |
| Pre-proposal Teleconference:  
To join the meeting via the web: TBD  
The telecom number is 1-844-467-6272 and the passcode is 549325 | January 8, 2020  
February 5, 2020  
2021 & 2022 Dates (TBD) |
| Due date for Phase I Proposals | February 21, 2020 |
| Due date Phase II Applications | TBD |
| Public announcement of awards | Estimated six months after proposals are submitted.  
(After the selection of awards, award notification will be sent to the PI for acceptance of award.) |
| Submission medium | Electronic proposal submission is required via NSPIRES; hard copies will not be accepted. See Chapter 4 of the NASA Guidebook for Proposers (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  
NOTE: There may be other selecting officials should other NASA appropriations decide to fund Fellows. | Torry Johnson  
Manager, MUREP  
NASA Office of STEM Engagement - NASA Headquarters  
Carolyn Knowles  
Manager, NASA Fellowships and International Internships  
NASA Office of STEM Engagement - NASA Headquarters |
| Management | Carolyn Knowles  
Manager, NASA Fellowships and International Internships  
NASA Office of STEM Engagement - NASA Headquarters  
NASA.Fellowships@nasaprs.com  
Vandhana Lal  
Activity Manager  
NASA Ames Research Center  
Office of STEM Engagement  
Mountain View, CA 94035  
650-604-4709  
vandhana.lal@nasa.gov |
Appendix B: 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 all the following requirements:

- Be a U.S. citizen or a U.S. national at the time of proposal submission;
- Hold a Bachelor’s degree in a STEM field earned before August 31 of each fiscal year;
- Students enrolling into a graduate program shall have a minimum GPA of 3.0 on a 4.0 scale;
- Be enrolled in a Master’s or Doctoral degree program no later than September 1 of the academic year in which the award is made;
- Intend to pursue a research-based Master’s or Doctoral program in a NASA STEM relevant field (see Appendix C for additional information);
- Have a projected degree plan for continuous full-time enrollment equating to the period of performance of this award and be no later than in their first academic year of the Master’s degree program or no later than in their second academic year of the doctoral degree program. (Students should not plan to graduate before the end of the performance period or request extensions based on their graduation date.)

NOTE

- Students are not eligible to apply for this opportunity if they have been awarded a Doctoral Degree in a STEM field.
- Students are eligible to apply if they have been awarded a Master’s in a non-STEM degree, such as an M.A., M.Ed., or M.B.A.
- Students are eligible to apply if they have been awarded a Doctoral Degree in a non-STEM degree, such as Ed.D., D.M.A., or J.D.
Appendix C: Eligible Graduate STEM Disciplines

CHEMISTRY

COMPUTER AND INFORMATION SCIENCE AND ENGINEERING (CISE)

ENGINEERING

GEOSCIENCES

LIFE SCIENCES

MATERIALS RESEARCH

MATHEMATICAL SCIENCES

PHYSICS AND ASTRONOMY

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/sciences
- 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 D: Step-by-Step Instructions for Proposal Submission

All proposals submitted under this Funding Announcement are required to submit a Data Management Plan (DMP), in accordance with the NASA Plan for Increasing Access to the Results of Scientific Research (http://www.nasa.gov/sites/default/files/files/NASA_Data_Plan.pdf). That plan must include:

- Specific data requirements and expectations;
- An example DMP or outline for the specific type of data likely to result from the funded projects; or
- A statement that a DMP is not required because of the nature of the activity (e.g., no data or proprietary or personally identifiable data are expected).

See SARA Q&A at http://science.nasa.gov/researchers/sara/faqs/dmp-faq-roses/ for more information on this plan.

Important Notes to Review Prior to Initiating Proposal Submission:

**Warning vs. Error.** 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 the Institution’s 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. The Institution 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/). Each registered institution will have a designated Authorizing Official Representative (AOR) who will be responsible for submitting the Institution’s candidate’s application. (Please see “NOTE” below if you do not have an AOR or cannot locate your AOR.)

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

3. The Institution’s candidate must be registered with NSPIRES and activate his/her account.

**NOTES:**

*Application tip for Institutions’ 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 institution 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 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 Institutions’ 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 institution’s designated AOR.

**Step 2**

1. The Faculty Adviser MUST initiate the proposal in NSPIRES for the Institution’s 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 Institution’s candidate’s name and click “Search” for the Member (Institution’s candidate) – system will display search results.

         c) Select the correct Institution’s candidate and click “Continue”

         d) On “Team Member” page, Assign Role/Privileges

         e) Select “Graduate/Undergraduate Role” from the pull-down menu

         f) Grant Institution’s 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”

5. Faculty Adviser MUST Logout of NSPIRES

Step 3a

1. NOTE: This step is ONLY for candidates that do not have a PI or AOR associated with the academic institution for your Phase I submission

2. Institution’s candidate logs into NSPIRES. If this section applies to the candidate, follow these steps:

3. Under “NSPIRES Options,” click “Account Management”


5. To add an affiliation, click “Add Affiliation”

6. In the search box, type “NASA Fellowship Proposal Submission Office,” then click Submit

7. Follow steps to adding the affiliation

8. Before the candidate can submit the proposal, the candidate will receive an email from NSPIRES confirming the affiliation request

9. Once the email is received then the candidate can proceed to Step 3b

Step 3b

1. Institution’s candidate logs into NSPIRES. At initial log on, the Institution’s candidate must follow these steps:
   a. Under “Reminders/Notifications,” click “Need Graduate/Undergraduate”

   b. Institution’s candidate Confirmation for Proposal: [proposal title] for Solicitation NASA Fellowship Activity Fellowships” link

   c. On “Team Member: Participation Confirmation” page, Institution’s 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” and 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) Institution’s candidate MUST Logout of NSPIRES

NOTE 1: All required proposal elements that are not part of the NSPIRES cover page shall be combined into a single pdf document and uploaded on NSPIRES for submission. The document shall include:

<table>
<thead>
<tr>
<th>Components</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Statement</td>
<td>2 pages</td>
</tr>
<tr>
<td>Faculty Adviser/PI Curriculum Vitae (CV)</td>
<td>3 pages</td>
</tr>
<tr>
<td>Project Description</td>
<td>6 pages</td>
</tr>
<tr>
<td>Degree Program Schedule</td>
<td>2 pages</td>
</tr>
<tr>
<td>Candidate’s Curriculum Vitae (CV)</td>
<td>2 pages</td>
</tr>
<tr>
<td>Personal Statement</td>
<td>2 pages</td>
</tr>
<tr>
<td>Transcripts</td>
<td>N/A</td>
</tr>
<tr>
<td>Letters of Recommendation (3)</td>
<td>N/A</td>
</tr>
<tr>
<td>Letter of Support – NASA</td>
<td>N/A</td>
</tr>
</tbody>
</table>

NOTE: In “Complete Proposal” section, the “Generate” button enables the submitter to review its proposal in the draft prior to submission. However, this option is independent of the submission process. If the proposal fails to generate, the submitter should still proceed with proposal submission.
Step 4

1. Institution’s 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 E: NASA Fellowship Activity Research Opportunities by Center

List of opportunities are subject to change each year. The list of opportunities posted is for the current 2020 year.

“000” Category for the “Open” opportunities (Student Proposed with Concurrence of NASA Technical Adviser; The Student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser)
Appendix E: NASA Fellowship Opportunities by Center
Updated 12/19/2019

-----------------------------------------------Armstrong Flight Research Center (AFRC)-----------------------------------------------
If you have questions about any of the following opportunities at Armstrong Flight Research Center, please contact Maria Caballero at maria.l.caballero@nasa.gov or 661-276-5569.

-----------------------------------------------Ames Research Center (ARC)-----------------------------------------------
If you have questions about any of the following opportunities at Ames Research Center, please contact Vandhana Lal at vandhana.lal@nasa.gov or 650-604-4709.

-----------------------------------------------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 Lab (JPL)-----------------------------------------------
If you have questions about any of the following opportunities at Jet Propulsion Lab, please contact Petra Milanian at petra.a.kneissl-milanian@jpl.nasa.gov or 818-354-0726.

-----------------------------------------------Johnson Space Center (JSC)-----------------------------------------------
If you have any questions about the following opportunities at Johnson Space Center, please contact Michele Martin at michele.martin-1@nasa.gov or 281-483-3033.

-----------------------------------------------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 Kimberly Brush at kimberly.m.brush@nasa.gov or 757-864.6454.

-----------------------------------------------Marshall Space Flight Center (MSFC)-----------------------------------------------
If you have questions about any of the following opportunities at Marshall Space Flight Center, please contact Tracey Washington at tracey.washington@nasa.gov.

-----------------------------------------------Stennis Space Center (SSC)-----------------------------------------------
If you have 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.
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<th>NASA Center</th>
<th>Center Code</th>
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<th>Opportunity Description/Objective (Specific student assigned)</th>
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<td>ARFC-000</td>
<td>ARMD</td>
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<td>Pursuing Master’s or Doctoral Degree</td>
<td>Derek Abramson</td>
<td>661-276-6129</td>
<td>Robert P. Jensen</td>
<td>661-276-2354</td>
<td><a href="mailto:matthew.j.boucher@nasa.gov">matthew.j.boucher@nasa.gov</a></td>
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<tr>
<td>AFRC-001</td>
<td>ARMD</td>
<td>Advancement of BSLD aircraft design and control</td>
<td>Bell Shaped Lift Distribution wing design has been utilized in several NASA projects and has shown promise to improve flight efficiency substantially, as well as in applications where simplicity of control structures is desirable. To date, this technology has been applied to aircraft missions with a very specific flight envelope. In this project, the candidate would design and present methods to expand the flight envelope of a Bell Shape Lift Distribution designed aircraft. Specifically, methods to: expand range of stable flight speeds, power aircraft, cooperative flight controls, or any combination of the above will be considered. A successful candidate may offer not only theoretical solutions but also flight testing on a subscale aircraft.</td>
<td>Master’s</td>
<td>Matthew J. Boucher</td>
<td>661-276-2152</td>
<td>Jacob Schafer</td>
<td>661-276-2152</td>
<td><a href="mailto:jacob.schafer@nasa.gov">jacob.schafer@nasa.gov</a></td>
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<tr>
<td>AFRC-002</td>
<td>ARMD</td>
<td>Control of Flexible Aircraft using Structural Feedback</td>
<td>Deliberate design of aircraft with flexible wings enables more efficient (e.g. high-ratio) configurations and the use of lightweight materials. Flexibility tends to incur the cost of reduced structural stability. Feedback control can compensate for that cost; stabilization and control of the unstable X-56A body-freedom flutter mode has been demonstrated in flight. But, opportunities remain to deliver a simple, robust, high-performance flight control system that additionally enhances ride quality, alleviates gust loads, and rejects disturbances. The Fiber-Optic Sensing System (FOSS) is one means to those ends. The X-56A implementation of FOSS is capable of measuring distributed strain (and other quantities) at hundreds of stations on the vehicle, yielding high-frequency state information about the aircraft shape. Fellows contributing to this project will explore the augmentation and replacement of conventional X-56 sensor feedback with FOSS. With the common theme of structural state feedback, the investigators seek control system designs that increase robustness to modeling uncertainty, precisely track commands in the presence of atmospheric turbulence, and/or reduce reliance on precise knowledge of multiple gain scheduling variables. Starting from pre-existing, flight-tested control laws, Fellows will incorporate FOSS and analyze and re-design the system using both their own tools and off-the-shelf software. Design considerations will include the reduction of distributed measurements to state estimates, and implications of finite sampling rate and time delays. Evaluation will entail a combination of linear analysis, batch nonlinear simulation, and fixed-base/piloted simulation. The work could serve as the basis for flight experiments in addition to publications. Depending on the interests of the fellow, the project could entail work with embedded computing systems and ground-based structural testing.</td>
<td>Master’s/Ph.D.</td>
<td>Matthew Boucher</td>
<td>661-276-2152</td>
<td>Jeffrey Ouallitter</td>
<td>661-276-2152</td>
<td><a href="mailto:jeffrey.ouallitter@nasa.gov">jeffrey.ouallitter@nasa.gov</a></td>
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<td>AFRC-003</td>
<td>ARMD</td>
<td>Modeling Flexible Aircraft from Flight Data</td>
<td>The X-56 aerelastic demonstrator features coupled rigid-body and flexible modes; one cannot be controlled or modeled without simultaneously accounting for the other. Fortunately, in addition to conventional aircraft sensors (e.g. gyros, air data, and accelerometers), X-56 is equipped with the Fiber Optic Sensing System (FOSS). FOSS measures the strain distribution at hundreds of stations across the vehicle, providing a tremendous amount of data with which to model the deformed shape and the interaction between the structure and the aerodynamics. The challenge addressed by this fellowship opportunity is to reduce the abundance of data to informative dynamic models and interpret the results. Working from literature in a variety of fields, the fellow will address a class of system identification problems in which the number of measurements greatly exceeds the number of important states. Identified models will take control surface commands (typically generated by a flight control system) as inputs, and give inertial, aerodynamic, and structural measurements as outputs. The goals include a low-order system of differential equations (transfer functions), physically-meaningful parameters that vary smoothly throughout the flight envelope, and a small set of intuitive model shapes. Those products will be used for validating pre-flight predictions and refining feedback control designs. A substantial body of flight test data is available to work from; there might also be an opportunity to participate in flight test activities and the acquisition of new data.</td>
<td>Master’s/Ph.D.</td>
<td>Matthew J. Boucher</td>
<td>661-276-2152</td>
<td>Jeffrey Ouallitter</td>
<td>661-276-2152</td>
<td><a href="mailto:jeffrey.ouallitter@nasa.gov">jeffrey.ouallitter@nasa.gov</a></td>
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<td>AFRC-004</td>
<td>ARMD</td>
<td>Quantifiable Uncertainty for Aeroservoelastic Control</td>
<td>The ability to use active closed loop control to insure structural robustness, offers significant potential for decreasing the required weight of the aircraft structure. Existing efforts have primarily focused on demonstrating the feasibility of such systems. Certification of such a system will require the ability to demonstrate robustness of the system to uncertainty in the vehicle parameters. The ability to handle such uncertainty is complicated by the large number of system parameters while remaining computationally efficient for the evaluation of the control system. Methods of determining reasonable values of uncertainty are needed as well as methods of implemented those uncertainties in an efficient framework useful for evaluation of a control system over the complete flight envelope.</td>
<td>Master’s/Ph.D.</td>
<td>Jeffrey Ouallitter</td>
<td>661-276-2152</td>
<td>Jeffrey Ouallitter</td>
<td>661-276-2152</td>
<td><a href="mailto:jeffrey.ouallitter@nasa.gov">jeffrey.ouallitter@nasa.gov</a></td>
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<td>AFRC-005</td>
<td>ARMD</td>
<td>Technology Trends Identification via Data Analytics</td>
<td>Armstrong Flight Research Center (AFRC) is the NASA atmospheric flight research center located at Edwards Air Force Base. As technology develops, NASA AFRC has to have its capabilities ready to integrate the new technologies into test systems for validation and further development. The technologies ready for flight integration might be found in technical papers written within NASA, AIAA, other technical conferences, and within the SBIR/STTR programs. It would be near impossible to read these papers to develop technology trends. NASA AFRC would like to use data analytics to gain insight in technology trends from the papers and SBIR/STTR programs. The student would identify the key conferences, gather data, and develop or use data analytic tools to gain the insight on technology trends. At the end of the study, the student would provide the results of the study with their key insights to the technology Trends.</td>
<td>Master's</td>
<td>David Voracek</td>
<td><a href="mailto:david.f.voracek@nasa.gov">david.f.voracek@nasa.gov</a></td>
<td>661-276-2463</td>
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<td>AFRC-006</td>
<td>ARMD</td>
<td>Tools for eVTOL Pilot Modeling, HQ and PIO Prediction</td>
<td>The dynamic nature of human pilots has historically been shown to be an important consideration in the development of aircraft and flight control systems. Poor handling qualities or PIO-prone configurations represent an unsafe design. Due to high demand, the pool of pilot candidates for UAM eVTOL operations may be less well-trained and less experienced than the typical commercial aviation pilot. Furthermore, many eVTOL aircraft will be single-pilot configurations and the pilot will have to manage passengers in addition to piloting the aircraft. The non-traditional configurations and operations envisioned for urban air mobility eVTOL aircraft require at a minimum a re-examination of the state-of-the-art tools in pilot modeling and handling qualities / PIO prediction. In some cases existing tools will have to be modified, and new tools developed for the community. The objective is to determine whether existing state-of-the-art tools for pilot modeling and for predicting aircraft handling qualities and the potential for pilot-in-the-loop oscillations are applicable to new eVTOL configurations. New tools may be developed, or existing tools modified. Also of interest are requirements for UAM eVTOL pilot training.</td>
<td>Master's / Ph.D.</td>
<td>Curtis Hanson</td>
<td><a href="mailto:curts.e.hanson@nasa.gov">curts.e.hanson@nasa.gov</a></td>
<td>661-276-3966</td>
<td>Shaun McWherter</td>
<td><a href="mailto:shaun.c.mcwherter@nasa.gov">shaun.c.mcwherter@nasa.gov</a></td>
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The student can submit a NASA-relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser.

**Opportunity Title:** Automated sUAS Inspection Capability for Wind Tunnels

**Opportunity Description/Objective (Specific student assigned):**

- 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 should have significant experience in successfully analyzing rock samples in hand and thin section, and in Raman and possibly IR 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.

**Desired Student Academic Level:** Master’s/Ph.D.

**NASA Technical Adviser’s Name:** David Murakami

**NASA Technical Adviser’s Phone Number:** 650-604-1485

**Co-Technical Adviser’s Name:** Virginia Gulick

**Co-Technical Adviser’s Phone Number:** 650-604-1281

**Student Identified NASA Technical Adviser:** Jin-Woo Han

**Student Identified NASA Technical Adviser’s Email:** jin-woo.han@nasa.gov

**Student Identified NASA Technical Adviser’s Phone Number:** 650-604-1281

**Student Proposed with Concurrence of NASA Technical Mentor:** Pursuing Master’s or Doctoral Degree

**Opportunity Title:** Building an Automated Science Analysis System for Mars Surface Exploration

**Opportunity Description/Objective (Specific student assigned):**

- 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 circuit and system design for self-healing electronics could benefit other space electronics programs including larger class of satellites.
- The candidate should have significant experience in successfully analyzing rock samples in hand and thin section, and in Raman and possibly IR 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.

**Desired Student Academic Level:** Master’s/Ph.D.

**NASA Technical Adviser’s Name:** Vignesh Glick

**NASA Technical Adviser’s Phone Number:** 650-604-1781

**Co-Technical Adviser’s Name:** Sandra Owen

**Co-Technical Adviser’s Phone Number:** 650-604-1281

**Student Identified NASA Technical Adviser:** Darrell Jan

**Student Identified NASA Technical Adviser’s Email:** darrell.jan@nasa.gov

**Student Identified NASA Technical Adviser’s Phone Number:** 650-604-1281

**Student Proposed with Concurrence of NASA Technical Mentor:** Pursuing Master’s or Doctoral Degree

**Opportunity Title:** Circuit and system design for self-healing electronics

**Opportunity Description/Objective (Specific student assigned):**

- Circuit and system design for self-healing electronics
- The student can submit a NASA-relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser.

**Desired Student Academic Level:** Master’s/Ph.D.

**NASA Technical Adviser’s Name:** Darrell Jan

**NASA Technical Adviser’s Phone Number:** 650-604-1385

**Co-Technical Adviser’s Name:** M. Meyyappan

**Co-Technical Adviser’s Phone Number:** 650-604-2565

**Student Identified NASA Technical Adviser:** Darrell Jan

**Student Identified NASA Technical Adviser’s Email:** darrell.jan@nasa.gov

**Student Identified NASA Technical Adviser’s Phone Number:** 650-604-1281

**Student Proposed with Concurrence of NASA Technical Mentor:** Pursuing Master’s or Doctoral Degree

**Opportunity Title:** Development of improved methods for efficient CO2 removal

**Opportunity Description/Objective (Specific student assigned):**

- Air quality for astronaut health requires that CO2 be continually removed and processed for oxygen reclamation. Current removal methods using sorbents do work, but do not reach the partial pressures of CO2 found on earth, even compared to low-ventilation, enclosed environments. Lower levels of CO2 are desirable, but not at the cost of mass, volume, power requirement, or reliability. Possible alternative approaches include but are not limited to alternative sorbents such as metal organic frameworks (MOFs), ionic liquids, or biologically inspired methods. The research opportunity is to further investigate and develop a CO2 removal approach that shows potential to improve CO2 control for spacecraft, system mass, volume, power, and reliability.

**Desired Student Academic Level:** Master’s/Ph.D.

**NASA Technical Adviser’s Name:** Darrell Jan

**NASA Technical Adviser’s Phone Number:** 650-604-3738

**Co-Technical Adviser’s Name:** Grace Boulanger

**Co-Technical Adviser’s Phone Number:** 650-604-4488

**Student Identified NASA Technical Adviser:** Darrell Jan

**Student Identified NASA Technical Adviser’s Email:** darrell.jan@nasa.gov

**Student Identified NASA Technical Adviser’s Phone Number:** 650-604-1281

**Student Proposed with Concurrence of NASA Technical Mentor:** Pursuing Master’s or Doctoral Degree
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<td>ARC-005</td>
<td>STMD</td>
<td>Distributed multi-objective spacecraft swarm control</td>
<td>Modern distributed computing and storage system has resulted in a massive increase in the capabilities of cloud or web-based services. The increased availability of systems, plus the fault-tolerant nature and graceful degradation, make such an architecture especially appealing for the future of space exploration. The challenges associated with concurrency, system heterogeneity, load balancing, and the risk of emergent phenomena are more significant in space systems. Where the time delays are larger, a more significant percentage of assets are bespoke with unique equipment, individual assets have more explicit responsibilities, and emergent behavior can be catastrophic. In collaboration with NASA researchers, the student will develop algorithms and approaches to control a distributed swarm of space crafts under realistic conditions while addressing multiple objectives and goals. The algorithms and approaches that the student could explore could include but are not limited to adaptive or optimal control, machine learning, or any other distributed algorithmic approaches.</td>
<td>Ph.D.</td>
<td>Nicholas Cramer</td>
<td><a href="mailto:ncramer.b.cramer@nasa.gov">ncramer.b.cramer@nasa.gov</a></td>
<td>650-604-1081</td>
<td>Kelley Hashemi</td>
<td><a href="mailto:kelley.e.hashemi@nasa.gov">kelley.e.hashemi@nasa.gov</a></td>
<td>650-604-2032</td>
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<tr>
<td>ARC-006</td>
<td>STMD</td>
<td>Human Swarm Interaction</td>
<td>Future NASA Missions will involve large numbers of autonomous agents that must coordinate in order to accomplish mission goals. The current approach for directing existing multi-agent mission cannot scale; ground operators must individually monitor and direct each asset in order to achieve the desired behavior of the group. In collaboration with NASA researchers, the student will develop technical approaches for improving the interaction between operators and these distributed missions. These approaches can include but are not limited to solutions that provide situational awareness to ground operators of these missions that encompasses both individual asset health and overall mission objective satisfaction, and knowledge representations that allow an operator to specify high-level goals of the overall behavior of the system without needing to provide individual asset actions.</td>
<td>Ph.D.</td>
<td>Daniel Cellucci</td>
<td><a href="mailto:daniel.w.cellucci@nasa.gov">daniel.w.cellucci@nasa.gov</a></td>
<td>650-604-0773</td>
<td>Nicholas Cramer</td>
<td><a href="mailto:ncramer.b.cramer@nasa.gov">ncramer.b.cramer@nasa.gov</a></td>
<td>650-604-1081</td>
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<td>ARC-007</td>
<td>STMD</td>
<td>Inkjet printable organic infrared photo sensor</td>
<td>This project aims to advance a printable shortwave infrared photo sensors 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 photo sensors and device characterization to identify the fundamental constraints in the reaction 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.</td>
<td>Ph.D.</td>
<td>Jin-Woo Han</td>
<td><a href="mailto:jin-woo.han@nasa.gov">jin-woo.han@nasa.gov</a></td>
<td>650-604-3800</td>
<td>M. Meyyappan</td>
<td><a href="mailto:m.meyyappan@nasa.gov">m.meyyappan@nasa.gov</a></td>
<td>650-604-0832</td>
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<tr>
<td>ARC-008</td>
<td>SMD</td>
<td>Observations and data analysis of transiting planets with the James Webb Space Telescope</td>
<td>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 student researcher to help plan 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 guaranteed time observers (GTOs) and other scientific experts.</td>
<td>Ph.D.</td>
<td>Thomas Gorne</td>
<td><a href="mailto:tom.gorne@nasa.gov">tom.gorne@nasa.gov</a></td>
<td>650-315-5244</td>
<td>Thomas Gorne</td>
<td><a href="mailto:tom.gorne@nasa.gov">tom.gorne@nasa.gov</a></td>
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<td>ARC-009 Rad-Hard neuromorphic device and circuit</td>
<td>Ultra-low power neuromorphic device and circuit using emerging device element such as memristor is called. The device models for “neurons” and “synapses” can operate ultra low voltage result in small computation energy in space application. Complemented with charge-based devices like CMOS, for large-scale networks of emerging devices can be suitable for different applications like analog-data-sensing, data conversion, cognitive-computing, associative memory, programmable-logic, and neuromorphic computing. The proposed device and design would achieve 1,000x lower computation energy for these application as compared to CMOS-only design. However, in order to influence the technology into space, the rad-hard tolerance should be considered. In this opportunity, the inherently radiation tolerant emerging device and the design are solicited.</td>
<td>Ph.D.</td>
<td>Jin-Woo Han</td>
<td><a href="mailto:Jin-Woo.Han@nasa.gov">Jin-Woo.Han@nasa.gov</a></td>
<td>650.604.1885</td>
<td></td>
<td>M. Meyyappan</td>
<td><a href="mailto:m.meyyappan@nasa.gov">m.meyyappan@nasa.gov</a></td>
<td>650.604.3356</td>
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<td>ARC-010 Resource-Bounded Autonomous Decision Making</td>
<td>NASA space exploration missions will often operate in uncertain environments. Adding to the challenges, communication delays may make it difficult to rely on Earth-based controllers and engineering analysis teams for operational support. While many computational techniques have been developed to address autonomous mission operations in the presence of uncertainty, they face challenges in adoption for use in aerospace applications. Some approaches may produce good solutions, but with high resource (CPU or memory) consumption that is infeasible for space qualified processors; some approaches may produce good solutions but have high software complexity, imposing the risk of failure due to software defects. Designers of autonomous systems do not have the right information at their disposal to evaluate the tradeoffs between different approaches to autonomous systems. Under the proposed research opportunity, students will evaluate technologies for autonomous decision making in the presence of uncertainty. The criteria for evaluation will include CPU time, memory use, solution quality, software complexity, and related metrics. These evaluations will be done on processors that could be used for robotic space missions and/or high performance unmanned air vehicles. The result of the evaluation will be guidelines of use to mission managers to select the best autonomy enabling technology for their missions. The ideal candidate will have interest/expertise in automated planning in the presence of uncertainty (e.g. contingent planning, markov decision processes, or temporal planning/controllability), software resource estimation, software quality assurance, and real-time operating systems. The candidate will be capable of integrating existing techniques for automated planning with multiple processors and operating systems to collect various metrics; the candidate may also develop new techniques to evaluate based on findings and ongoing research.</td>
<td>Ph.D.</td>
<td>Jeremy Frank</td>
<td><a href="mailto:Jeremy.d.frank@nasa.gov">Jeremy.d.frank@nasa.gov</a></td>
<td>650.604.2324</td>
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<td>650.604.3513</td>
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<td>ARC-011 Setting up a molecular Rayleigh scattering system in a wind-tunnel to study shock-boundary layer interactions</td>
<td>We are trying to advance molecular Rayleigh scattering to measure turbulence parameters in large transonic and supersonic wind tunnels. Time averaged values and fluctuation spectra of velocity, temperature and density in such tunnels are difficult to measure. The goal of the project is to demonstrate such a capability in a small tunnel. The candidate is expected to setup a system, address various engineering challenges with innovative approaches, create hardware setup and software program for data analysis.</td>
<td>Master’s/Ph.D.</td>
<td>Jay Panda</td>
<td><a href="mailto:jay.panda.1@nasa.gov">jay.panda.1@nasa.gov</a></td>
<td>650.606.3513</td>
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<td>ARC-012 Studying protostars and brown dwarfs with the James Webb Space Telescope</td>
<td>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 planning, analysis, and information retrieval of JWST observations 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. Ideally this would 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 team of guaranteed time observers (GTOs) and other scientific experts.</td>
<td>Ph.D.</td>
<td>Thomas Greene</td>
<td><a href="mailto:tom.greene@nasa.gov">tom.greene@nasa.gov</a></td>
<td>650.518.3244</td>
<td></td>
<td>Mark Malesy</td>
<td><a href="mailto:mark.malesy@nasa.gov">mark.malesy@nasa.gov</a></td>
<td>650.604.3255</td>
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<td>ARC-013</td>
<td>STMD</td>
<td>Testing novel approach for in situ analysis in the search for extraterrestrial life</td>
<td>Answering the question of whether life in the Universe exists requires the development of universal approaches for detecting evidence of extraterrestrial life forms. The fundamental limitation of today’s life detecting strategy is the lack of a reliable universal approach as well as instrumentation that can detect the presence of life as we know it as well as life forms entirely different from life that evolved on Earth. The manifestations of life are most often listed as growth, movement, irritability, reproduction, and metabolism. Taken collectively, they indeed are indicative of life. But which are fundamental and which are not? Here we hypothesize that disregarding the type of lifeform that could be envisioned, they all must share in common the attribute of being entities that decrease their internal entropy at the expense of free energy obtained from its surroundings and produce heat associated with its metabolic reactions. These two components structural complexity and metabolic energy consumption, both related to energy are the most essential attributes of life which can be used for its detection. Analysis of free energy entropy term (and thus, their structural complexity) and enthalpy term (as manifestation of energy of metabolic reactions) may provide definitive conclusions for the presence of life. This approach may allow possible detection of unknown forms of life without need of complementary measurements. We will test this hypothesis using available sensitive calorimetric instrumentation as a valid technique to assess the presence of life in different environments, gaseous, liquid and/or solid state. Our first objective is to demonstrate that calorimetric technology is suitable to definitively detect and characterize extant life with high sensitivity and probability. Our second objective is to demonstrate the feasibility for modification/customization of the micro calorimetric technique for its incorporation into a space exploration platform as a life-detecting instrument. The candidate will be capable of performing microbiological experiments; participate in experiment planning, design, and performance. The candidate may have strong analytical and organizational skills, interested in data analysis, and familiar with the general analytical instrumentation and methods in a field of analytical chemistry, biophysics, and biochemistry.</td>
<td>Master’s</td>
<td>Yuri Griko</td>
<td><a href="mailto:yuri.v.griko@nasa.gov">yuri.v.griko@nasa.gov</a></td>
<td>650-604-0519</td>
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<td>ARC-014</td>
<td>SMD</td>
<td>Understanding Channel, Valley, and Gully Formation on Mars and the Implications for Mars’ Paleoclimatic History</td>
<td>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 astrobiological 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.</td>
<td>Master’s/Ph.D.</td>
<td>Virginia Gulick</td>
<td><a href="mailto:Virginia.Gulick@nasa.gov">Virginia.Gulick@nasa.gov</a></td>
<td>650-604-081</td>
<td>Sandra Owen</td>
<td><a href="mailto:sandra.j.owen@nasa.gov">sandra.j.owen@nasa.gov</a></td>
<td>650-604-1281</td>
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<td>GRC-000</td>
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<td>Student Proposed with Concurrence of NASA Technical Mentor</td>
<td>The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser</td>
<td>Pursuing Master's or Doctoral Degree</td>
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<td>Student Identified NASA Technical Adviser</td>
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<td>GRC-001</td>
<td>SMD / HEOMD</td>
<td>Advanced Materials for Space Nuclear Power and Propulsion</td>
<td>Fission power can be used for surface power on the moon or Mars or as the energy source in nuclear thermal propulsion for faster space travel. These power/propulsion systems have different flux, total fluence, and temperature environments than typical terrestrial power reactor systems. Student proposals are encouraged that emphasize material development or characterization for space nuclear power/propulsion relevant engines and structural systems.</td>
<td>Master's / Ph.D.</td>
<td>Justin Milner</td>
<td><a href="mailto:justin.l.milner@nasa.gov">justin.l.milner@nasa.gov</a></td>
<td>216-433-5913</td>
<td>Cheryl Bowman</td>
<td><a href="mailto:cheryl.bowman@nasa.gov">cheryl.bowman@nasa.gov</a></td>
<td>216-433-8402</td>
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<td>GRC-002</td>
<td>ARMD</td>
<td>AI Aerospace system design tool</td>
<td>PeTaL (Periodic Table of Life) is an open source artificial intelligence (AI) design tool to enable researchers to design novel systems by leveraging data from nature and technology. We are looking for data science proposals to enhance the core capabilities of the software including an ontology, unstructured database, topic modeling and computer vision (activity recognition, feature recognition). The focus of computer vision is to identify pattern-function/structure-function relationships by leveraging digitized (CT-scans, images) collections, videos or images.</td>
<td>Master's / Ph.D.</td>
<td>Vikram Shyam</td>
<td><a href="mailto:vikram.shyam-1@nasa.gov">vikram.shyam-1@nasa.gov</a></td>
<td>216-433-3511</td>
<td>Pahi. Jiangphanich</td>
<td><a href="mailto:pahi.jiangphanich@nasa.gov">pahi.jiangphanich@nasa.gov</a></td>
<td>216-433-3503</td>
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<td>GRC-003</td>
<td>HEOMD</td>
<td>Autonomous power control of multi-system faults</td>
<td>Autonomous power control of complex power distribution systems such as what would be required for planetary surface power will be required to respond to multi-failure scenarios within the power system. The power control system will need to be able to rapidly assess a multi-failure event and determine the best method of system reconfiguration to optimize the remaining operational power system. Identifying and demonstrating methods that could be utilized to process such an event are needed which could include implementing concepts such as neural networks.</td>
<td>Master's / Ph.D.</td>
<td>Jeffrey Csank</td>
<td><a href="mailto:jefrey.t.csank@nasa.gov">jefrey.t.csank@nasa.gov</a></td>
<td>216-433-3479</td>
<td>James Soeder</td>
<td><a href="mailto:james.f.soeder@nasa.gov">james.f.soeder@nasa.gov</a></td>
<td>216-433-5328</td>
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<td>GRC-004</td>
<td>ARMD / SMD</td>
<td>Computationally-Driven Alloy Design</td>
<td>Advancements in fundamental material modeling and advanced computational techniques such as machine learning can be used to accelerate alloy development and tailor alloys for specific high performance applications. Student proposals are encouraged that demonstrate methods for rapid alloy design and implementation of alloy design techniques for aerospace power and propulsion. Examples of high performance applications include: structural materials with high temperature strength, oxidation resistance and erosion resistance; shape memory alloys with exceptionally high or exceptionally low transition temperatures; and nanocomposite magnetic alloys for operation at higher temperatures/frequencies.</td>
<td>Master's / Ph.D.</td>
<td>Timothy Smith</td>
<td><a href="mailto:timothy.m.smith@nasa.gov">timothy.m.smith@nasa.gov</a></td>
<td>216-433-2602</td>
<td>Christopher Kantzos</td>
<td><a href="mailto:christopher.a.kantzos@nasa.gov">christopher.a.kantzos@nasa.gov</a></td>
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<td>GRC-005</td>
<td>ARMD / SMD</td>
<td>Improved Reliability Techniques for Additively Manufactured Components</td>
<td>The increasing prevalence of additive manufacture in flight system hardware development has changed the component design and material property suite paradigm. The advantage for using heritage material is minimized when qualifying flight hardware produced through additive manufacturing and there is concomitant opportunity to design the alloy in parallel with the component. Student proposals are encouraged that develop methods for rapid material discovery of alloys designed for additive manufacture and targeting NASA aerospace applications. Advanced methods for structural property characterization and qualification of components as well as methods for developing targeted witness coupons are also encouraged.</td>
<td>Master's / Ph.D.</td>
<td>Justin Milner</td>
<td><a href="mailto:justin.l.milner@nasa.gov">justin.l.milner@nasa.gov</a></td>
<td>216-433-5913</td>
<td>David Ellis</td>
<td><a href="mailto:david.l.ellis@nasa.gov">david.l.ellis@nasa.gov</a></td>
<td>216-433-8736</td>
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<td>GRC-006</td>
<td>HEOMD</td>
<td>Low gravity research opportunities in support of combustion science, fluid physics or complex fluids projects.</td>
<td>This opportunity pertains to Microgravity environment investigations to conduct fundamental research and to develop technologies enabling human space exploration in the areas of combustion science, complex fluids and fluid physics. NASA Glenn Research Center has a world-class and unique suite of ground-based microgravity research facilities that include: a 2.2-second drop tower, a 5.18 second Zero-Gravity Facility, access to reduced-gravity aircraft and a vibration isolated zero-gravity locomotion simulator. These facilities are utilized for 1) developing longer-duration space flight experiments to be conducted on the International Space Station, and 2) conducting ground-based research. Research investigations are in the specific areas of fluid physics (in support of the fluid and thermal management), complex fluids (in support of soft matter physics such as colloids and liquid crystals), combustion science, spacecraft fire safety, and advanced life support systems.</td>
<td>Ph.D.</td>
<td>John McQuillen</td>
<td><a href="mailto:john.b.mcquillen@nasa.gov">john.b.mcquillen@nasa.gov</a></td>
<td>216-433-2876</td>
<td>Daniel Dietrich</td>
<td><a href="mailto:daniel.l.dietrich@nasa.gov">daniel.l.dietrich@nasa.gov</a></td>
<td>216-433-8759</td>
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<td>GRC-007</td>
<td>ARMD</td>
<td>Multifunctional thermal management systems for Aerospace</td>
<td>We are looking for research proposals that involve innovative use of lightweight thermal management systems for aerospace. Proposals that involve machine learning and data mining to assist with topology optimization, topology identification and structure optimization for additive manufacturing are also welcome. Emphasis is on unique methods or ideas. We are also looking for ways to generate large volumes of data to train machine learning algorithms that can help in system design.</td>
<td>Master’s/Ph.D.</td>
<td>Vikram Shyam</td>
<td><a href="mailto:vikram.shyam@nasa.gov">vikram.shyam@nasa.gov</a></td>
<td>216-433-3511</td>
<td>Ezra McNichols</td>
<td><a href="mailto:ezra.o.mcnichols@nasa.gov">ezra.o.mcnichols@nasa.gov</a></td>
<td>216-433-8013</td>
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<td>GRC-008</td>
<td>ARM / SMD</td>
<td>Nanocomposite Magnetic Materials Maturation</td>
<td>NASA is pushing the advancement of higher power, medium frequency power systems for a wide range of demanding propulsion and power management applications. Nanocomposite soft magnetic alloys provide magnetic property tailoring at temperatures and electrical frequencies required for increasing performance in many aerospace power systems. Student proposals are encouraged for atomic-level microstructural characterization, improved fundamental understanding of microstructure and properties developed upon strain or field annealing, and component-driven material characterization.</td>
<td>Master’s/Ph.D.</td>
<td>Alex Leary</td>
<td><a href="mailto:alex.s.leary@nasa.gov">alex.s.leary@nasa.gov</a></td>
<td>216-433-8884</td>
<td>Ron Noebe</td>
<td><a href="mailto:ronald.d.noeb@nasa.gov">ronald.d.noeb@nasa.gov</a></td>
<td>216-433-2093</td>
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<td>GRC-009</td>
<td>HEOMD / ARM</td>
<td>Shape Memory/Super Elastic Alloy Development and Utilization</td>
<td>Shape memory and super elastic affect alloys can enable a wide range of unique aerospace mechanism subsystems. Previous aeronautical applications are folding wings or control surfaces. Previous space applications are panel deployment, rock splitting, and spring tires. Student proposals are encouraged that explore how lightweight and reliable mechanisms can be designed with active or passive application of shape memory or super elastic affect alloys. Advancements in fundamental alloy design, new techniques for alloy training, and reliability characterization are encouraged.</td>
<td>Master’s/Ph.D.</td>
<td>Othmane Benafan</td>
<td><a href="mailto:othmane.benafan@nasa.gov">othmane.benafan@nasa.gov</a></td>
<td>216-433-8538</td>
<td>Glen Bigelow</td>
<td><a href="mailto:glen.s.bigelow@nasa.gov">glen.s.bigelow@nasa.gov</a></td>
<td>216-433-6603</td>
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<td>GRC-010</td>
<td>STMD / HEOMD</td>
<td>Surface Electric Power Transmission and Distribution</td>
<td>There are complex issues on how to implement power transmission and distribution for planetary surface power that must be resolved. Today’s electronics power processing capabilities opens the debate for direct current vs alternating current transmission. Also many of the proposed power generation concepts will require the power generation to be remotely located as far as a kilometer from the end users. Cost and mass effective methods for power transmission and distribution will not be trivial. Then there is implementing a transmission system with potential sources that are not suitable for direct human contact. Issues such as transfer mass, losses, thermal, power efficiency, environments, and how a system can be implemented are all complex and need to be studied.</td>
<td>Master’s/Ph.D.</td>
<td>Robert Scheidegger</td>
<td><a href="mailto:robert.s.scheidegger@nasa.gov">robert.s.scheidegger@nasa.gov</a></td>
<td>216-433-8342</td>
<td>Walter Santiago</td>
<td><a href="mailto:walter.santiago@nasa.gov">walter.santiago@nasa.gov</a></td>
<td>216-433-8486</td>
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<td>GRC-011</td>
<td>ARMD / SMD</td>
<td>Turbo-machinery CFD in Propulsion Airframe Integration for electric powered aircrafts</td>
<td>Next generation sub-sonic fixed wing project seeks after challenging modeling methods that analyze fan stage CFD under propulsion-airframe integration (PAI). The modeling to be considered covers the full annulus Unsteady Reynolds Averaged Navier Stokes (URANS) and quasi-unsteady methods in both frequency and time domain, including methods of harmonic balance (HB), non-linear harmonic (NLH) and space-time-gradient (STG). A 1/rev distortion is generated by influencing body, i.e. the airframe and the electrically driven fan stage is consequently analyzed under the ingested distortion. A NASA’s in-house code or an open source code will be provided to the student as a baseline code for development. The developed analysis method will be applied to BLITS (Boundary Layer Ingesting Tail-cone System) with an aerodynamically designed fan stage provided by NASA Glenn Research Center.</td>
<td>Master’s/Ph.D.</td>
<td>May-Fun Liou</td>
<td><a href="mailto:may-fun.liou@nasa.gov">may-fun.liou@nasa.gov</a></td>
<td>216-433-3600</td>
<td>Byung Joong Lee</td>
<td><a href="mailto:byung.joong.lee@nasa.gov">byung.joong.lee@nasa.gov</a></td>
<td>216-416-5707</td>
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<td>GRC-012</td>
<td>ARMD</td>
<td>Ultra Efficient Multiscale Modeling via Machine Learning</td>
<td>Materials discovery and structure optimization is accelerated through simulation and modelling by predicting the properties of candidate materials and structures. Material properties depend on physical processes that operate at length scales separated by many orders of magnitude. Physics based models operate at a narrow range of lengths and fail to predict the effects of processes on all length scales simultaneously. Neural networks can act as accurate and computationally efficient surrogate models and are general enough to mimic physics based models. The student will develop an efficient framework to generate accurate surrogates of lower length scale models to be used within higher length scale models. One particular goal is to develop surrogate models to mimic NASA’s MAC/GMC code, which captures the microscale response of composites to physical loading, and use the surrogate within finite element analysis software. A challenging aspect of this framework will be developing neural networks that capture history, path dependence, and uncertainty. A multiscale model of this nature will enable design optimization of composite aerospace structures based on lower length scale features.</td>
<td>Ph.D.</td>
<td>Joshua Stuckner</td>
<td><a href="mailto:joshua.stuckner@nasa.gov">joshua.stuckner@nasa.gov</a></td>
<td>216-433-3178</td>
<td>Steve Arnold</td>
<td><a href="mailto:steven.m.arnold@nasa.gov">steven.m.arnold@nasa.gov</a></td>
<td>216-433-3334</td>
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<td>GRC-013</td>
<td>STMD</td>
<td>Ultrathin perovskite solar cells for space applications</td>
<td>The advent of highly efficient thin film solar cells based on perovskite structures that are processed at room temperatures enable the development of potentially printable, very large solar arrays. Issues abound in this nascent technology including an extreme sensitivity to moisture. However in the typical applications of space environments that include earth orbits, extraterrestrial habitats or deep space missions this concern vanishes. NASA GRC as part of the Power and Energy Conversion core competency is exploring through STMD funded programs the possibility of in-space manufacture of these solar arrays to enable both long lifetimes and very large constructions. We are seeking materials investigations focused on meeting this goal and therefore the materials should be space compatible and work towards the ability to deposit the materials in space.</td>
<td>Master’s/Ph.D.</td>
<td>Timothy Peshek</td>
<td><a href="mailto:timothy.peshek@nasa.gov">timothy.peshek@nasa.gov</a></td>
<td>216-433-2386</td>
<td>Lyndsey McAlpin-Brown</td>
<td><a href="mailto:lyndsey.m.mcalpinbrown@nasa.gov">lyndsey.m.mcalpinbrown@nasa.gov</a></td>
<td>216-433-5197</td>
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<td>GSFC-001</td>
<td>SMD</td>
<td>Astrophysics</td>
<td>The Astrophysics Science Division at NASA Goddard Space Flight Center conducts a broad program of research in astronomy, astrophysics, and fundamental physics. Individual investigations address issues such as the nature of dark matter and dark energy, which planets outside our solar system may harbor life, and the nature of space, time, and matter at the edges of black holes. Observing photons, particles, and gravitational waves enables researchers to probe astrophysical objects and processes. Researchers develop theoretical models, design experiments and hardware to test theories, interpret and evaluate the data, archive and disseminate the data, provide expert user support to the scientific community, and publish conclusions drawn from research.</td>
<td>Master's/Ph.D.</td>
<td>Applicant should work with their campus PI to identify a specific research area and NASA GSFC scientist of interest from <a href="https://science.gsfc.nasa.gov">https://science.gsfc.nasa.gov</a> (for general questions email: <a href="mailto:gsfc-education@mail.nasa.gov">gsfc-education@mail.nasa.gov</a>)</td>
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<tr>
<td>GSFC-002</td>
<td>SMD</td>
<td>Computational and Information Sciences and Technology</td>
<td>The Computational and Information Sciences and Technology Office (CISTO) at NASA Goddard Space Flight Center provides applied information system research and services to support the research programs of the Science and Exploration Directorate (SEDS). The office provides high-performance computing and networking, mass storage and information systems technologies, computational science expertise, software engineering and performance optimization services, information technology (IT) security services, scientific visualization services, and research in information science and technology.</td>
<td>Master's/Ph.D.</td>
<td>Applicant should work with their campus PI to identify a specific research area and NASA GSFC scientist of interest from <a href="https://science.gsfc.nasa.gov">https://science.gsfc.nasa.gov</a> (for general questions email: <a href="mailto:gsfc-education@mail.nasa.gov">gsfc-education@mail.nasa.gov</a>)</td>
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<td>GSFC-003</td>
<td>SMD</td>
<td>Earth Science</td>
<td>The Earth Sciences Division at NASA Goddard Space Flight Center plans, organizes, evaluates, and implements a broad program of research on our planet’s natural systems and processes. Major focus areas include climate change, severe weather, the atmosphere, the oceans, sea ice and glaciers, and the land surface. To study the planet from the unique perspective of space, the Earth Science Division develops and operates remote-sensing satellites and instruments. We analyze observational data from these spacecraft and make it available to the world’s scientists.</td>
<td>Master's/Ph.D.</td>
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<td>GSFC-004</td>
<td>Heliophysics</td>
<td>The Heliophysics Science Division at NASA Goddard Space Flight Center conducts research on the Sun, its extended solar-system environment (the heliosphere), and interactions of Earth, other planets, small bodies, and interstellar gas with the heliosphere. Division research also encompasses geospace – Earth’s uppermost atmosphere, the ionosphere, and the magnetosphere – and the changing environmental conditions throughout the coupled heliosphere (solar system weather). Scientists in the Heliophysics Science Division develop models, spacecraft missions and instruments, and systems to manage and disseminate heliophysical data. They interpret and evaluate data gathered from instruments, draw comparisons with computer simulations and theoretical models, and publish the results.</td>
<td>Master's/Ph.D.</td>
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<td>GSFC-005</td>
<td>Miniaturized instruments enabled by nanomaterials for future space missions</td>
<td>Nanomaterials offer a unique set of characteristics that can be leveraged to make miniaturized, low power, radiation hard, lightweight instruments for the next generation space missions. This work focuses on the development of nanomaterial-based instruments. Current efforts include the development of a multifunctional sensor platform by printing nanomaterials such as graphene, carbon nanotube, molybdenum disulfide and other transition metal dichalcogenides using additive manufacturing techniques to make highly sensitive devices. The effort involves device design, fabrication, characterization, integration and packaging of devices, and the student assignment can be related to any of these aspects. In addition, NASA GSFC is also developing a miniaturized multispectral imager with quantum dot pixels used as a filter array. The effort includes the optimization of the printing process of the quantum dots to fabricate the spectrometer, building an optical test setup for the spectrometer, integration of the overall instrument and characterization of the instrument. The student assignment may include, but not limited to, expanding the current wavelength ranges by developing new materials or nanostructures, design and integration of the overall instrument and device characterization. These instruments have a wide range of applications in planetary science, earth science and heliophysics.</td>
<td>Master's/Ph.D.</td>
<td>Mahmoda Sultana</td>
<td><a href="mailto:mahmoda.sultana@nasa.gov">mahmoda.sultana@nasa.gov</a></td>
<td>301-286-2158</td>
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<td>GSFC-006</td>
<td>Simultaneous Localization and Mapping (SLAM) for Space Exploration</td>
<td>Future NASA missions to explore, land on, and return samples from small bodies, planets and moons require autonomous, onboard Terrain Relative Navigation (TRN) using optical cameras and/or LIDAR. TRN methods are also applicable to satellite rendezvous, servicing and on-orbit assembly missions. Terrestrial robots navigate using Simultaneous Localization and Mapping (SLAM) techniques that estimate a vehicle’s position and orientation (localization) and the location of an unknown number of features in the environment (mapping) simultaneously. For space applications, mapping locates features on the target body. Current approaches to TRN require a priori maps, computationally expensive image processing, and can have difficulties with missed feature detections and clutter. This research focuses on developing new or improved SLAM algorithms for space applications that overcome these limitations and demonstrating their effectiveness via simulation and testing.</td>
<td>Ph.D.</td>
<td>Gaylor David</td>
<td><a href="mailto:david.gaylor@nasa.gov">david.gaylor@nasa.gov</a></td>
<td>301-286-0066</td>
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<td>JPL-000</td>
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<td>Student Proposed with Concurrence of NASA Technical Mentor</td>
<td>The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser</td>
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<td>JPL-001</td>
<td>SMD / STMD / ARMD</td>
<td>2020 NASA Fellowship Opportunities at JPL</td>
<td>JPL’s technical competencies revolve around end-to-end implementation of unprecedented robotic space missions that study Earth, the solar system, and the universe. We are soliciting student-proposed NASA-relevant and independently conceived research proposals in STEM fields addressing topics that fall within the following areas: Earth Sciences, Astrophysics and Space Sciences, Spacecraft and Robotic Technologies, Planetary Sciences, Communications and Computing Software and Instrument Technologies. Students are encouraged to review open literature to identify and communicate with JPL researchers who investigate topics in the proposer’s area of interest to determine if a collaboration is mutually desirable and beneficial. To learn more about research conducted at JPL please visit: <a href="http://www.jpl.nasa.gov">http://www.jpl.nasa.gov</a></td>
<td>Master's / Ph.D.</td>
<td>Petra Kneissl</td>
<td><a href="mailto:petra.kneissl@jpl.nasa.gov">petra.kneissl@jpl.nasa.gov</a></td>
<td>818-354-0726</td>
<td>Adrian Ponce</td>
<td><a href="mailto:adrian.ponce@jpl.nasa.gov">adrian.ponce@jpl.nasa.gov</a></td>
<td>818-354-8196</td>
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<td>The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser.</td>
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<td>JSC-001</td>
<td>STMD</td>
<td>3D Printing Space Hardware using Thermoset Resins</td>
<td>New materials and cost-effective manufacturing techniques are needed for future spacecraft to support NASA’s Exploration goals. Highly filled thermoset resin mixtures are a class of materials that can be used to produce thermal protection for spacecraft or other spacecraft components. The objective of this research is to improve current thermoset resin mixture properties and advance the capability of 3D printing and curing parts. The avenues of study with this effort include: 1) Modulation of thermoset resin properties (such as thermal expansion and modulus) using additives to better suit application requirements; 2) Enhance print quality through parametric study of nozzle design and toolpath; 3) Refine printer and extruder design to upgrade feed system and upstream raw material mix technology; 4) Investigate option for curing parts and material during and after deposition.</td>
<td>Master’s / Ph. D.</td>
<td>Stan Bouslog</td>
<td><a href="mailto:Stan.a.bouslog@nasa.gov">Stan.a.bouslog@nasa.gov</a></td>
<td>281-483-3327</td>
<td>Kevin Righter</td>
<td><a href="mailto:kevin.righter-1@nasa.gov">kevin.righter-1@nasa.gov</a></td>
<td>281-483-5125</td>
</tr>
<tr>
<td>JSC-002</td>
<td>STMD</td>
<td>Chemical and Physical Origin and Evolution of Primitive Extraterrestrial Materials</td>
<td>Amorphous silicates are associated with the most primitive solar system bodies such as cosmic dust, comets, and the most primitive meteorites. Amorphous materials (including insoluble organic matters) will be key components in the returned samples of the future planetary robotic sample return missions. Mineralogical and experimental studies of extraterrestrial amorphous materials and their analogs are performed at nanometer to sub-micrometer scales using transmission electron microscopy techniques. Current research focuses on the studies of early solar system materials preserved in primitive meteorites, cosmic dusts and Stardust mission samples. These analyses are pursued in a coordinated fashion with other analytical instruments in our facilities including isotopic and spectroscopic analysis techniques. Our research is to constrain origin and formation models of primitive amorphous materials and their precursor and post products by evaporation, thermal and hydrous experiments.</td>
<td>Ph.D.</td>
<td>Keiko Nakamura-Moestinger</td>
<td><a href="mailto:Keiko.Nakamura-1@nasa.gov">Keiko.Nakamura-1@nasa.gov</a></td>
<td>281-244-5007</td>
<td>Paul B. Niles</td>
<td><a href="mailto:paul.b.niles@nasa.gov">paul.b.niles@nasa.gov</a></td>
<td>281-483-7860</td>
</tr>
<tr>
<td>JSC-003</td>
<td>STMD</td>
<td>Experimental Studies of Planetary Accretion, Differentiation, and Magmatism</td>
<td>The origin and evolution of planetary interiors, though remote from us both temporally and spatially, can be elucidated through high-pressure and temperature laboratory experiments. This research is conducted in Johnson’s high-pressure experimental petrology facility, which features hydraulic presses fitted with multiple anvil and piston cylinder devices that can achieve high pressures (0.1 to 25.0 GPa) and high temperatures (up to 2,500 C) in relatively large sample volumes. This capability allows the laboratory observation of mineral and magma properties at conditions equivalent to a depth of 700 km in the Earth and Venus, 2,000 km in Mars, and pressures exceeding the Moon’s central core at 1,700 km. Current research includes studies of the physics and chemistry of accretion and core formation in Earth and its Moon, Mars, and asteroids; the timing of differentiation of terrestrial planets; the geochemistry of the platinum group elements; and the nature of planetary basaltic magmatism.</td>
<td>Ph.D.</td>
<td>Kevin Righter</td>
<td><a href="mailto:kevin.righter-1@nasa.gov">kevin.righter-1@nasa.gov</a></td>
<td>281-483-5125</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.Simon@nasa.gov">Justin.Simon@nasa.gov</a></td>
<td>281-483-6408</td>
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<td>JSC-004</td>
<td>STMD</td>
<td>Isotopic and Chemical Studies of Aqueous Environments</td>
<td>Research is centered on understanding and interpreting the geologic conditions of past aqueous environments on Earth, Mars, and meteorite parent bodies. We seek to answer questions regarding the temperatures, time scales, nature of water-rock interaction, and chemical characteristics of these ancient aqueous systems with the final goal of assessing their suitability for sustaining life. The approach to the problem encompasses analysis of data returned from planetary missions (such as MSL, Phoenix, and the MER rovers), geochemical analysis of samples, laboratory experiments, and field work. Sample analysis includes mineralogy and bulk chemistry with an emphasis on light stable isotope measurements. Laboratory experiments are used in conjunction with theoretical calculations to better understand complex systems where kinetic processes may be dominant. Field work has primarily focused on terrestrial analogs to planetary environments. Our recent focus has been centered on Mars including analysis of data returned from the SAM instrument on the Curiosity rover, analysis of martian meteorites (e.g. ALH84001), laboratory experiments exploring the weathering of minerals in cryogenic environments, laboratory experiments on abiotic methane synthesis and oxidation, and field work at continental hot springs in Nevada and California.</td>
<td>Ph.D.</td>
<td>Paul B. Niles</td>
<td><a href="mailto:paul.b.niles@nasa.gov">paul.b.niles@nasa.gov</a></td>
<td>281-483-7860</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.Simon@nasa.gov">Justin.Simon@nasa.gov</a></td>
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<td>JSC-005</td>
<td>STMD</td>
<td>Isotopic and Chemical Studies of Meteorites and Rocks to Probe the Origin and Early History of the Solar System and Formation of the Rocky Planets</td>
<td>In my research group we develop and employ state-of-the-art analytical methods to address research in isotope cosmochemistry and geochemistry. Our research links sample studies to astrophysics, the evolution of the early solar system, and terrestrial planet formation. Our team measures a wide variety of elements and their isotopes to understand the origin of our Solar System, the processes that transformed nebular dust and gas into the building blocks of planets, and planet formation (accretion &amp; differentiation). Investigations include the measurement of: (1) Short- and long-lived radionuclides for chronology studies, (2) Fractionation of stable isotopes to study the formation mechanisms of these planetary materials, and (3) Isotopic analyses that utilize extinct radioactivity and traditional ways that radiogenic isotopic compositions can be used to study interaction among different reservoirs within the protoplanetary disk and terrestrial planets. We strive to integrate all of these isotopic measurements into a petrological context. We perform both micro-analytical in situ approaches (LA-MC-ICPMS and ion microprobe) and bulk sample methods (e.g., chemical separation solution analyses by TIMS &amp; MC-ICPMS) to achieve high spatial resolution and higher precision measurements, respectively. This research is carried out in the mass spectrometry laboratories in the Center for Isotope Cosmochemistry and Geochronology at NASA Johnson Space Center and often in collaboration with other NPP principal investigators residing in the Astromaterials Research and Exploration Science (ARES) Division.</td>
<td>Ph.D.</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.I.Simon@nasa.gov">Justin.I.Simon@nasa.gov</a></td>
<td>281-484-6408</td>
<td>Scott R. Messenger</td>
<td><a href="mailto:Scott.R.Messenger@nasa.gov">Scott.R.Messenger@nasa.gov</a></td>
<td>281-244-2786</td>
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<tr>
<td>JSC-006</td>
<td>STMD</td>
<td>Isotopic and Elemental Studies of Stardust, Interstellar Matter, and Extraterrestrial Materials</td>
<td>Isotopic and elemental studies of extraterrestrial materials are performed at submicrometer scales by Nano SIMS 50L ion microprobe. Current research areas include the characterization of circumstellar and interstellar grains, and molecular cloud matter and isotopic and trace element studies of calcium, aluminum-rich inclusions and chondrules in primitive meteorites. Isotopic compositions are used to constrain models of stellar nucleosynthesis, galactic chemical evolution, the histories of interstellar grains in the galaxy, and chemical processes in the interstellar medium and the early solar system.</td>
<td>Ph.D.</td>
<td>Scott R. Messenger</td>
<td><a href="mailto:Scott.R.Messenger@nasa.gov">Scott.R.Messenger@nasa.gov</a></td>
<td>281-244-2786</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.I.Simon@nasa.gov">Justin.I.Simon@nasa.gov</a></td>
<td>281-484-6408</td>
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<td>JSC-007</td>
<td>STMD</td>
<td>Mars Surface Chemistry and Mineralogy</td>
<td>The objectives of this research are to search for and identify chemical weathering and/or aqueous alteration products on the surface of Mars using data returned from past, current, and future missions (e.g., Mars Exploration Rovers, Mars Reconnaissance Orbiter, Phoenix, Mars Lander, and Mars Science Laboratory). Studies are also underway to establish datasets on the mineralogical, chemical, spectral, magnetic, and physical properties of Mars analog materials to aid in the interpretation of data returned from Mars robotic missions. The overall intent of this research is to provide a better understanding of the geological processes responsible for the formation of Martian soils and other potential chemical weathering or aqueous alteration products (e.g., phyllosilicates, sulfates, Fe-oxyhydroxides, carbonates, zeolites). The identification and understanding of the formation processes for chemical weathering are keys to defining the environmental conditions under which these phases formed and aid in the characterization of the environment as a habitable zone. Research projects in Mars surface mineralogy and chemistry are encouraged, especially phyllosilicates, carbonate, sulfate, and Fe- oxyhydroxides mineralogy and mineral synthesis studies. Experimental and analytical facilities include X-ray diffraction analysis, infrared spectroscopy, Moessbauer spectroscopy, electron microscopy (SEM, TEM, EMPA), thermal analysis, and wet chemistry analysis (AAS, IC).</td>
<td>Ph.D.</td>
<td>Douglas W. Ming</td>
<td><a href="mailto:douglas.w.ming@nasa.gov">douglas.w.ming@nasa.gov</a></td>
<td>281-484-5409</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.I.Simon@nasa.gov">Justin.I.Simon@nasa.gov</a></td>
<td>281-484-6408</td>
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<td>JSC-008</td>
<td>STMD</td>
<td>Microbial Alteration of Astromaterials</td>
<td>Bacteria, Archaea, and Fungi are capable of altering terrestrial materials as a way to acquire organic carbon and or trace nutrients. This alteration includes mineral dissolution and precipitation reactions, stable isotope fractionation and the production and consumption of a variety of organic compounds. Similar alteration of extra-terrestrial materials has been observed in meteorites. This opportunity is to understand the physical, chemical and microbiological signatures associated with microbial action on Astromaterials. The goal is to characterize the metabolic pathways employed to alter Astromaterials under anaerobic conditions like those encountered in the Astromaterials Curation labs. An alternate goal is to quantify the extent of alteration that has occurred to NASA meteorites. These goals could be accomplished with DNA and RNA sequencing as well as identification and quantification of biosignatures. The geomicrobiology group has access to a fully functional BSL-2 (Bio Safety Level) laboratory for aerobic and anaerobic culturing experiments as well as several different types of gas and liquid chromatography that could be used to characterize biosignatures produced during Astromaterials alteration.</td>
<td>Ph.D.</td>
<td>Aaron B. Regberg</td>
<td><a href="mailto:aaron.b.regberg@nasa.gov">aaron.b.regberg@nasa.gov</a></td>
<td>281-484-7243</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.I.Simon@nasa.gov">Justin.I.Simon@nasa.gov</a></td>
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<td>JSC-009</td>
<td>STMD</td>
<td>Mineralogy and aqueous alteration of the martian surface</td>
<td>Surface mineralogy and geochemistry of Mars are key to characterizing geological processes on ancient and modern Mars. Mineralogical and geochemical measurements from Mars show that the ancient surface and geochemical trends observed on the surface can help determine the characteristics of these ancient aqueous environments and whether or not they would have been habitable to microbial life. The goal of this research is to reconstruct the history of liquid water on Mars through mineralogical and geochemical measurements of the martian surface and analog materials. These analog materials can be synthesized in the laboratory or collected from Mars analog sites on Earth. Studies of phyllosilicate, iron oxide, sulfate, and carbonate minerals and amorphous or poorly crystalline phases are encouraged. Studies of mineral sorting and segregation in fluvio-lacustrine and Aeolian environments on Earth as a means to interpret the mineralogy of martian surface deposits are also of great interest. Analytical instruments available at JSC include X-ray diffraction, infrared spectroscopy, thermal and evolved gas analysis, laser-induced breakdown spectroscopy, ion chromatography, scanning electron microscopy, transmission electron microscopy, and electron microprobe. JSC also has test bed instruments for the CheMin X-ray diffraction-meter on the Mars Science Laboratory Curiosity rover, the Sample Analysis at Mars (SAM) instrument on Curiosity, the Thermal and Evolved Gas Analyzer (TEGA) on Phoenix, ChemCam on Curiosity, and the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on the Mars Reconnaissance Orbiter, and data collected on these instruments are directly comparable to those collected on Mars. Scientists with experience analyzing weathering products or amorphous materials using Synchrotron techniques are also encouraged to apply.</td>
<td>Ph.D.</td>
<td>Elizabeth B. Rampe</td>
<td>281-480-0126</td>
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<td>JSC-010</td>
<td>STMD</td>
<td>Mineralogy of Fine-Grained Extraterrestrial Materials</td>
<td>The early history of the solar system is being explored through detailed characterization of the minerals and noncrystalline phases composing primitive extraterrestrial materials. As these materials are typically very fine grained, this research is being performed principally by analytical electron microscopy, high-resolution transmission electron microscopy, electron back-scattered diffraction, and synchrotron X-ray microdiffraction. We are currently examining carbonaceous chondrites, interplanetary dust particles, asteroid Itokawa and comet Wild 2 grains, and fluid inclusions and primitive organics in meteorites.</td>
<td>Ph.D.</td>
<td>Michael Ewing Domínguez</td>
<td>281-480-5125</td>
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<td>JSC-011</td>
<td>STMD</td>
<td>Multidisciplinary Studies on the Formation and Evolution of Solar System Geomaterials</td>
<td>Understanding the processes responsible for the formation and evolution of rocks from different planetary bodies requires a diversity of tools, including (but not limited) to stable and radiogenic isotope geochemistry, experimental petrology, numerical modeling, and thinking outside the box. Projects often link experts in multiple fields and at multiple institutions in order to solve complex problems beyond the capabilities of any individual group. Of particular current interest are projects related to various aspects of volatile elements, and the formation and evolution of rocky bodies such as the Moon and Mars. You are encouraged to reach out to the PI as well as to other scientists in the Astromaterials Research and Exploration Science (ARES) group to discuss proposal opportunities. We are especially interested in projects involving secondary ion mass spectrometry (SIMS) or Isotope Ratio Infrared Spectroscopy (IRIS) techniques (e.g. Cavity Ring Down Spectroscopy, CRDS) of volatile stable isotope systems. Applications welcomed from all candidates with doctoral degrees in geoscience, chemistry, planetary sciences, or related fields who are interested in pursuing cutting-edge planetary science problems in a supportive, inclusive atmosphere.</td>
<td>Ph.D.</td>
<td>Jeremy W. Joyce</td>
<td>281-481-1275</td>
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<td>JSC-012</td>
<td>STMD</td>
<td>Physicochemical State of the Martian Surface</td>
<td>The general objective of this continuing research program is to understand the mineralogical and elemental composition of surficial material on Mars and to determine the weathering processes that evolved the surface to its current state. Specific tasks include studies of geologic samples that have been weathered in terrestrial environments considered to be analogous in some important respects to those on Mars and theoretical and experimental studies of the optical properties of pure and substituted iron-bearing compounds, including nanophase materials. Emphasis is placed on multidisciplinary analyses of samples to maximize comparison with the data base available for Mars from the Viking, Phobos-2, Mars Pathfinder, and Mars Global Surveyor missions and telescopic observations. Experimental and analytical facilities include ferromagnetic resonance spectroscopy, vibrating sample magnetometer, Mössbauer spectroscopy, ultraviolet-visible-infrared spectroscopy, and x-ray diffraction.</td>
<td>Ph.D.</td>
<td>Richard Van Morris</td>
<td>281-481-5125</td>
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<td>JSC-013</td>
<td>Planetary Mineralogy and Petrology</td>
<td>I am currently seeking highly motivated postdoctoral candidates interested in pursuing research in planetary mineralogy and petrology through the analysis of Astromaterials and/or through experimental petrology. Specifically, I seek candidates interested in determining the abundances and roles of volatiles (H2O, F, Cl, S, C, N) in magmatic systems within terrestrial planetary bodies, including Earth, Moon, Mars, Venus, Mercury, and asteroids. Additionally, I seek candidates interested in determining the thermal and magmatic evolution of terrestrial planets under a variety of conditions relevant to planet formation from core formation to crust formation.</td>
<td>Ph.D.</td>
<td>Francis M. McCubbin</td>
<td><a href="mailto:francis.m.mccubbin@nasa.gov">francis.m.mccubbin@nasa.gov</a></td>
<td>281-483-5326</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.Simon@nasa.gov">Justin.Simon@nasa.gov</a></td>
<td>281-484-6408</td>
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<tr>
<td>JSC-014</td>
<td>Prebiotic Chemical Evolution in the Solar System</td>
<td>The analysis of organic molecules found in meteorites and other Astromaterials has provided invaluable authentic samples with which we can study prebiotic chemistry. The discovery of biologically important classes of organic molecules including amino acids, nucleobases, and sugar acids provides concrete evidence of the types and diversity of molecules that were likely around during the origins of life on Earth. Our goal is to understand how these prebiotic molecules could have evolved under conditions relevant to early Earth (or other terrestrial bodies) and the role they could have played in the origins of life. This is accomplished through the study of meteorite organics and laboratory experiments simulating relevant chemical and physical processes. Research is carried out in the Soluble Organics in Astromaterials Laboratory (SOAL) within the Astromaterials Research and Exploration Science (ARES) directorate at the NASA Johnson Space Center. The SOAL contains a variety of gas and liquid-chromatography instrumentation with mass spectrometry, FID, fluorescence and absorbance detection. Also within ARES are a number of instruments for geochemical analysis that are also available for use.</td>
<td>Ph.D.</td>
<td>Aaron Burton</td>
<td><a href="mailto:Aaron.S.Burton@nasa.gov">Aaron.S.Burton@nasa.gov</a></td>
<td>281-2-44-2773</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.Simon@nasa.gov">Justin.Simon@nasa.gov</a></td>
<td>281-484-6408</td>
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<tr>
<td>JSC-015</td>
<td>Spacecraft and Instrument Development for Planetary Science and Exploration</td>
<td>The Astromaterials Research and Exploration Science (ARES) Directorate at NASA Johnson Space Center supports NASA's Solar System exploration and research goals through participation on various spacecraft missions. ARES personnel are actively engaged in missions such as the Mars rovers Opportunity and Curiosity, the DAWN spacecraft to asteroid Ceres, and the OSIRIS REx sample return spacecraft to near-Earth asteroid Bennu. I am currently seeking qualified individuals with degrees in Planetary Science or Aerospace Engineering with career interests in areas of, but not limited to, instrument and spacecraft development, modeling and computational analyses, observational and experimental design, and systems engineering. My current research interest is focused on the development of concept designs and feasibility studies of science instruments and engineering experiments to be flown on robotic and human spacecraft missions. These activities will support planetary science investigations for the Science Mission Directorate (SMD) and the Human Exploration and Operations Mission Directorate (HEOMD). Ideally the goal is to refine these initial designs and studies so that they will be selected for upcoming NASA missions. I am specifically interested in participating in missions that will investigate the Moon, Earth’s Orbital Environment, Near-Earth Objects, Main belt Asteroids, Comets, Mars and its Satellites, and the Trojan Asteroids. Selected candidates will be intimately involved with the entire process of concept formulation and will participate in further development in areas related to instrument design/fabrication, computational/experimental modeling, and system engineering tests. The goal of this “hands on” approach is to develop and design hardware at relatively low technology readiness levels that can be upgraded for inclusion into future flight missions.</td>
<td>Ph.D.</td>
<td>Paul Abell</td>
<td><a href="mailto:Paul.A.Abell@nasa.gov">Paul.A.Abell@nasa.gov</a></td>
<td>281-483-0293</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.Simon@nasa.gov">Justin.Simon@nasa.gov</a></td>
<td>281-484-6408</td>
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<td>JSC-016</td>
<td>The Nature of Early Solar System and Presolar materials</td>
<td>Mineralogical and petrographic studies of extraterrestrial materials are performed at nanometer scales using primarily transmission electron microscopy techniques. Current research focuses on the studies of primitive early solar system materials preserved in meteorites and interplanetary dust particles, circumstellar and interstellar grains, and molecular cloud matter. These analyses are pursued in a coordinated fashion with other analytical instruments in our facilities including isotopic and spectroscopic analysis techniques. Our research is focused on gaining a better understanding of the conditions and processes that affected these primitive materials from their formation through their evolution.</td>
<td>Ph.D.</td>
<td>Lindsay P. Keller</td>
<td><a href="mailto:Lindsay.P.Keller@nasa.gov">Lindsay.P.Keller@nasa.gov</a></td>
<td>281-483-6900</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.Simon@nasa.gov">Justin.Simon@nasa.gov</a></td>
<td>281-484-6408</td>
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<td>JSC-017</td>
<td>STMD</td>
<td>The Origin of Modified Optical Properties of Natural and Experimental Space-Weathered Materials</td>
<td>Space weathering is a term used to include all of the processes that act on material exposed at the surface of a planetary or small body. In the case of the Moon, it includes a variety of processes that have formed the lunar regolith, caused the maturation of lunar soils, and formed patina on rock surfaces. The processes include micrometeorite impact and reworking, implantation of solar wind and flare particles, radiation damage and chemical effects from solar particles and cosmic rays, interactions with the lunar atmosphere, and sputtering erosion and deposition. Understanding these effects is critical in order to fully integrate the lunar sample collection with remotely sensed data from recent robotic missions (e.g., Lunar Prospector, Clementine, Galileo). A major objective of this research is to analyze lunar breccia's for evidence of preserved space weathering effects in component grains and clasts. The main research techniques include optical and electron microscope analysis for chemical compositions, mineralogy, and petrography. In addition to the lunar breccia studies, parallel research will be undertaken on gas-rich meteorite breccia’s, interplanetary dust particles, and experimental analogues using the same suite of analytical techniques in order to understand space-weathering effects on chondritic materials.</td>
<td>Ph.D.</td>
<td>Lindsay P. Keller</td>
<td><a href="mailto:Lindsay.P.Keller@nasa.gov">Lindsay.P.Keller@nasa.gov</a></td>
<td>281-483-6000</td>
<td>Justin Simon</td>
<td><a href="mailto:Justin.Simon@nasa.gov">Justin.Simon@nasa.gov</a></td>
<td>281-484-5486</td>
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<td>KSC-000</td>
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<td>Student Proposed with Concurrence of NASA Technical Mentor</td>
<td>The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser</td>
<td>Pursuing Master’s or Doctoral Degree</td>
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<td>Student Identified NASA Technical Adviser</td>
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<td>KSC-001</td>
<td>HEO-MD</td>
<td>Lunar Lander Plume Surface Impingement Studies</td>
<td>The study will assess risks due to lunar lander plume interactions with surface regolith. Risks may include the effects of high speed dust particles impacting the vehicle during and after landing, risks to existing lunar surface and orbital systems resulting from multiple lunar landings, and the effectiveness of mitigation technologies (pads, berms, etc.) to minimize ejecta impact hazards.</td>
<td>Ph.D.</td>
<td>Mantovani, James</td>
<td><a href="mailto:james.g.mantovani@nasa.gov">james.g.mantovani@nasa.gov</a></td>
<td>321-867-1900</td>
<td>Beverly Watson Kemmerer</td>
<td><a href="mailto:beverly.a.watson@nasa.gov">beverly.a.watson@nasa.gov</a></td>
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<tr>
<td>KSC-002</td>
<td>HEO-SLPSRA</td>
<td>Microgravity Simulation Studies</td>
<td>Microgravity is the most significant stress factor experienced by living organisms during spaceflight. The spaceflight environment is known to influence biological processes ranging from stimulation of microbial metabolism, impacts on cellular damage repair, suppression of immune functions, and muscle plus bone loss in astronauts. While there have been reports on these and other physiological and functional changes, no mechanism by which these changes occurs has been fully elucidated. Therefore, understanding cellular responses to altered gravity at the molecular level is critical for expanding our knowledge of life in space. Since the opportunity to conduct experiments in space is scarce, various microgravity simulators or techniques, such as 2-D/3-D Clinostats, Synthecon HARV/RWV bioreactors, 3-D Random Positioning Machines, and hind limb suspension, have been developed and widely used in microgravity research on the ground. These simulated microgravity conditions have produced some, but not all of the biological effects observed in the true microgravity environment. Research topics of interest for this opportunity focus on evaluating: (1) The similarities and the differences between biological responses in living organisms (cells, 3D tissue models, microbes, or model/crop plants) to simulated microgravity and those to true microgravity as revealed in previous ISS studies; (2) The biological effects of simulated microgravity in combination with other space environmental factors (e.g. radiation). Hypothesis driven approaches for evaluating physiological changes combined with state-of-the-art omics and imaging analyses targeting mechanisms are highly encouraged.</td>
<td>Ph.D.</td>
<td>Ye Zhang</td>
<td><a href="mailto:ye.zhang1@nasa.gov">ye.zhang1@nasa.gov</a></td>
<td>321-861-2553</td>
<td>Howard Levine</td>
<td><a href="mailto:howard.g.levine@nasa.gov">howard.g.levine@nasa.gov</a></td>
<td>312-861-3502</td>
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<tr>
<td>KSC-003</td>
<td>HEO-SLPSRA</td>
<td>Plants for Food and Human Life Support</td>
<td>Long missions in space will require sufficient supplies of food and other life support commodities for human crews. The use of plants to supplement these supplied foods could provide key nutrients and improve the acceptability of the diet for early missions, and expand to cover more of the life support (total food and oxygen supplies) for future missions. To achieve this requires an understanding of horticultural approaches and agricultural engineering for growing plants in space, as well as plant responses to space environmental factors. These latter factors could include different types of lighting, CO2 levels, and water/nutrient delivery concepts envisioned for space. These challenges are similar to challenges for controlled environment agriculture (CEA) on Earth, but could also include unique aspects of space, such as elevated radiation levels, reduced gravity environments (micro and fractional g), tightly closed atmospheres where organic volatiles like ethylene can accumulate, and even reduced atmospheric pressures, which have been considered for future missions. NASA is interested in research that addresses these questions at the molecular, metabolite, and phenotype / whole plant level, as well as the supporting engineering to optimize the system performance.</td>
<td>Master’s / Ph.D.</td>
<td>Gioia Massa</td>
<td><a href="mailto:gioia.massa@nasa.gov">gioia.massa@nasa.gov</a></td>
<td>321-861-2988</td>
<td>Raymond Wheeler</td>
<td><a href="mailto:raymond.m.wheeler@nasa.gov">raymond.m.wheeler@nasa.gov</a></td>
<td>312-861-2850</td>
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<td>NASA Center</td>
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<td>LaRC-000</td>
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<td>The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser</td>
<td>Pursuing Master's or Doctoral Degree</td>
<td>Valerie Wiesner</td>
<td>757-864-4384</td>
<td>757-864-8074</td>
<td><a href="mailto:Valerie.L.Wiesner@nasa.gov">Valerie.L.Wiesner@nasa.gov</a></td>
<td>Guillaume Gronff</td>
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<td>LaRC-001</td>
<td>STMD / SMD / HEOMD</td>
<td>Active Strategies to Mitigate Lunar Dust Adhesion for Moon Missions</td>
<td>A return to the lunar surface presents a number of familiar and new challenges, especially when considering mission planning and requisite technologies to support an extended or even sustained presence. In addition to the expected difficulties that come with operating in a harsh lunar environment, preventing lunar dust adhesion to components is widely considered a significant design hurdle to overcome. Lunar dust consists of fine, highly abrasive particulates that readily adhere and embed into surfaces. The aim of this work is to develop novel active mitigation strategies, including but not limited to chemical surface and topographical modifications, in order to produce coatings and/or components resistant to lunar dust adhesion. The investigation could be accomplished via experimentation, simulation, or a combination of the two approaches.</td>
<td>Master's / Ph.D.</td>
<td>John W. Connell</td>
<td>757-864-4264</td>
<td>757-864-2298</td>
<td><a href="mailto:john.w.connell@nasa.gov">john.w.connell@nasa.gov</a></td>
<td>Guillaume Gronff</td>
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<td>LaRC-002</td>
<td>ARMD</td>
<td>Advanced Materials for Energy Storage in Electric Aircraft</td>
<td>All electric vertical take-off and landing vehicles (eVTOL) for urban air mobility (UAM) concepts face numerous challenging technical barriers before their introduction into service. The most challenging of these technical barriers is an energy storage system capable of meeting both the rigorous aerospace safety and performance criteria. Aircraft safety is essential for operation, and systems level analyses have indicated that there are five key properties to enable such vehicles; safety, energy density, power, packaging design and scalability. The battery systems must be constructed of nonflammable materials for safety and be able to achieve fast discharge rates as needed for the flight profiles (2C and higher). Current state-of-the-art (SOA) lithium-ion batteries meet or exceed the requirements for electric aviation in the areas of power and scalability, but are insufficient in energy, safety and packaging design. The proposals should focus on battery technology that meets all five key performance criteria. As an example, the approach could utilize nonflammable electrolytes, solid-state electrolytes, novel battery chemistries and combinations thereof to meet the performance requirements.</td>
<td>Master's / Ph.D.</td>
<td>Yi Lin</td>
<td>757-864-6984</td>
<td>757-864-2219</td>
<td><a href="mailto:yi.lin-1@nasa.gov">yi.lin-1@nasa.gov</a></td>
<td>Yi Lin</td>
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<td>LaRC-003</td>
<td>ARMD</td>
<td>Advanced Modeling of Turbulence for Combustion Applications</td>
<td>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 general 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. The problem is further aggravated in simulations of supersonic combustion, where the flow and chemistry time scales could be on the same order, and the models are least accurate. 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 conventional combustion models. However, computational affordability has been of primary concern and must be considered in the proposed work.</td>
<td>Ph.D.</td>
<td>Tomasz Drozda</td>
<td>757-864-2298</td>
<td>757-864-8074</td>
<td><a href="mailto:tomasz.d.rozdak@nasa.gov">tomasz.d.rozdak@nasa.gov</a></td>
<td>Yi Lin</td>
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<td>LaRC-004</td>
<td>SMD</td>
<td>Atmospheric chemistry of planetary atmospheres around active stars</td>
<td>Active stars, such as the Young Sun, or the red dwarfs that will be on of the primary target for life detection with the JWST, bombard their planets' atmospheres with very energetic charged particles. These particles in turn ionize and dissociate the atmospheric species, leading to chemical reactions that are of importance for prebiotic chemistry and for the creation of greenhouse gases. We developed tools to investigate these effects and explore the evolution of atmospheres around such stars, which could have impact on our understanding of the apparition of life at earth and other planets. The aim of this work will be to study the parameter space of these chemical creations through the inputs of different realistic atmospheres.</td>
<td>Master's / Ph.D.</td>
<td>Guillaume Giron</td>
<td>757-864-5996</td>
<td>757-864-5996</td>
<td><a href="mailto:gillaume.giron@nasa.gov">gillaume.giron@nasa.gov</a></td>
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<td>LaRC-005 ARMD</td>
<td>On-Demand Mobility (ODM) refers to the movement of passengers and cargo through integrated air and ground segments where the customer dictates the origin, destination, and timing of the transportation, which is similar to how cars or ride-hailing services (e.g., Uber, Lyft) are used today. The ODM concept typically relies on air vehicles designed for one to nine passengers or cargo from small packages up to approximately 2000 lb., and ODM encapsulates urban air mobility (UAM), &quot;thin-haul,&quot; and &quot;regional&quot; air mobility (RAM) concepts. ODM aircraft may utilize vertical, short, and/or conventional takeoff and landing (VTOL, STOL, and/or CTOL) modes to provide travelers or cargo with a rapid mode of transportation that improves door-to-door transport time for existing trips and enables new trips to become practical. This novel concept of operations introduces a number of inherent challenges to vehicle and mission design, such as affordability, community noise signature, ride quality, safety, near-all-weather operations, scalability, and emissions. Many ODM aircraft concepts involve highly coupled disciplines in their design. A distributed electric propulsion blown-wing concept with high-lift propellers, for example, relies on aero-thermo-optical interactions to achieve short takeoff and landing; however, the distributed propellers can then lead to aeronautical interaction problems in the form of whirl flutter. Additionally, an aero-thermo-control and propulsion problem could be solved to vary propeller rotational speeds to minimize power and maximize lift while maintaining constant thrust. The objective of this research topic is to develop tools and work processes that can bring knowledge of these multidisciplinary couplings earlier in the design process. Earlier knowledge can allow for earlier detection of design-limiting constraints and better design decisions, leading to less rework and an overall better vehicle design. Graduate students are requested for: Development of multidisciplinary tools and/or tool workflows Verification of tools and/or tool workflows Integration of tools into a larger overall aircraft design process.</td>
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<td>LaRC-006 ARMD</td>
<td>Tracking battery health in Unmanned Aerial Vehicles, UAVs, is essential to safe operation and completion of mission objectives. Model-based estimation of State of Charge, SoC, is an effective way of estimating remaining useful battery life and establishing confidence intervals. The development and implementation of mathematical models remains an area of ongoing research. Mathematical models of batteries are nonlinear and the SoC cannot be directly observed. The challenge here is to construct an accurate battery model and nonlinear state observer. Adaptive models hold the potential to self-adjust to account for environmental changes and effects of model mismatch due to battery aging. Another aspect of SoC estimation and prognostics is implementation on board a small airframe. The battery health monitor, BHM, must be computationally light and capable of nonlinear system modeling and state observation given low bandwidth sensor input. Skill set: Nonlinear system modeling and state estimation, MATLAB, C++ programming, embedded systems, Kalman filtering (extended, unscented, particle, etc.)</td>
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<td>LaRC-007 STMD / SMD / HEOMD</td>
<td>Developing Novel Wear-Resistant Materials for Lunar Exploration In order to enable long duration missions to the moon's surface, materials resistant to the harsh lunar environment are critically needed. Lunar dust poses a significant threat to the durability of components and vehicles operating on the lunar surface. The fine, jagged morphology and highly abrasive nature of the dust enable particles to adhere and embed into surfaces of components and devices potentially leading to premature failure. The objective of this project is to examine properties of candidate material systems, including but not limited to ceramics and composites, that are highly wear resistant and/or resistant to lunar dust adhesion for lunar applications as coatings and/or bulk components. New coating chemistries and architectures could be designed and implemented to meet the lunar dust mitigation requirements of lunar vehicles. This investigation could be accomplished via experimentation, simulation, or a combination of the two approaches.</td>
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| LaRC-008 STMD / HEOMD                                                   | Enabling Technologies for Modular, Persistent In-Space and Planetary Surface Assets. This topic area seeks pioneering research into developing innovative and integrated structural and automated assembly architectures, operations concepts and methods for building, servicing, and reconfiguring a modular in-space or planetary surface asset. The primary objectives are to create a versatile and scalable structural architecture that can be easily tailored to accommodate a subset of modular and interchangeably payloads while satisfying a set of baseline structural requirements. This could include researching modular and reversible payload connectors and the persistent structure(s) they connect to. It can also include integrating the ability to provide power and data to multiple and distributed payloads on a persistent asset. This work would create a fundamental shift in how we fly and maintain space assets by reducing development and life cycle costs and time to launch, increasing serviceability and reuse, and reducing risk over a mission lifecycle. Specific focus problems include: (1) Persistent Telescope – In-Space Assembled Telescope (ISAT); (2) Persistent Surface Outlet – Lunar Payload Operations Planning & Services (POPS); (3) Persistent Platform – In-Space Tested
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<td>LaRC-009</td>
<td>ARMD</td>
<td>Flow control for safe, quiet, and efficient on-demand mobility aircraft</td>
<td>Low-complexity solutions are likely important, particularly in the near-term, to enable more rapid vehicle certification and keep operating costs affordable for the average passenger. Research may include, but is not limited to: investigating the benefits and tradeoffs associated with the proposed technology, developing tools to enable rapid design optimisation, validation of these tools with experimental data, and vehicle-level design analysis of the application of the technology. In order to achieve successful characteristics in the design of ODM aircraft, it is necessary to consider the use of additional technologies which may alleviate some of these challenges. Students are requested to propose one or multiple low-complexity solutions to the requirement for quiet, efficient, and safe ODM vehicles. Flow control to ODM vehicles, with particular regard for aerodynamics, acoustics, and structural characteristics. Flow control may be especially useful for transitioning VTOL vehicles (for example, tilt wing, lift duct, deflected slipstream), which typically experience adverse flight characteristics, such as buffeting and pitching moment changes, when transitioning between hover and wing-borne cruise flight. Students are invited to include vehicle-level design analysis of the application of their flow control technique(s) to ODM vehicles, and development of conceptual design tools for aircraft incorporating flow control. Original ideas outside of the examples given here are also welcomed.</td>
<td>Master’s/Ph.D.</td>
<td>Armand Chou</td>
<td><a href="mailto:armanda.chou@nasa.gov">armanda.chou@nasa.gov</a></td>
<td>757-864-5941</td>
<td>Beau Pollard</td>
<td><a href="mailto:beau.pollard@nasa.gov">beau.pollard@nasa.gov</a></td>
<td>757-864-4637</td>
</tr>
<tr>
<td>LaRC-010</td>
<td>ARMD</td>
<td>Freestream disturbance effects on shock-boundary layer interaction</td>
<td>Low-complexity solutions are likely important, particularly in the near-term, to enable more rapid vehicle certification and keep operating costs affordable for the average passenger. Research may include, but is not limited to: investigating the benefits and tradeoffs associated with the proposed technology, developing tools to enable rapid design optimisation, validation of these tools with experimental data, and vehicle-level design analysis of the application of the technology. In order to achieve successful characteristics in the design of ODM aircraft, it is necessary to consider the use of additional technologies which may alleviate some of these challenges. Students are requested to propose one or multiple low-complexity solutions to the requirement for quiet, efficient, and safe ODM vehicles. Flow control to ODM vehicles, with particular regard for aerodynamics, acoustics, and structural characteristics. Flow control may be especially useful for transitioning VTOL vehicles (for example, tilt wing, lift duct, deflected slipstream), which typically experience adverse flight characteristics, such as buffeting and pitching moment changes, when transitioning between hover and wing-borne cruise flight. Students are invited to include vehicle-level design analysis of the application of their flow control technique(s) to ODM vehicles, and development of conceptual design tools for aircraft incorporating flow control. Original ideas outside of the examples given here are also welcomed.</td>
<td>Master’s/Ph.D.</td>
<td>Armand Chou</td>
<td><a href="mailto:armanda.chou@nasa.gov">armanda.chou@nasa.gov</a></td>
<td>757-864-5941</td>
<td>Beau Pollard</td>
<td><a href="mailto:beau.pollard@nasa.gov">beau.pollard@nasa.gov</a></td>
<td>757-864-4637</td>
</tr>
<tr>
<td>LaRC-011</td>
<td>ARMD</td>
<td>Low-Complexity Solutions for Quiet and Efficient On-Demand Mobility Aircraft</td>
<td>Low-complexity solutions are likely important, particularly in the near-term, to enable more rapid vehicle certification and keep operating costs affordable for the average passenger. Research may include, but is not limited to: investigating the benefits and tradeoffs associated with the proposed technology, developing tools to enable rapid design optimisation, validation of these tools with experimental data, and vehicle-level design analysis of the application of the technology. In order to achieve successful characteristics in the design of ODM aircraft, it is necessary to consider the use of additional technologies which may alleviate some of these challenges. Students are requested to propose one or multiple low-complexity solutions to the requirement for quiet, efficient, and safe ODM vehicles. Flow control to ODM vehicles, with particular regard for aerodynamics, acoustics, and structural characteristics. Flow control may be especially useful for transitioning VTOL vehicles (for example, tilt wing, lift duct, deflected slipstream), which typically experience adverse flight characteristics, such as buffeting and pitching moment changes, when transitioning between hover and wing-borne cruise flight. Students are invited to include vehicle-level design analysis of the application of their flow control technique(s) to ODM vehicles, and development of conceptual design tools for aircraft incorporating flow control. Original ideas outside of the examples given here are also welcomed.</td>
<td>Master’s/Ph.D.</td>
<td>Armand Chou</td>
<td><a href="mailto:armanda.chou@nasa.gov">armanda.chou@nasa.gov</a></td>
<td>757-864-5941</td>
<td>Beau Pollard</td>
<td><a href="mailto:beau.pollard@nasa.gov">beau.pollard@nasa.gov</a></td>
<td>757-864-4637</td>
</tr>
<tr>
<td>LaRC-012</td>
<td>OCIO</td>
<td>Machine Learning for Automated Detection of Above-Cloud Cirrus Plumes</td>
<td>Machine learning (ML) is a weather phenomenon where cirrus plumes are ejected into the stratosphere from convective updrafts. AACPs have been observed to precede more severe weather such as tornadoes, high winds, and hail. Automated detection of AACPs would enable more timely severe weather warnings saving lives and preserving property. A dedicated student is desired to develop machine learning algorithms for automated detection of AACPs using satellite imagery. The student should have strong experience in deep learning models such as convolutional neural networks, semantic segmentation models, and recurrent neural networks. Familiarity with leveraging cloud services for machine learning algorithm development is also desired but not required.</td>
<td>Master’s/Ph.D.</td>
<td>Charles Jiles</td>
<td><a href="mailto:charles.jiles@nasa.gov">charles.jiles@nasa.gov</a></td>
<td>757-864-3157</td>
<td>Ed McAloney</td>
<td><a href="mailto:ed.mcaloney@nasa.gov">ed.mcaloney@nasa.gov</a></td>
<td>757-864-1023</td>
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Opportunity Title: Metaprogramming and Advanced Discontinuous Galerkin Techniques for High-Speed Flow Applications

A critical aspect for determining the environment of high-speed vehicles with complex configurations is an accurate prediction of solution gradients, such as shear stresses, heat fluxes, pressure gradients, and density gradients. These quantities are required in reducing uncertainties in predicting turbulent flows, separation and reattachment points, and surface heat fluxes of spacecraft and hypersonic vehicles, to name a few. Furthermore, analysis of boundary layer instabilities also requires a nearly pristine set of solution gradients. The vehicles’ geometrical complexities such as wings, protruberances, cavities, thermal protection systems, compression pads, reaction control surfaces, as well as complexities in the flow field such as shocks, shock-boundary layer interactions, shock-shock interactions, separations, and vortices are the main reasons for using purely simple (triangle and tetrahedral) elements. The high-order Discontinuous Galerkin method is one of the attractive high-order schemes that is mathematically sound, and combines the benefits of both finite-volume and finite-elements schemes. The research opportunity seeks an independent original proposal in either of the following two general topics: 1) novel, parallel, and scalable C++ metaprogramming techniques for development of efficient backend for compressible DG, and 2) novel numerical algorithms for robust, efficient, and accurate prediction of high-order solution gradients on simplex elements for compressible Navier-Stokes equations.

Opportunity Title: Modeling and Simulation of Conjugate Heat Transfer driven Fluid Structure Interactions for Engineering Applications in High-Speed Flows

Fluid Structure Interactions (FSI) and Conjugate Heat Transfer (CHT) are two important research areas in their own right. However, combining and leveraging existing capabilities in these areas for use in engineering applications where high heating rates introduce thermally-induced structural growth and distortions has become a critical need for supersonic combustion ramjet (scramjet) designers. These structural changes, and the resulting impact on the flow, alter the expected behavior of the scramjet engine and may lead to significant loss of performance. The objective of the current opportunity is to survey existing capabilities for FSI and CHT, identify and address physics-based challenges associated with coupling these technologies, and develop effective strategies for implementing and/or interfacing various capabilities with existing computational fluid dynamic (CFD) solvers. The research should be focused on the fully coupled problem rather than the development of the individual software tool components, although some software development is expected when embedding the multi-physics solvers within a CFD framework that can enable high-performance computations of the coupled problem. The successful research will pave the way towards allowing fully coupled FSI/CHT/CFD analysis to be performed at a much higher level of fidelity than is currently practical.

Opportunity Title: Modeling and Simulation of UAM Network Operations

Urban air mobility (UAM) is an emerging aviation market that seeks to revolutionize mobility around metropolitan areas via a safe, efficient, and accessible on-demand air transportation system for passengers and cargo. Such revolutionary mobility could fundamentally change how transportation networks operate and bring aviation into people’s daily lives.

Because UAM represents a paradigm shift in aviation capabilities, existing assumptions about aircraft operations and the requirements derived from the current operations are likely invalid; consequently, new concepts of operation are needed that consider new aircraft with potentially different capabilities, new techniques for air traffic management (ATM), and new infrastructure to and from which operations will occur (i.e., “UAM ports”). Many fundamental questions about UAM operations that could have first-order impacts on requirements for aircraft, future ATM, and infrastructure remain largely unexplored.

The objective of this topic is to develop non-proprietary modeling approaches for an overall UAM transportation system that is capable of modeling the operations in UAM networks throughout entire days and/or some of the “sub-models” that must also be developed for the network modeling to provide accurate results, such as demand models and dispatch models. Ideally the overall network modeling could be tied to models for existing ground transportation networks, be able to accommodate various sub-models (including those of varying fidelity), and be developed to run at varying levels of fidelity. Similar sort of network modeling is described in the following references: https://arc.aiaa.org/doi/abs/10.2514/6.2018-3677 and https://ntrs.nasa.gov/search.jsp?R=20190001282.

Opportunity Title: Multifunctional Structural Materials for Extreme Space Environments

Multifunctional materials can enable revolutionary design schemes for future aerospace vehicles and structures for NASA missions such as Artemis Space Program for Moon and Mars exploration especially in extreme space environments. Recent studies of nanocomposite materials have shown the potential for both structural integrity and multifunctional capabilities; such as actuating, health monitoring, radiation shielding, energy harvesting, thermal management, and thermal protection. For example, small loadings of nano-inclusions such as carbon nanotubes (CNT), boron nitride nanotubes (BNNT), 2D nanomaterials, or combinations of these inclusions in a polymer, ceramic, or metallic matrix may result in improving mechanical and thermal properties significantly while offering sensing/actuating/energy harvesting and radiation shielding functionalities. To explore the potential of emerging multifunctional materials, new composites, fibers, and yarns with nano-inclusions will be developed experimentally and computationally to study their mechanical, thermal, electrical, sensing/actuation, radiation shielding, and exotic electromagnetic properties systematically for aerospace applications in extreme environments to protect crew and electronic devices. A gifted student is sought to research and develop new multifunctional nanocomposite materials that will be used for future aerospace applications.
<table>
<thead>
<tr>
<th>NASA Center</th>
<th>Center Code</th>
<th>Opportunity Title</th>
<th>Opportunity Description/Objective (Specific student assigned)</th>
<th>Desired Student Academic Level</th>
<th>NASA Technical Adviser Name</th>
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<th>Co-Technical Adviser’s Email</th>
<th>Co-Technical Adviser’s Phone Number</th>
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<tbody>
<tr>
<td>LaRC-017</td>
<td>HEDMD</td>
<td>Multi-model Uncertainty Quantification for Reliability Analysis</td>
<td>Develop a means to use multiple models of varying fidelity (e.g., multi-fidelity Monte Carlo, multi-level Monte Carlo, approximate control variates) for reliability analysis. Specific challenges could include extending existing methods to estimation of full distributions, multi-dimensional probabilistic performance envelopes, or rare event statistics.</td>
<td>Master’s / Ph.D.</td>
<td>James Warner</td>
<td><a href="mailto:jw_larsen@nasa.gov">jw_larsen@nasa.gov</a></td>
<td>757-864-1681</td>
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<td>LaRC-018</td>
<td>ARMD</td>
<td>Passive Radio Frequency Surveillance System for UAM/AAM Airspace</td>
<td>Advanced Air Mobility (AAM) is gaining in global importance as related to the aviation industry. NASA as a major contributor to U.S. dominance in the aviation sector is also developing innovative technologies that will transform and enable new air transportation modes in urban and inter urban environments. The organization and planning of critical research is underway in the areas of Urban Air Mobility (UAM) whereby communication, navigation and surveillance (CNS) requirements are a priority. There is great interest in detection and tracking systems for Unmanned Aerial Vehicles (UAVs). Detection of cooperative and non-cooperative air vehicles in the low altitude Urban Air environment by the use of imagery, acoustic signatures, and RF systems show great potential. The ambient electromagnetic environment (EME) is a complex, persistent, pervasive, and immersive field of time distributed signals across a broad band of frequencies. Any object that moves through that field creates a disturbance within the field. Through deliberate passive monitoring and correlation of patterns in the spectrum of ambient signals it is theoretically possible to detect UAVs. Traditionally the EME background noise would be considered as an obstacle for detection in both active and passive RF systems, but by taking advantage of machine learning algorithms capability of extracting latent patterns from data, the electromagnetic environment may be used as an untapped source of information that can provide knowledge on the objects interacting within it. New approaches in data collection and machine learning can provide enhanced detection, tracking, and surveillance capabilities and the realization of an integrated airspace surveillance system. A student pursuing Masters and eventually Ph.D. level education in electrical engineering with concentration in electromagnetics is sought to investigate and develop passive RF monitoring techniques for detection, tracking, and surveillance of UAVs in urban airspaces.</td>
<td>Master’s / Ph.D.</td>
<td>Kenneth Dudley</td>
<td><a href="mailto:k_dudley@nasa.gov">k_dudley@nasa.gov</a></td>
<td>757-864-1899</td>
<td>Truong Nguyen</td>
<td><a href="mailto:truong.nguyen@nasa.gov">truong.nguyen@nasa.gov</a></td>
<td>757-864-7328</td>
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<td>LaRC-019</td>
<td>ARMD</td>
<td>Physics-informed Machine Learning for Certification of Materials</td>
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<td>LaRC-020</td>
<td>ARMD</td>
<td>Predicting the Performance of Additively Manufactured Components</td>
<td>Leverage test data to develop, verify and validate computational tools for predicting the performance of additively manufactured components. Proposal should consider the effect of defects, residual stresses, and uncertainty on residual strength and fatigue life.</td>
<td>Master’s / Ph.D.</td>
<td>William Leser</td>
<td><a href="mailto:w_leser@nasa.gov">w_leser@nasa.gov</a></td>
<td>757-864-1426</td>
<td>John Newman</td>
<td><a href="mailto:j_newman@nasa.gov">j_newman@nasa.gov</a></td>
<td>757-864-8945</td>
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<tr>
<td>LaRC-021</td>
<td>ARMD</td>
<td>Predictive modeling of multi-body/flexible spacecraft structures</td>
<td>This goal of this opportunity is aimed at the development of simulation and modeling software and techniques for in-space assembly operations of multi-agent autonomous systems. This opportunity is aimed at the development of multi-body dynamics and flexible-body simulation software capable of running at or near real-time calculation capabilities in the Langley Standard Real-time Simulation in C++ (LaSRS+) framework. A background in software development techniques (C++ preferred) and structures/dynamics engineering is preferred. Experience with multi-processor/multi-threaded applications would be helpful.</td>
<td>Master’s / Ph.D.</td>
<td>Jacek Nowak</td>
<td><a href="mailto:jacek.nowak@nasa.gov">jacek.nowak@nasa.gov</a></td>
<td>757-863-6416</td>
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**LaRC-017**
- **Opportunity Title**: Multi-model Uncertainty Quantification for Reliability Analysis
- **Description/Objective**: Develop a means to use multiple models of varying fidelity for reliability analysis. Specific challenges could include extending existing methods to estimation of full distributions, multi-dimensional probabilistic performance envelopes, or rare event statistics.

**LaRC-018**
- **Opportunity Title**: Passive Radio Frequency Surveillance System for UAM/AAM Airspace
- **Description/Objective**: Advanced Air Mobility (AAM) is gaining in global importance. NASA is developing innovative technologies to transform and enable new air transportation modes in urban and inter-urban environments. The organization and planning of critical research is underway in the areas of Urban Air Mobility (UAM) in communication, navigation, and surveillance (CNS) requirements. There is great interest in detection and tracking systems for Unmanned Aerial Vehicles (UAVs). Detection of cooperative and non-cooperative air vehicles in the low-altitude Urban Air environment by the use of imagery, acoustic signatures, and RF systems shows great potential. The ambient electromagnetic environment (EME) is a complex, persistent, pervasive, and immersive field of time-distributed signals across a broad band of frequencies. Any object that moves through that field creates a disturbance within the field. Through deliberate passive monitoring and correlation of patterns in the spectrum of ambient signals, it is theoretically possible to detect UAVs. Traditionally, the EME background noise is considered as an obstacle for detection in both active and passive RF systems, but by taking advantage of machine learning algorithms' capability of extracting latent patterns from data, the electromagnetic environment may be used as an untapped source of information that can provide knowledge on the objects interacting within it. New approaches in data collection and machine learning can provide enhanced detection, tracking, and surveillance capabilities and the realization of an integrated airspace surveillance system. A student pursuing Masters and eventually Ph.D. level education in electrical engineering with concentration in electromagnetics is sought to investigate and develop passive RF monitoring techniques for detection, tracking, and surveillance of UAVs in urban airspaces.

**LaRC-019**
- **Opportunity Title**: Physics-informed Machine Learning for Certification of Materials
- **Description/Objective**: Develop physics-informed machine learning methods to model material response while simultaneously quantifying uncertainty given mechanical test data. A student should propose implementation of current methods or development of new methods. Mechanical test data could be provided by LaRC if required.

**LaRC-020**
- **Opportunity Title**: Predicting the Performance of Additively Manufactured Components
- **Description/Objective**: Leverage test data to develop, verify, and validate computational tools for predicting the performance of additively manufactured components. Proposal should consider the effect of defects, residual stresses, and uncertainty on residual strength and fatigue life.

**LaRC-021**
- **Opportunity Title**: Predictive modeling of multi-body/flexible spacecraft structures
- **Description/Objective**: This goal of this opportunity is aimed at the development of simulation and modeling software and techniques for in-space assembly operations of multi-agent autonomous systems. This opportunity is aimed at the development of multi-body dynamics and flexible-body simulation software capable of running at or near real-time calculation capabilities in the Langley Standard Real-time Simulation in C++ (LaSRS+) framework. A background in software development techniques (C++ preferred) and structures/dynamics engineering is preferred. Experience with multi-processor/multi-threaded applications would be helpful.
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<th>Opportunity Title</th>
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<th>Desired Student Academic Level</th>
<th>NASA Technical Adviser Name</th>
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<tr>
<td>Progressive damage analysis method development for prediction of structural failure due to fiber kinking</td>
<td>The fiber kinking damage mechanism controls failure under compressive loads in many composite structural applications. While existing methods can predict the onset of fiber kinking in some cases, many situations such as fiber kinking under fatigue loading and prediction of the post-kinking behavior remain poorly understood. The student will research and develop methods and tools for progressive failure analysis of fiber kinking in composite structures subject primarily to compressive loading. Modeling should focus on predicting fiber kinking onset and propagation resulting from compressive loading of structures with features known to trigger fiber kinking such as bolted connections, manufacturing defects (e.g., fiber waviness), or low-velocity impact damage. Particular attention should be given to detailed validation of the behavior after fiber kinking initiates including kink band characteristics, residual load transfer, and conjugate kinking enabled by high-fidelity experimental observations of kinking evolution under load. Since fiber kinking is found across a variety of material systems (conventional unidirectional tape laminates, fabrics, thin-ply materials) and loading conditions (quasi-static, dynamic, fatigue) and occurs in a wide variety of aerospace applications, a unified modeling approach is sought.</td>
<td>Ph.D.</td>
<td>Andrew Bergan</td>
<td><a href="mailto:Andrew.c.bergan@nasa.gov">Andrew.c.bergan@nasa.gov</a></td>
<td>757-864-3744</td>
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<tr>
<td>Transformational inter-city Transportation</td>
<td>How can point-to-point, inter-city transportation of people and goods on small, conventional takeoff and landing (CTOL) aircraft become economically feasible? This market typically suffers from high direct operating costs (pilots, fuel, maintenance, etc.) and high fixed costs (airframe, insurance, etc.) due to low utilization. However, if these costs can be addressed, this &quot;long, thin tail&quot; can bring about transformational solutions in mobility. For example, a multi-modal configuration, that allows the aircraft to be rapidly switched between passenger and cargo configurations, enables higher utilization. Potential technologies include airborne electric propulsion, which reduces operating costs through increased efficiency and lower maintenance costs, and the integration of selective autonomy/optionally piloted operations, which introduces autonomy to the lowest-risk mission, enabling this aircraft to be a pathfinder for future, fully autonomous passenger operations. This research topic seeks proposals that propose and evaluate operational concepts similar to those described above for their potential technical, sociotechnical, and economic viability.</td>
<td>Master of Ph.D.</td>
<td>Kevin Antcliff</td>
<td><a href="mailto:kevin.r.antcliff@nasa.gov">kevin.r.antcliff@nasa.gov</a></td>
<td>757-864-4026</td>
<td>Nick Borer</td>
<td><a href="mailto:nick.borer@nasa.gov">nick.borer@nasa.gov</a></td>
<td>757-864-4918</td>
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<td>Turbulent Viscous Drag Reduction</td>
<td>Turbulent viscous drag accounts for a substantial portion of the drag of low-speed and high-speed aircraft. In order to foster the development of new aircraft that are substantially more efficient and environmentally friendly than current aircraft, proposals are sought to investigate flow control techniques to reduce viscous drag as well as techniques to make direct measurements of viscous drag reduction. Proposals are encouraged that address passive, active or reactive concepts for external, attached, fully developed, turbulent boundary layer viscous drag reduction in air. Target conditions are flight-relevant Reynolds numbers at either high subsonic (0.7 &lt; M &lt; 0.9), supersonic (M = 5), or hypersonic speeds. Proposals at lower Mach and Reynolds numbers shall provide a discussion of a developmental path towards flight-relevant conditions but not necessarily inclusive of actual flight. Laboratory and flight measurements of viscous drag reduction are notoriously difficult. Proposals investigating new techniques to acquire these measurements in a laboratory setting at a low Mach number as well as at the final target conditions described above are also encouraged.</td>
<td>Master of Ph.D.</td>
<td>Catherine McGinley</td>
<td><a href="mailto:catherine.b.mcginley@nasa.gov">catherine.b.mcginley@nasa.gov</a></td>
<td>757-864-5557</td>
<td>Mariel Kikuk</td>
<td><a href="mailto:mariel.kikuk@nasa.gov">mariel.kikuk@nasa.gov</a></td>
<td>757-864-8740</td>
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<td>MSFC-000</td>
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<td>Student Proposed with Concurrence of NASA Technical Mentor</td>
<td>The student can submit a NASA relevant, independently conceived research proposal with the concurrence of a university principal investigator and a NASA Technical Adviser</td>
<td>Pursuing Master's or Doctoral Degree</td>
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<td>Student Identified NASA Technical Adviser</td>
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Appendix F: Professional Development Requirements

The goal 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 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 be led by the PI and 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. Allowable expense for attending professional research, graduate student conferences, symposiums, and workshops.
   1. Registration Fees
   2. Maximum three nights in a hotel per event (Home rentals, such as Airbnb, are not included)
   3. Per diem of three full days and two half days
   4. Travel costs to and from event

B. Publication costs for conference presentation material, related research papers, thesis, and dissertation.

C. Professional training for required skills, such as software training.

   NOTE: International travel and International conference participation is not funded under this award.

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 IDP is to help the Fellow 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 NASA program management to review the grant requirements, funding requirements, and to answer questions that they might have. In addition, the call is to better understand the roles and responsibilities of the PI, NASA Fellows, NASA Project Manager, and the NASA Activity Manager.

October – webinar
- Pre-planning for the Center Based Research Experience (CBRE)
  - Fall/Winter phone meeting with the NASA Technical Adviser
  - Summer research plan requirements
  - Answer any additional questions that have arisen
- Mandatory participation is required for MUREP funded Fellows for the SREB conference upon invitation.

November – webinar
- Research Ethics and Integrity
  This session focuses 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.

December – 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 85%? This discussion provides an overview of soft skills and why they are essential to your professional and personal life.


January – webinar
- NASA Onboarding and the CBRE – Review the process for onboarding and the preparation for the CBRE.
- Conference Travel Requirements – Review the process for travel fund requests and expectations from NASA Fellows and the PI’s.
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 is required for each year. (The Annual Renewal Process can be found in Appendix H.)

April – webinar
• Networking for Personal and Professional Development: managing your future in a Social Networking World

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 NASA 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.

November – webinar
• Center Based Research Experience Presentations: In 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, focus 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 (The Annual Renewal Process can be found in Appendix H.)
- Publishing - Getting Started to Getting Done Part 2: This session will provide you with the information about the legal issues related to 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. Fellows are required to submit their summer deliverables to NASA 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 NASA 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 year.
- **Leaders for the Future**: This session will provide information on training in leadership and business communication skills.

**October – webinar**
- 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.

**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 successful techniques 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:
- Plan for STEM Outreach – Giving Back Program: 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 G: Fellowship Travel Funds Procedure

All travel funds shall be used in support of a grant awarded by NASA for the Fellowship program. All steps shall be completed before approval for travel will be given. Travel funds are for domestic travel only. Federal civilian employees and others authorized to travel at the government’s expense must follow the policies defined in the Federal Travel Regulation (FTR). Funds shall ONLY be used for professional purposes. The Travel Request is completed by the PI with the Fellow’s assistance. The NASA Training Grant is awarded to the institution; therefore, NASA does not provide direct support awards to Fellows. The Fellow is expected to work with the PI to understand the norms of performing research for a Federal Government agency and how to manage a budget.

Before Travel:

1. A written statement and request shall be submitted by the Fellow’s PI that includes all the following documents:
   a. Fellow’s Name
   b. Fellow’s Institution
   c. Grant Number
   d. Principal Investigator
   e. NASA Technical Adviser/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
      - If the Fellow 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 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) and Public Release of Scientific and Technical Information (STI) review must be completed with the assistance of the NASA Technical Adviser:
   a. If the presentation, research paper, and or poster does not require an ITAR review, an email from the NASA Technical Adviser shall be submitted with the request.
   b. If the NASA Technical Adviser 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.
   c. More information on STI and ITAR can be found via; NASA Grant and Cooperative Agreement Manual
4. Submit approval documents to Fellowship Program Management.
5. Fellows must show at least 12 months of work conducted under this research award in order to be eligible for travel reimbursements.
After Travel:

1. The Fellow shall complete a **Travel Follow-up Report** within two weeks of the end of travel. The report shall include all of the following:
   
   A. Fellow and Development Opportunity or Conference Information:
      
      1) Fellow’s Name
      2) Fellow’s Institution
      3) Grant Number
      4) Principal Investigator
      5) NASA Technical Adviser/Mentor’s Name
      6) NASA Center
      7) Development Opportunity or Conference Title
      8) Venue
      9) Dates attended
   
   B. If the Fellow 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
Appendix H: Annual Renewal Process

NASA Fellowship Activity awards are made initially for a one-year period of performance and may be renewed for an additional three years for doctoral Fellows and up to two years for all other graduate students contingent upon satisfactory progress, as reflected in the academic performance, research progress, recommendation by the faculty adviser, NASA Technical Adviser and the availability of funds. Fellows seeking renewal shall submit a Renewals Application Package to fellowship management and the grant management (NSCC) for each Academic Year. The Renewals Application Package includes the Annual Progress Report that is 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 Application Package is required before the Program Grants Officer can release funding for additional years. The responsible parties for submitting the documentation for renewals are the Fellow and the Faculty PI to fellowship management.

Annual Progress Report for Renewal:

The NASA Grant and Cooperative Agreement Manual (GCAM) - Exhibit E, identifies the publications and reports required for submission. Technical Publications and Reports should be submitted in accordance with the terms and conditions at 2 CFR 1800.902.

Grant recipients must comply with 2 CFR 180.335 and 2 CFR 180.350 of the reporting requirements. In addition to the annual progress report, the recipients are also required to submit quarterly and final Federal Financial Reports (SF-425s) per the award terms and conditions (see NASA Grants and Cooperative Agreement Manual, Appendix D, Section D6, pg. 59) via the HHS Payment Management System.

NOTE: Any changes in academic status should be reported and submitted with your renewal application.

It is the PI’s responsibility to ensure all documents are submitted prior to 5pm ET on June 30 of each fiscal year. Failure to meet this deadline will result in non-renewal of the NASA Fellowship.

The Annual Progress Package includes all the following:

- Annual Progress Report (template will be provided)
- Certification of Compliance: (PDF Form NF1206) completed by AOR (Not required if Certificate of Compliance has been completed at the time of proposal application submission.)
- Budget Report
- Faculty Adviser Evaluation form
- NASA Technical Adviser Evaluation form

1. Annual Progress Report shall include all the following (template will be provided):
   a. NASA Grant Number;
   b. Project Title;
   c. Institution Name;
   d. Principal Investigator Name;
   e. Fellow Name;
   f. NASA T. A Name;
   g. Period of Performance covered by the report;
   h. Report Date;
i. Program Year.

2. **Annual Progress Report** shall include all the following details:
   a. Accomplishments: Start by reminding us what were your (the Fellow’s) major academic goals and objectives for the academic year and what you did to achieve those goals. For example, mention participation in any educational activities or programs outside classes, describe major activities, projects or research completed or attendance of any conferences or academic/professional meetings.
   b. Resolutions: Did you have goals and objectives that were difficult to meet or not met? How did you resolve the problem or attempt to resolve the problem?
   c. Results: How have the results been disseminated? For example, include a list of publications that have appeared as a result of the award.
   d. Future plans: What are you planning to do next in order to develop academically professionally? Be sure to include:
      i. An updated schedule for completing the degree program;
      ii. Professional development plans for the upcoming year, such as conferences; and
      iii. The budget proposal for next year.

3. **Itemized Estimated Fellowship Budget:**
   The goal of the Estimated Fellowship Budget is to ensure that all funding is spent yearly and that no funds remain on the NASA Training Grants at the end of the performance period.
   a. A budget is a blueprint for spending the project’s funds. An effective proposal budget outlines the proposed project in fiscal terms and helps reviewers to determine how the project will be conducted.
   b. The budget plan shall depict how all the funds will be utilized within the yearly period of performance.
   c. The proposed budget shall provide an accurate assessment of all cost items and cost amounts that are deemed necessary and reasonable. It also shall be complete and within the program’s allowances; that is, it shall include all the costs of any personnel, supplies, and activities required by the project.
   d. All budgeted items shall be fully justified.

4. Faculty Adviser Evaluation Form (evaluation form will be provided).
5. NASA Technical Adviser Evaluation Form (evaluation form will be provided).

**The Annual Progress Package Checklist:**

- Annual Progress Report (template will be provided)
- Certification of Compliance: (PDF Form NF1206) completed by AOR (Not required if Certificate of Compliance has been completed at the time of proposal application submission.)
- Budget Report
- Faculty Adviser Evaluation form
- NASA Technical Adviser Evaluation form

Annual Progress Package must be sent to the following email address: Fellowships@mail.nasa.gov
Appendix I: Additional Year Extension Process

Fellows are invited to apply for an additional year of extension during their final year of the period of performance, pending availability of funds. For Doctoral Fellows, the additional year extension is an opportunity to ask creative questions related to research from the previous years. It is intended to provide teams with the chance to apply their findings in new settings or build upon discoveries not previously outlined in the original proposal. For Master’s Fellows, the additional year extension is an opportunity to receive consideration for a revised proposal that describes specific differences from the original proposal.

NOTE:
Extension proposals based significantly on the need for more time to complete the initially-proposed work or the Fellow’s graduation date will not be considered and returned without review.

In order to be considered for this extension, the following shall be submitted to the Office of STEM Engagement:

Project Description: This proposal section shall be titled “Project Description” and shall not exceed six single-spaced pages (using a 12-point font with at least 1” margins on all sides). The Project Description shall provide a clear description of the Fellow’s intended research. The Project Description shall begin with a brief abstract summarizing the scientific problem to be addressed, the proposed science plan, the Fellow’s methodology, and expected results. The Project Description follows the order below and shall contain all 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
4. Project Schedule / Timeline (state specific targeted, identifiable goals that will be accomplished in the one year period of extension)
5. Explanation of new or novel techniques
6. Expected results and their significance or application
7. Literature citations, where appropriate

Itemized Estimated Fellowship Budget: The goal of the Estimated Fellowship Budget is to ensure that all funding is spent yearly and that no funds are remaining on the NASA Training Grant at the end of the period of performance.

- A budget is a blueprint for spending the project’s funds. An effective proposal budget outlines the proposed project in fiscal terms and helps reviewers to determine how the project will be conducted.
- The budget plan shall depict how all the funds will be utilized within the yearly period of performance.
- The proposed budget shall provide an accurate assessment of all cost items and cost amounts that are deemed necessary and reasonable. It also shall be complete and within the program’s allowances; that is, it should include all the costs of any personnel, supplies, and activities required by the project.
- All budgeted items shall be fully justified.

Impact: To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
**Letter of Continued Support:** The NASA Center to be utilized as part of the extension effort shall provide a letter stating its support with the extension of research and its willingness to continue serving as a NASA Technical Adviser. To ensure there is no conflict of interest, a letter of support shall be included from a second NASA civil servant who is familiar with the research proposal.

**Letter of Recommendation:** The NASA Center to be utilized as part of the extension effort shall provide a letter stating its recommendation with the extension of research. A NASA civil servant shall address in the letter whether the extension is aligned to NASA’s mission and extends the Agency’s current research.

**Evaluation:** Proposals for extensions will be peer-reviewed by the subject matter experts.

**NOTE:**

1. Non-thesis Master’s program is not eligible for an extension.
2. If the Fellow is enrolled in a 3-year Master’s program, please provide proof or documentation that supports the 3-year degree program structure.
Appendix J: Allowances Explained

**Fellowship Stipend:** A stipend offsets the Fellow’s living expenses. Stipend payments shall be prorated evenly across a ten-month academic school year.

**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 institution shall exempt the student from paying the difference between the tuition and fees allowance and the actual tuition and fees.

**Center Based Research Experience (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 shall be released within a month of the planned CBRE, and the last payment shall 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 shall require receipts for all travel-related expenses to the organization’s project manager.

**Health Insurance Allowance:** Permissible up to a maximum value, only to the level of the actual expected cost.

**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.

**Fellow Professional Development Allowance:** This allowance may be used in direct support of training, attending technical and scientific conferences, and publication needs of the Fellow. This allowance may be used in concurrence with the Faculty Adviser Allowance to cover the Fellow’s approved domestic travel to technical and scientific meetings. Each Fellow shall 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. Conferences are to be attended after the first year of the training grant. Fellows presenting their research papers at the conference shall have advanced written approval from their NASA Technical Advisers and NASA’s export control office.

Allowable expense details for attending professional research, conferences, symposiums, and workshops:

a) Registration Fees
b) Accommodation - maximum three nights in a fire safe hotel* per event (per diem 3 full days and two ½ days)
c) Travel costs to and from event
d) Publication costs for conference presentation materials, related research papers, thesis, and dissertation
e) Training for professional required skills such as software training, etc.


NASA funds may not be used to purchase equipment such as computers, furniture and non-related research equipment.

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

Pre-award costs are not allowable.

Tax questions should be directed to the Internal Revenue Service. Refer to IRS publications on “Scholarships and Fellowships.” (http://www.irs.gov/)
Appendix K: Process for Appeals to Formal Requests for Reconsideration

This NRA is limited to the awarding of grants and cooperative agreements to Minority Serving Institutions (MSIs). Accordingly, the appeals and reconsideration processes under this NRA do not include protest rights either at the U.S. Government Accountability Office (GAO) or with the Agency, as defined in FAR 33.101. The provisions at 48 FAR 52.233-2 (“Service of Protest”) and NFS 1852.233-70 (“Protests to NASA”) do not apply to this NRA.

A Principal Investigator (PI) who is not satisfied with the explanation of the basis for the declination of its proposal may contact the Selecting Official, in writing (delivered via e-mail, fax or regular mail) stating the reasons for requesting reconsideration of the declination and requesting a written or oral debriefing (see Formal Request for Reconsideration, below).

Formal Requests for Reconsideration

(a) Debriefing by the NASA Project Manager

A PI whose proposal has not been selected may request a written or oral debriefing from the NASA Project Manager. The debriefing will be provided expeditiously, i.e., usually within two weeks.

(b) Written Request for Reconsideration to Selecting Official

Following the debriefing, dissatisfied PIs shall, within 30 calendar days of the debriefing, submit in writing a Request for Reconsideration to the Selecting Official. If no debriefing has been conducted, the Request for Reconsideration shall be submitted within 60 calendar days of notification that the proposal had not been selected. The Selecting Official will respond in writing to the Request for Reconsideration within 30 calendar days of receipt of the request. If additional time is required to prepare a response, an explanation of the need for more time will be provided to the PI within 30 calendar days. Following a response from the Selecting Official, if the PI is still not satisfied with the Selecting Official’s decision, the PI may request a formal reconsideration within 30 days of the Selecting Official’s decision. Electronic or faxed requests for formal reconsiderations will not be accepted. Formal requests shall only be submitted through the United States Postal Service (USPS) and shall: 1) detail the reasons for the reconsideration request; 2) be printed on institutional letterhead; 3) be co-signed by the PI and the AOR; and 4) be addressed to the Deputy Associate Administrator for STEM Engagement, NASA Headquarters, Washington, DC 20546 Telephone: 202-358-0103.

(c) Appeals above the Deputy Associate Administrator for STEM Engagement

Appeals above the Deputy Associate Administrator for STEM Engagement shall be made within 30 calendar days of receipt of that decision. The written appeal shall be submitted to the Associate Administrator for STEM Engagement. A response to the appeal should be provided to the PI within 30 calendar days.