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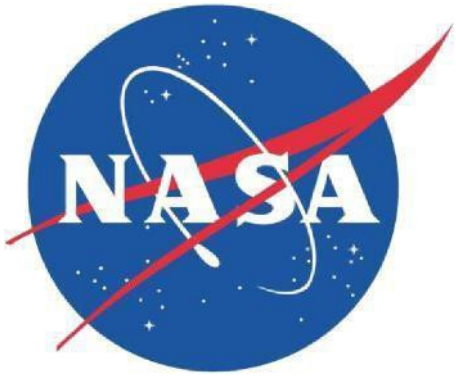

National Aeronautics and Space Administration
Office of STEM Engagement
FY 2022 NASA Notice of Funding Opportunity (NOFO)

Established Program to Stimulate Competitive Research (EPSCoR)

Suborbital Flight Opportunity (SFO) Announcement

Announcement Number: NNH22ZHA002C
Catalog of Federal Domestic Assistance (CFDA) Number: 43.008

Release Date:	January 15, 2022
Proposal Due Date:	April 15, 2022

NASA Headquarters Office of STEM Engagement
Washington, DC 20546-0001

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Introduction

NASA's Office of STEM Engagement (OSTEM), in collaboration with the NASA Space Technology Mission Directorate (STMD) Flight Opportunities (FO) program, solicits proposals for the fiscal year 2022 NASA Established Program to Stimulate Competitive Research (EPSCoR) program. This solicitation is for current or previously funded EPSCoR projects or other research projects that are mature enough to design a research experiment or develop research experimental hardware to the point that it can be flown in a suborbital environment.

Suborbital flight can be used as a maturation step from ground-based research to downstream orbital flight research/demonstration or can be used for scientific research that can be accomplished in suborbital flight. Proposals shall state how suborbital flight will influence/mature the results/quality of any prior ground-based research or technology development and will provide insight into how the suborbital flight fits into a larger scientific research or space technology development context, as applicable.

Collaboration between EPSCoR and the STMD FO program will strengthen relationships between the respective communities and build experience and know-how in the EPSCoR community on the availability, usability, and value of U.S.-based commercial suborbital flight services. The partnership will engage the EPSCoR community with commercial suborbital flight providers, as well as open new paths for the jurisdictions to compete for and win larger spaceflight research projects.

Each funded NASA EPSCoR proposal is expected to establish research activities that will make significant contributions to NASA's strategic research and technology development priorities and contribute to the overall research infrastructure, science and technology capabilities of higher education, and economic development of the jurisdiction receiving funding. See NASA Strategic Plan: https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf

NASA will assign a Technical Monitor (TM) to each award. The TM will monitor the progress of the research and collaborate as required to keep the research aligned with the approved project. The awardee will provide annual reports regarding the progress of the research; each report will be reviewed by the TM and approved by the NASA EPSCoR Project Manager. These reports will be shared with the NASA Space Technology Mission Directorate (STMD) FO program.

The program parameters are:

- Jurisdictions responding to this Notice of Funding Opportunity (NOFO) may submit one proposal in accordance with paragraph 2.0 of this NOFO, NASA EPSCoR Eligibility and Proposal Acceptance. Proposals will be selected from this solicitation for FY 2022 funding.
- The maximum research funding request per proposal is $250,000. This amount is to be expended over a three-year period for performance.
- Flight costs, including facilities and administrative (F&A) costs on the flight provider quote, are delimited by the maximum number of allowable flights.
- Cost-sharing by proposers to this NOFO is not required. While proposers may

offer cost-sharing on a voluntary basis, NASA will not give any extra evaluation credit if a proposal includes cost-sharing.

- All proposals shall be submitted through the jurisdiction's NASA EPSCoR Director's office. However, only one proposal per jurisdiction may be submitted to NASA for consideration.
- It is anticipated that four (4) awards of up to $250,000 each for research plus costs for flight services and associated F&A to be expended over a three-year period of performance may be made under this NOFO.
- Awards will be in accordance with regulatory guidance found at Title 2 Code of Federal Regulations (CFR) Part 200, Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards, as adopted and supplemented by NASA through Title 2 CFR Part 1800: Federal Agency Regulations for Grants and Agreements – NASA, and the NASA Grant and Cooperative Agreement Manual (GCAM), Appendix E. The exact number of awards depends on the available NASA EPSCoR Budget.
- The Government's obligation to make an award is contingent upon the availability of appropriated funds from which payment can be made.

The NASA Authorization Act for Fiscal Year 1993, Public Law 102-588, and its Reauthorization Act of 2017 (Public Law 114-329 Section 103), authorizes NASA to initiate NASA EPSCoR to strengthen the research capability of jurisdictions that have not historically participated equably in competitive aerospace research activities. The goal of NASA EPSCoR is to provide funding that will enable jurisdictions to develop a research enterprise directed toward long-term, self-sustaining, nationally competitive capabilities in aerospace and aerospace-related research. This capability will, in turn, contribute to the jurisdiction's economic viability and expand the nation's base for aerospace research and development.

The following are the specific objectives of NASA EPSCoR:

- Contribute to and promote the development of research capability in NASA EPSCoR jurisdictions in areas of strategic importance to the NASA mission
- Improve the capabilities of the NASA EPSCoR jurisdictions to gain support from sources outside the NASA EPSCoR program
- Develop partnerships among NASA research assets, academic institutions, and industry; and
- Contribute to the overall research infrastructure and economic development of the jurisdiction.

Based on the availability of funding, NASA will continue to help jurisdictions achieve these goals through NASA EPSCoR. Funded jurisdictions' proposals shall be selected through a merit-based, peer-review competition. Proposals accepted by the NASA EPSCoR Project Office will first be evaluated by STMD/FO representatives/ Subject Matter Experts for proposed flight provider eligibility and flight feasibility. Next, all evaluated proposals will be presented to a Mission Directorate review panel for funding recommendations.

Solicitation Availability
This NOFO is accessible for a period of three (3) years through NSPIRES and through Grants.gov but will close on the proposal due date and no proposals will be accepted after that date. To access this announcement through NSPIRES, go to http://nspires.nasaprs.com and click on Solicitations. For Grants.gov, go to https://www.grants.gov/web/grants/search-grants.html and select the link for NASA under Agency.

Eligibility
While proposals can be accepted only from institutions where a NASA EPSCoR Jurisdiction Director is currently serving, all institutions associated with higher education within the jurisdiction shall be made aware of this NOFO and given the opportunity to submit a proposal to the NASA EPSCoR Jurisdiction Director for competition for submission to NASA. Only one proposal from each jurisdiction may be submitted to NASA.

As stated in NASA EPSCoR legislation, jurisdictions eligible to compete for this opportunity are those jurisdictions eligible to compete in the National Science Foundation (NSF) EPSCoR Research Infrastructure Improvement Grant Program (RII). A jurisdiction is eligible to participate in NSF EPSCoR if their most recent 5-year level of total NSF funding is equal to or less than 0.75% of the total NSF budget; this excludes EPSCoR funding and NSF funding to other federal agencies. The most recent eligibility table is located at:
https://www.nsf.gov/od/oia/programs/epscor/Eligibility_Tables/FY2021_Eligibility.pdf

Proposals will be accepted from the resident institution of the NASA EPSCoR Jurisdiction Director in each jurisdiction. The 28 jurisdictions that are eligible to propose for the opportunity in this NOFO are: Alabama, Alaska, Arkansas, Delaware, Guam, Hawaii, Idaho, Iowa, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, Puerto Rico, Rhode Island, South Carolina, South Dakota, US Virgin Islands, Vermont, West Virginia, and Wyoming.

Availability of Funds and Period of Performance
NASA's ability to make awards is contingent upon the availability of appropriated funds from which payment can be made.

The estimated funding and number of proposals anticipated to be funded, as shown in this NOFO under the Introduction, are subject to the availability of appropriated funds, as well as the submission of a sufficient number of proposals of adequate merit.

NASA EPSCoR awards will support a three-year cooperative agreement. It is anticipated that this period of performance will enable the researchers to achieve the performance task objectives stated in the original proposal and/or any amendments submitted with annual progress reports and accepted by the NASA EPSCoR project office.

It is anticipated that approximately (4) awards of up to $250,000 for the science/technical effort plus costs for flight services and associated F&A each with a period of performance not to exceed three years each may be made under this NOFO pursuant to the authority of 2 CFR Part 200, 2 CFR Part 1800, and the NASA GCAM. The proposer's organization will directly purchase the proposed flight(s) on a currently available U.S. commercial vehicle. The proposer is limited to using one (1) flight provider in one (1) vehicle class. The associated maximum

number of allowed flights for each vehicle is detailed in Section 1.3. The proposer is responsible for choosing a vehicle which best meets their needs. However, the proposal shall only utilize vehicles whose providers have conclusively demonstrated successful flight(s) – test flights or commercial flights that were launched and recovered successfully with payload intact and have achieved the minimum flight capabilities.

The period of performance (start and end dates) are not fixed values, and are requested by the jurisdiction. The official period of performance (start and end dates) are set forth in the award document issued by the NASA Shared Services Center (NSSC).

Proposal Submission

All information needed to respond to this solicitation is contained in this announcement and in the *Guidebook for Proposers Responding to a NASA Notice of Funding Opportunity (NOFO) effective April 28, 2021 Edition* (NASA Guidebook for Proposers). The latest PDF version is available at: https://www.nasa.gov/offices/ocfo/gpc/regulations_and_guidance

Proposers are cautioned that only the Grants Officer at the NSSC has the authority to make commitments, obligations, or awards on behalf of NASA or authorize the expenditure of cooperative agreement funds. No commitment on the part of NASA should be inferred from technical or budgetary discussions with NASA managers, Mission Directorate employees, or any other NASA support staff. An organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by a NASA NSSC Grants Officer does so at its own risk.

Inquiries

Inquiries regarding the submission of electronic proposal materials to NSPIRES should be addressed to:

NASA Research and Education Support Services (NRESS)
Althia Harris
2345 Crystal Drive, Suite 500
Arlington, VA 22202-4816
Telephone: (202) 479-9030 x310
E-mail: aharris@nasaprs.com

Technical and scientific questions about programs in this NOFO may be directed to:

EPSCoR
Dr. Mitch Krell
Deputy Project Manager, NASA EPSCoR
Stennis Space Center, MS 39529
Telephone: (228) 688-1821
Cell Phone: (228) 342-7462
E-mail: mitch.krell@nasa.gov

STMD Flight Opportunities Program (FO)
Alexander van Dijk
Technologist, Flight Opportunities Program
Ames Research Center, CA 94035
Phone: (650) 604-1641
E-Mail: alexander.vandijk@nasa.gov

1.0 Description of Opportunity

1.1 NASA EPSCoR Program and Project Levels

The NASA EPSCoR is a component of the OSTEM at NASA Headquarters. NASA EPSCoR Program Management is closely coordinated with NASA Headquarters Mission Directorates, NASA Centers, and JPL. The NASA EPSCoR Project Office is located at the Kennedy Space Center (KSC). This Project Office has the overall responsibility for oversight, evaluation, and reporting. Technical and scientific questions about programs in this solicitation may be directed to the NASA Deputy EPSCoR Project Manager.

NASA's Space Technology Mission Directorate's (STMD) mission is to address key research and technology challenges that will advance revolutionary capabilities for both NASA exploration mission challenges and national needs, as well as address the market challenges associated with providing state-of-the-art commercial space products and services. STMD's focus is on missions beyond low Earth orbit that would enable the return of humans to the Moon for long-term exploration and utilization, followed by human missions to Mars and other destinations. STMD innovates, develops, demonstrates, and infuses revolutionary, high- payoff technologies through transparent, collaborative partnerships, expanding the boundaries of the aerospace enterprise. STMD employs a merit-based competition model with a portfolio approach, spanning a range of discipline areas and technology and market readiness levels. More information about NASA STMD can be found at: http://www.nasa.gov/spacetech

Flight Opportunities rapidly demonstrates promising technologies for space exploration, discovery, and the expansion of space commerce through suborbital testing with industry flight providers. The program matures capabilities needed for NASA missions and commercial applications while strategically investing in the growth of the U.S. commercial spaceflight industry. More information about the Flight Opportunities program can be found at: https://www.nasa.gov/flightopportunities; Selected technologies: https://flightopportunities.nasa.gov/technologies; Newsletter: http://go.usa.gov/xNfkw;
and Flight campaign photos: https://www.flickr.com/photos/nasafo/albums

Jurisdiction Level

The NASA EPSCoR Jurisdiction Director will serve as the managing Principal Investigator (PI) for the award, providing leadership and administrative direction for the team from an oversight role. The submitting and awardee institution will be that of the NASA EPSCoR Jurisdiction Director. The Director is responsible for oversight and overall administrative management of the project to assure compliance with NASA EPSCoR. The Director is responsible for ensuring the timely reporting of the team's progress and accomplishment of its work.

The investigator who will be responsible for the scientific direction, day-to-day management of the proposed work and flight provider interface shall be listed as the Science-I (Sc-I). If the Sc-I's institution is different from the submitting institution, awards may be made to the Sc-I's institution through a subaward from the award recipient/institution.

The Government's obligation to continue any award is based on satisfactory progress as detailed in the recipient's required annual progress reports. The research proposal may include an approved

indirect cost rate if one has been negotiated with the Federal cognizant agency for funding of management, administrative, and oversight function of the NASA EPSCoR Jurisdiction Director. For NASA to accept less than the approved indirect cost rate, a deviation is required. If a deviation is needed, the submitter shall include its proposed indirect cost amount as part of the award cap.

The NASA EPSCoR Jurisdiction Director shall provide guidance and updates to the Sc-Is regarding NASA policy and direction from both an Agency technical perspective and from a NASA EPSCoR programmatic standpoint. The Director shall maintain an awareness of NASA research and technology development priorities and jurisdiction research priorities. As the primary point of contact for NASA regarding EPSCoR in the jurisdiction, the Director will identify and develop opportunities for collaboration within the jurisdiction with existing EPSCoR and EPSCoR-like programs from other federal agencies. Also, the NASA EPSCoR Jurisdiction Director will consult with appropriate jurisdiction organizations, such as the economic development commission, in addressing the jurisdiction's research priorities.

1.2 Program Description

The NASA Authorization Act for Fiscal Year 1993, Public Law 102-588 and the Reauthorization Act of 2017 (Public Law 114-329 Section 103), authorized NASA to initiate NASA EPSCoR to strengthen the research capability of jurisdictions that have not historically participated equably in competitive aerospace research activities. The goal of NASA EPSCoR is to provide seed funding that will enable jurisdictions to develop an academic research enterprise directed toward long-term, self-sustaining, nationally competitive capabilities in aerospace and aerospace-related research. This capability will, in turn, contribute to the jurisdiction's economic viability and expand the nation's base for aerospace research and development. NASA EPSCoR is administered through NASA's OSTEM.

Each NASA EPSCoR project shall perform scientific and/or technical research in a suborbital environment that supports NASA's strategic research and technology development priorities. NASA will assign a Technical Monitor (TM) to each award. The TM will monitor the progress of the research and collaborate as required to keep the research aligned with the approved project's objective(s). Each awardee shall provide an annual report on the progress of the research, documenting expected performance goals, indicators, targets, baseline data, data collection, and other outcomes. These reports will be reviewed by the TM and approved by the NASA EPSCoR Project Manager and will be shared with the STMD Flight Opportunities (FO) program.

The program parameters are:

- While proposals can be accepted only from institutions where a NASA EPSCoR Jurisdiction Director is currently serving, all institutions of higher education within the jurisdiction shall be made aware of this NOFO and given the opportunity to submit a proposal to the NASA EPSCoR Jurisdiction Director for competition for submission to NASA. However, only one proposal per jurisdiction will be accepted.
- The maximum funding request per proposal is $250,000 plus costs associated with flight services and facilities and administrative (F&A) costs. This amount is to be expended over a three-year period.
- Cost-sharing by proposers is not required. While proposers may offer cost-

sharing on a voluntary basis, NASA will not give any extra evaluation credit if a proposal includes cost-sharing.

- It is anticipated that four (4) awards may be made under this NOFO in accordance with regulatory guidance found at Title 2 CFR Part 200, Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards, as adopted and supplemented by NASA through Title 2 CFR Part 1800: Federal Agency Regulations for Grants and Agreements – NASA, and the NASA GCAM.
- The Government's obligation to make an award is contingent upon the availability of appropriated funds from which payment can be made.
- This NOFO is available in electronic form through the NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) and Grants.gov. However, all proposals shall be submitted through NSPIRES.
- Pre-award costs are those incurred prior to the effective date of an award directly pursuant to the negotiation and in anticipation of the award where such costs are necessary for efficient and timely performance of the scope of work. Such costs are not allowed under this solicitation.

To access this announcement through NSPIRES, go to http://nspires.nasaprs.com and click on Solicitations. For Grants.gov, go to https://www.grants.gov/web/grants/search-grants.html and select the link for NASA under Agency.

1.3 Eligible Flight Providers & Maximum Allowable Number of Flights

The proposer will directly purchase the proposed flight(s) on a currently available U.S. commercial vehicle. The proposer is responsible for choosing which vehicle best meets their needs. *The proposer is not restricted to flight providers previously funded by the Flight Opportunities program*. However, the proposal shall only utilize vehicles whose providers have conclusively demonstrated successful flight(s) – test flights or commercial flights that were launched and recovered successfully with payload intact and have achieved the minimum flight capabilities as described in the table below.

The proposer is limited to proposing to use one (1) flight provider in one (1) vehicle class. For Suborbital Rockets, Rocket-Powered Lander Vehicles, and High-Altitude Balloons, the maximum number of allowable flights is one (1). For aircraft following reduced-gravity flight profiles, up to four (4) flights (one flight is one take-off/landing) may be proposed, to be performed within the proposed project duration. Human-tended flights other than for aircraft following reduced-gravity flight profiles are not allowed to be proposed and will be rejected under this solicitation.

Table 1 Minimum Demonstrated Flight Capabilities of Eligible Vehicle Classes. Note: Proposals may include flights to lower altitudes, however, the minimum demonstrated flight capability requirements for the vehicle are still applicable.

Vehicle Class	Sub Class	Minimum Demonstrated Flight Capabilities	Allowable Flights

Rocket-Powered Vehicles	Suborbital Rocket	Minimum altitude of 80 km above Mean Sea Level (MSL)	1
	Rocket-Powered Lander Vehicle	Controlled descent and controlled vertical landing of a free-flying vehicle using a propulsion system of a class that can operate in a vacuum	1*
High-Altitude Balloons		Minimum altitude of 30 km above MSL	1
Aircraft Following Reduced-Gravity Flight Profiles		No minimum requirement	Up to 4

* For Rocket-Powered Lander Vehicles, one flight may include precursor shakedown/tethered testing.

NASA holds no safety responsibility for suborbital flights conducted in response to this NOFO. All flights will be regulated by the Federal Aviation Administration (FAA). An award recipient's institution and the flight service provider are responsible for meeting all applicable local, state, and federal regulations. In the event of an in-flight anomaly, the Flight Opportunities program considers all payloads being flown under this solicitation as expendable. If human or other living test subjects are involved in the research, the proposer's institutional review board and the flight providers are responsible for meeting all applicable research requirements. The Flight Opportunities program is unable to provide a list of currently available flight providers. Historical flight providers can be found using the following link; however, proposers are not restricted to using these flight providers. https://www.nasa.gov/directorates/spacetech/flightopportunities/flightproviders

1.4 Award Information and Restrictions

Awards from this NOFO 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.

Proposals submitted in response to this NOFO shall 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 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 of the NSPIRES application document includes a questionnaire to determine whether a specific proposal falls within the Grants REC and must be completed as part of the NOFO 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.

Per the *NASA Guidebook for Proposers, Title 2 CFR* Parts *200 and 1800*, and the NASA GCAM, the following restrictions govern the use of the NASA-provided EPSCoR funds and are applicable to this NOFO:

- Funds shall not be used to fund research carried out by non-U.S. institutions. However, U.S. research award recipients may directly purchase supplies and/or services that do not constitute research from non-U.S. sources. Subject to export control restrictions, a foreign national may receive remuneration through a NASA award for the conduct of research while employed either full- or part-time by a U.S. institution. For additional guidance on foreign participation, see Section 3.2 of the *NASA Guidebook for Proposers* and the NASA FAR Supplement (NFS) part 1835.016-70.
- Travel, including foreign travel, is allowed for the meaningful completion of the proposed investigation, as well as for reporting results at appropriate professional meetings. Foreign travel to meetings and conferences in support of the jurisdiction's NASA EPSCoR research project is an acceptable use of NASA EPSCoR funds, with a limit of $3,000 per trip for up to two (2) separate years of a jurisdiction's proposal (i.e., the maximum amount the jurisdiction can request for foreign travel is $3,000 total in any one year and a limit of $6,000 total for each research proposal). NASA EPSCoR support shall be acknowledged by the NASA EPSCoR research project number in written reports and publications.
- Domestic travel, defined as travel that does not require a passport, does not have a funding limit and shall be appropriate and reasonable to conduct the proposed research.
- NASA EPSCoR funding shall not be used to purchase general purpose equipment (e.g. desktop workstations, office furnishings, reproduction and printing equipment) as a direct charge. Special purpose equipment purchases (i.e., equipment that is used only for research, scientific, and technical activities directly related to the proposed research activities) are allowed and can be reflected as a direct charge as per cost principles cited in the GCAM Appendix D, Equipment and Other Property. Per 2 CFR 200.439, special purchase equipment items with a unit cost of $5,000 or more must have the prior written approval of the Federal awarding agency (i.e., the NASA Grants Officer).
- NASA EPSCoR funding shall not be used to support NASA civil service participation (i.e., full time equivalents (FTEs)) in a research project. That funding is provided through a funding vehicle between the jurisdiction and NASA Center, such as a Space Act Agreement or another reimbursable agreement. NASA EPSCoR may set aside funding from an award to send to a Center for contractor support (including travel) and/or services as identified by the proposer.
- NASA EPSCoR funds shall be expended on NASA EPSCoR institutions. If a Co-Investigator (Sc-I/Co-I) with an NASA EPSCoR award transfers to a non-EPSCoR institution, the EPSCoR funding amount, or the portion of it that remains unobligated at the time of Sc-I/Co-I transfer, shall not be transferred to the non-EPSCoR institution.

- All proposed funds shall be allowable, allocable, and reasonable. Funds may only be used for the NASA EPSCoR project. All activities charged under indirect costs shall be allowed under the cost principles set forth in 2 CFR 200.
- Grants and Cooperative Agreements shall not provide for the payment of fee or profit to the recipient.
- Non-Federal entities/the proposer may use one of the methods of procurement as prescribed in 2 CFR 200.320. As defined in 2 CFR 200.67, the micro-purchase threshold for acquisitions of supplies or services made under grant and cooperative agreement awards issued to institutions of higher education, or related or affiliated nonprofit entities, or to non-profit research organizations or independent research institutes, is $10,000; or such higher threshold as determined appropriate by the head of the relevant executive agency and consistent with audit findings under chapter 75 of Title 31, United States Code, internal institutional risk assessment, or State law.
- Unless as otherwise directed in 2 CFR 200, for changes to the negotiated indirect cost rate that occur throughout the project period, the proposer/recipient shall apply the rate negotiated for that year, regardless of whether it is higher or lower than at the time the budget and application was accepted and awarded.
- Proposals shall not include bilateral participation, collaboration, or coordination with China or any Chinese-owned company or entity, whether funded or performed under a no-exchange-of-funds arrangement.
- This NOFO is not for the purpose of soliciting the renewal or augmentation of funds for existing projects. Only proposals for new projects will be considered.
- Procurement contracts shall not be awarded by NASA in response to this solicitation.

1.5 Access to Research Results

Recipients receiving awards under this NOFO shall comply with the provisions set forth in the NASA Plan for Increasing Access to the Results of Scientific Research (http://www.nasa.gov/sites/default/files/files/NASA_Data_Plan.pdf) including the responsibility for—

- Submitting as approved peer-reviewed manuscripts and metadata to a designate repository: and
- Reporting publications with the annual and final progress reports.

All proposals shall include a Data Management Plan (DMP) or an explanation as to why one is not necessary given the nature of the work proposed. *The DMP shall be submitted by responding to the NSPIRES cover page question about the DMP (limited to 4000 characters)*. Any research project for which a DMP is not necessary shall provide an explanation in the DMP block.

Example explanations:

- *This is a development effort for flight technology that will not generate any data that my entity can release, so a DMP is not necessary*
- *The data that our entity will generate will be ITAR; or*
- *Explain why the proposed project is not going to generate data.*

The proposal type that requires a DMP is described in the *NASA Plan for Increasing Access to Results of Scientific Research* (see above link). The DMP shall contain the following elements, as appropriate to the project:

- A description of data types, volume, formats, and (where relevant) standards
- A description of the schedule for data archiving and sharing
- A description of the intended repositories for archived data, including mechanisms for public access and distribution
- A discussion of how the plan enables long-term preservation of data; and
- A discussion of roles and responsibilities of team members for accomplishing the DMP. (If funds are required for data management activities, these shall be included in the budget and budget justification sections of the proposal.).

Proposers that include a plan to archive data shall allocate suitable time for this task. Unless otherwise stated, this requirement supersedes the data sharing plan included in the *NASA Guidebook for Proposers*.

In addition, as part of an award term and conditions, award recipients submitting NASA-funded articles in peer-reviewed journals or papers from conferences now shall make their work accessible to the public.

1.6 Foreign National Participation

All recipients shall work with NASA project/program staff to ensure proper credentialing for any individuals who need access to NASA facilities and/or systems. Such individuals include U.S. citizens and lawful permanent residents ("green card" holders). Please note that foreign nationals (individuals who are neither U.S. citizens nor permanent residents) are not normally allowed access to NASA facilities. Foreign nationals from "designated" countries or countries designated by the State Department and listed by NASA as being sponsors of terrorism cannot be allowed on any NASA facilities unless they are green card holders. Furthermore, and as stated above, 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, will be ineligible for award.

1.7 Flight Activities

Proposals that include flight activities (not normal passenger travel) such as aircraft or helicopter flight services, including Unmanned Aircraft Systems (UAS)/Drones operations or the acquisition or construction of such flight vehicles, shall comply with NASA Policy Directive 7900.4D. Questions concerning flight compliance requirements may be addressed to Norman Schweizer at norman.s.schweizer@nasa.gov.

2.0 Eligibility

2.1 Jurisdictions Eligible to Apply

While proposals can be accepted only from institutions where a NASA EPSCoR Jurisdiction Director is currently serving, all institutions of higher education within the jurisdiction shall be made aware of this NOFO and given the opportunity to submit a proposal to the NASA EPSCoR

Jurisdiction Director for competition for submission to NASA. Only one proposal per NASA EPSCoR jurisdiction may be submitted to NASA.

As stated in NASA EPSCoR legislation, jurisdictions eligible to compete for this opportunity are those jurisdictions eligible to compete in the NSF EPSCoR Research Infrastructure Improvement Grant Program (RII). NSF eligibility is based on whether the most recent three-year level of NSF research support is equal to or less than 0.75 percent. The most recent eligibility table is located at:

https://www.nsf.gov/od/oia/programs/epscor/Eligibility_Tables/FY2021_Eligibility.pdf

Proposals will be accepted from the resident institution of the NASA EPSCoR Jurisdiction Director in each jurisdiction. The 28 jurisdictions that are eligible to submit proposals for this opportunity are: Alabama, Alaska, Arkansas, Delaware, Guam, Hawaii, Idaho, Iowa, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, Puerto Rico, Rhode Island, South Carolina, South Dakota, US Virgin Islands, Vermont, West Virginia, and Wyoming.

3.0 Proposal Submission Instructions and Due Date/Time

All proposals in response to this announcement shall be submitted electronically via NSPIRES (http://nspires.nasaprs.com). Hard copies of the proposal will not be accepted. Electronic proposals shall be submitted in their entirety by 11:59 p.m., Eastern Time on the proposal due date of **April 15, 2022.**

Respondents without Internet access or that experience difficulty using the NSPIRES proposal site (http://nspires.nasaprs.com) may contact the Help Desk at nspires-help@nasaprs.com or call 202-479-9376 between 8:00 a.m. and 6:00 p.m. (ET), Monday through Friday, except Federal holidays. NSPIRES automatically identifies any proposals that are late. Proposals received after the due date may be returned without review. If a late proposal is returned, it is entirely at the proposer's discretion whether or not to resubmit it in response to a subsequent solicitation.

Please carefully note the following requirements for submission of an electronic proposal via NSPIRES:

- Every organization intending to submit a proposal to NASA in response to this NOFO shall be registered in NSPIRES. Registration for the proposal data system shall be performed by an organization's electronic business point-of-contact (EBPOC) who holds a valid registration with the System for Award Management (SAM) at https://sam.gov/content/home.

- Each individual team member (e.g., PI, co-investigators), including all personnel named on the proposal's electronic cover page, shall be individually registered in NSPIRES.

While every effort is made to ensure the reliability and accessibility of the NSPIRES web site and to maintain a help center via e-mail and telephone, difficulty may arise at any point on the Internet, including with the user's own equipment. Prospective proposers are strongly urged to

familiarize themselves with NSPIRES and to submit the required proposal materials well in advance of the proposal submission deadline. Difficulty in registering with or using NSPIRES is not, in and of itself, a sufficient reason for NASA to consider a proposal that is submitted after the proposal due date.

3.1. Proposal Preparation

Required elements of the proposal are described below and shall be submitted as one or more PDF documents that are uploaded for proposal submission. In the *NASA Guidebook for Proposers*, please refer to Section 3.6 (provides guidelines for style formats) and Section 3.7 (provides guidelines for proposal content). NASA is implementing a process to collect demographic data from grant applicants for the purpose of analyzing demographic differences associated with its award processes. Submission of the requested information on NASA Form 1839 is voluntary and will not affect the organization's eligibility for an award. Any individual who does not want to submit some or all of the information shall check the box provided for this purpose.

Table 2. Required elements of the proposal

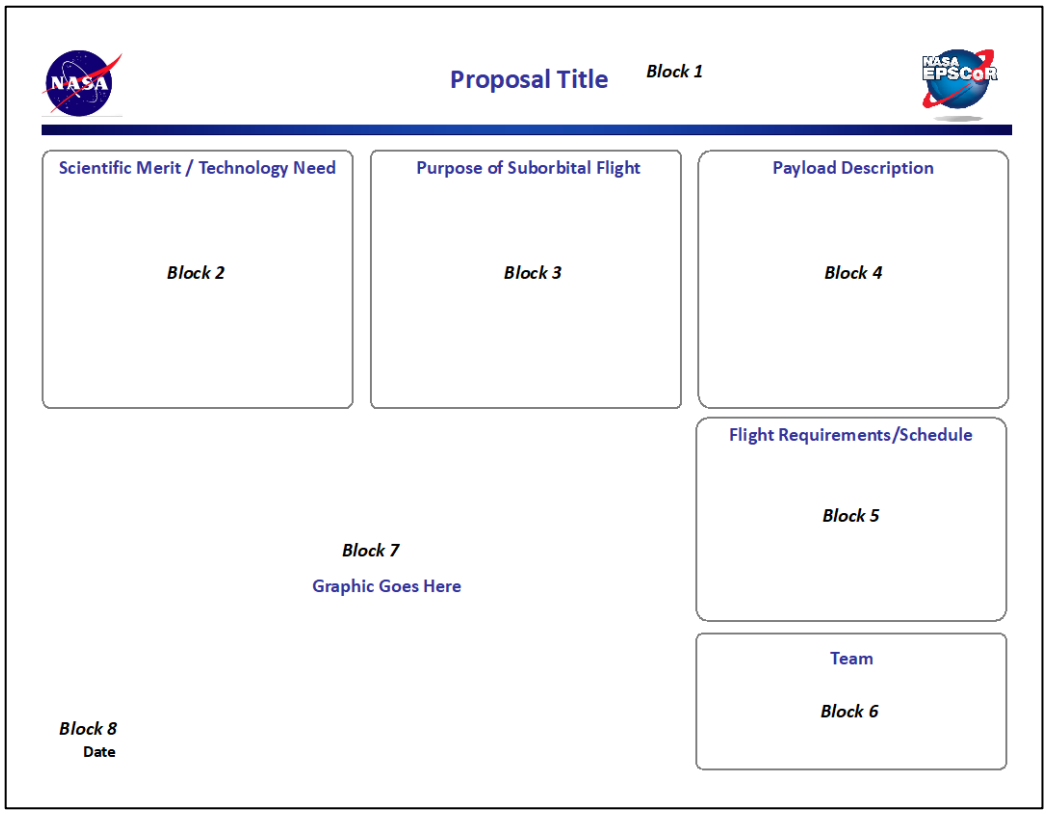
REQUIRED SECTIONS OF THE PROPOSAL (in order of assembly/presentation)	**PAGE LIMIT**
Proposal Cover Page	NSPIRES proposal cover page that is available at http://nspires.nasaprs.com/
Proposal Summary (abstract)	4,000 characters including spaces
Data Management Plan	4,000 characters, including spaces
Table of Contents	As needed
Summary Chart	1
Scientific/Technical/Management/Flight Plan	15*
References and Citations	As needed
Biographical Sketches for:	
the Principle Investigator (P-I)	2
the Science Investigator (Sc-I)	2
each Co-Investigator (Co-I)	1
Current and Pending Support	As needed
Statements of Commitment and Letters of Support	As needed
Budget Justification: Narrative and Details	As needed
• *Includes proposed budget, itemized list detailing expenses within major budget categories, detailed subawards and summary of personnel (User's Guide section 3.18 and Appendix C).*	
• *For grants/cooperative agreements, the table of personnel and work effort shall immediately follow the proposal budget and is not included in the budget.*	
Flight Provider Quote, Cost, and Schedule	As needed
Facilities and Equipment	As needed
Special Notifications and/or Certifications	As needed
** includes all illustrations, tables, and figures, where each "n-page" fold-out counts as n-pages and each side of a sheet containing text or an illustration counts as a page.*	

In addition to the above, the proposal shall provide a Summary Chart as shown in the figure below. Proposals that do not include a completed Summary Chart may be declared non-responsive and excluded from further award consideration/declined. The Summary Chart does not count toward page count,

The purpose of the Summary Chart is to capture the top-level, critical information from the entire proposal into a single, stand-alone page. The summary chart shall occupy the entire 8.5" x 11" page and be in landscape format. The Summary Chart will be used during the proposal review process, for NASA internal presentations, and may also be released publicly if the proposal is selected. Proprietary Data and/or International Traffic in Arms Regulations/Export Administration Regulations (ITAR/EAR) information shall not be included and all information on the chart must be able to be publicly released by NASA. The Summary Chart shall use the format as provided in the Summary Chart Template figure below. A template in a commonly used presentation software format is provided for this purpose, however proposers are not required to use any particular software. The specific instructions for each block are given in the PowerPoint format template available at: https://tinyurl.com/epscor-iss-fo-2021,as well as below.

Block 1 -Proposal Title
Provide the complete proposal title exactly as submitted in the NSPIRES Proposal Cover Page.
Block 2 –Scientific Merit / Technology Need
Describe the scientific merit of the research and/or technology development.
Block 3 –Purpose of Suborbital Flight
Describe the overall concept and purpose of the suborbital flight(s).
Block 4 –Payload Description
Provide a brief description of the actual payload flight apparatus. This should include the overall size and weight as well as any special interface and operational requirements.
Block 5 -Flight Requirements/Schedule
Outline the overall flight plan and identify flight vehicle and number of flights required. The flight readiness date should be included.
Block 6 -Team
Provide the name and the organizational title of the Principal Investigator (PI). Provide the name of the submitting organization. Prior EPSCoR funding for this work should be detailed with the Cooperative Agreement number(s).
Block 7 -Graphic
Provide graphics (photos, functional schematics, etc.) of the test apparatus and/or mission concept/ConOps.
Block 8 –Date
Provide the current date.

Summary Chart Template available at https://tinyurl.com/epscor-iss-fo-2021



Flight Test Plan

Outline the flight objectives, which shall be clear, measurable, and relevant to the advancement of the proposed research. Identify the key test objectives and measurable success criteria for each. Provide evidence that the flight test approach is realistic, fits the test objectives, and is relevant to the advancement of the research. Show that the proposed flight service provider is well-suited to execute the flight. Provide evidence (including a quote from the flight provider) of the flight provider's ability to provide the requested flight on a qualified vehicle.

Identify the roles, responsibilities, and contributions of the proposed project lead and team members. Identify any prior or current work that demonstrates that the combined team has the skill, expertise, and experience needed to successfully execute the proposed technical approach. Cite previous experience with flight testing and/or science research/technology development including experience in other NASA programs.

The proposal shall include a quote from a commercial flight service provider. This quote shall include the following:

- Quote addressed to the Sci-I or Sci-I organization
- Standard services provided (e.g. minimum 20 parabolas, # of parabolic flights, pre and post flight processing resources etc.)
- Non-standard services provided (e.g. power, venting, access to window, etc.)
- Location of services

- Vehicle to be used
- Scheduled dates of service
- Period of validity
- Associated cost
- Confirmation that the proposed payload requirements from the Sci-I have been reviewed by the flight provider

Proposals without a flight provider quote may be declared non-compliant and eliminated from further consideration for award/declined.

For flight providers that have not previously flown with the Flight Opportunities program, proposers must show that the vehicle has successfully flown and submit evidence that the flight provider is a U.S. commercial flight provider – licensed to operate commercial flights for compensation or hire in the U.S.

It is the proposer's responsibility to ensure that the proposed flight provider has the necessary certifications including (but not limited to) permits, licenses, or waivers for operation, as applicable, from the FAA or other governing authority for the flight activity, and is capable of meeting the flight demonstration schedule within the timeframe specified in the solicitation. However, these certifications do not need to be included in the proposal.

Proposers are strongly encouraged to contact their flight provider well in advance of the proposal due date to ensure that sufficient time is available for the proposer to obtain a flight provider quote.

3.2 Announcement of Updates/Amendments to the Solicitation

Additional programmatic information for this NOFO may be made available before the proposal due date. If so, such information will be added as a formal amendment to this NOFO and posted at its homepage on http://nspires.nasaprs.com.

Also, any clarifications or questions and answers regarding this NOFO will be posted at its homepage on http://nspires.nasaprs.com.

Each prospective proposer has the responsibility to regularly check this NOFO's homepage for any and all updates.

3.3 Cancellation of Program Announcement

NASA OSTEM reserves the right to not make any awards under this NOFO and/or to cancel this NOFO. NASA assumes no liability (including for proposal costs) for cancelling the NOFO or for any entity's failure to receive such notice of cancellation.

3.4 Contacts

Inquiries regarding the submission of electronic proposal materials to NSPIRES shall be addressed to:

NASA Research and Education Support Services (NRESS)
Althia Harris
2345 Crystal Drive, Suite 500
Arlington, VA 22202-4816
Telephone: (202) 479-9030 x310
E-mail: aharris@nasaprs.com

Technical and scientific questions about programs in this NOFO may be directed to:

EPSCoR
Dr. Mitch Krell
Deputy Project Manager, NASA EPSCoR
Stennis Space Center, MS 39529
Telephone: (228) 688-1821
Cell Phone: (228) 342-7462
E-mail: mitch.krell@nasa.gov

STMD Flight Opportunities Program (FO)
Alexander van Dijk
Technologist, Flight Opportunities Program
Ames Research Center, CA 94035
Phone: (650) 604-1641
E-Mail: alexander.vandijk@nasa.gov

Questions pertaining to programs mentioned in this NOFO may be directed to the appropriate NASA POC listed in the appendices.

4.0 Proposal Review and Selection

All proposals submitted in response to this announcement shall be submitted electronically via NSPIRES (http://nspires.nasaprs.com). Hard copies of the proposal will not be accepted. Electronic proposals shall be submitted in their entirety by 11:59 p.m., Eastern Time on the proposal due date of **April 15, 2022.**

4.1 Evaluation Criteria

Evaluation by peer review will be used to assess each proposal's overall merit. The evaluation criteria for award are: Intrinsic Merit, NASA Alignment and Partnerships, Management and Evaluation, and Budget Justification: Narrative and Details. A NASA Headquarters Mission Directorate panel will use the results of the peer evaluation to make funding recommendations to the Selecting Official. See Section 5.0, Proposal Evaluation Criteria.

4.2 Review and Selection Process

Review of proposals submitted in response to this NOFO shall be consistent with the general policies and provisions contained in the *NASA Guidebook for Proposers*, Appendix D. Selection procedures will be consistent with the provisions of the *NASA Guidebook for Proposers*, Section 5. However, the evaluation criteria described in this NOFO under Section 5.0, Proposal Evaluation,

take precedence over the evaluation criteria described in Section 5 of the *NASA Guidebook for Proposers*. The Selecting Official for this NOFO is the NASA EPSCoR Project Manager or their appointed representative.

The NASA EPSCoR Grants Officer will conduct a pre-award review of risk associated with the proposer as required by 2 CFR 200.205. For all proposals selected for award, the Grants Officer will review the submitting organization's information available through the Federal Awardee Performance and Integrity Information System (FAPIIS) and the System for Award Management (SAM) to include checks on entity core data,registration expiration date, active exclusions, suspension, debarment, and delinquent federal debt.

Prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold (currently $250,000), the NASA Grant Officer will conduct a pre-award review of risk associated with the proposer as required by 2 CFR 200.205. For all proposals selected for award, the Grant Officer will review the submitting organization's information available through multiple government wide repositories such as SAM (SAM.gov), FAPIIS, the Contractor Performance and Assessment Reporting System (CPARS), the Federal Audit Clearinghouse (FAC), USAspending.gov, and Grant Solutions Recipient Insight.

At its option, an applicant may review information about itself that NASA previously entered and that is currently in FAPIIS and may comment on such information.

NASA will consider any comments by the applicant, in addition to the other information in FAPIIS, in reaching a determination 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.

Successful research proposals are likely to be those that provide sound contributions to both immediate and long-term scientific and technical needs of NASA as explicitly expressed in current NASA documents and communications, as well as those that contribute to the overall research infrastructure and economic development of the jurisdiction.

Jurisdictions are strongly encouraged to submit proposals that demonstrate partnerships or cooperative arrangements among academia, government agencies, business and industry, private research foundations, jurisdiction agencies, and local agencies.

Limited Release of Proposers Confidential Business Information

For proposal evaluation and administrative processing, NASA may find it necessary to release proposal information to individuals who are not NASA employees (e.g., NASA support contractors). Business information that would ordinarily be entitled to confidential treatment may be included in the information released to these individuals. Accordingly, by submission of its proposal, the proposer consents to this limited release of its confidential business information (CBI).

Except where otherwise provided by law, NASA will permit the limited release of CBI only pursuant to non-disclosure agreements signed by the assisting NASA support contractor or subcontractor, and their individual employees who may require access to the CBI to perform

work under such support contract with NASA. Of course, these NASA support contractors, subcontractors, and their employees are not eligible to submit a proposal in any capacity under this solicitation.

4.3 Selection Announcement

NASA's stated goal is to announce selections as soon as possible. However, NASA does not usually announce new selections until the funds needed for those awards are made available through the federal budget process. Therefore, a delay in NASA's budget process may result in a delay of the selection date(s). After 180 days past the proposal's submitted date, proposers may contact the NASA EPSCoR Project Manager for a status.

A proposer has the right to be informed of the major factor(s) that led to the acceptance or rejection of the proposal. Debriefings will be available upon request. Again, it is emphasized that non-selected proposers should be aware that proposals of nominally high intrinsic and programmatic merits may be declined for reasons entirely unrelated to any scientific or technical weaknesses.

4.4 Notice of Award

For selected proposals, the NASA Grant Officer will contact the business office of the proposer's institution. The Grant Officer is the only official authorized to obligate the Government. For a grant or cooperative agreement, any costs that the proposer incurs within 90 calendar days before an award are at the recipient's risk in accordance with 2 CFR § 1800.209.

An anticipated award date announcement will be determined by the NASA EPSCoR Project Manager upon the conclusion of the review process. The award should take place on or about July 31, 2022.

4.5 Administrative and National Policy Requirements

All administrative and national policy requirements may be found at Title 2 CFR Part 200, Title 2 CFR Part 1800 (https://ecfr.federalregister.gov/current/title-2), and the NASA GCAM (https://www.nasa.gov/offices/ocfo/gpc/regulations_and_guidance).

4.6 Award Reporting Requirements

Recipients shall submit a report to the NASA Grant Officer at the NSSC, with copies to Agency-EPSCoR and to the supported organization on the results pertaining to this award no later than 120 days after the project's end date. The reporting requirements for awards made through this NOFO will be consistent with the reporting requirements outlined in the NASA GCAM Appendix D. Recipients also shall comply with reporting requirements at 2 CFR § 180.335 and 2 CFR §180.350.

5.0 Proposal Evaluation

The evaluation will follow the normal EPSCoR two-part process: An EPSCoR representative will review all submitted proposals for compliance with the solicitation requirements. An STMD/FO

representative will review the proposed flight provider's eligibility and flight feasibility. Then all compliant proposals will be subsequently evaluated by a team of NASA Subject Matter Experts against the evaluation criteria outlined in this section. Following this, all evaluated proposals will be presented to a Mission Directorate review panel for funding recommendations.

Successful proposals shall provide sound contributions to both immediate and long-term scientific and technical needs of NASA, as explicitly expressed in current NASA documents and communications, as well as contribute to the overall research infrastructure, science and technology capabilities of higher education, and economic development of the jurisdiction.

Successful proposals shall also include pragmatic plans for generation of sustained non-EPSCoR support.

Proposals will be evaluated based on the following criteria for award: Intrinsic Merit, NASA Alignment and Partnerships. Management and Evaluation, and Budget Justification: Narrative and Details. The bulleted lists after each criterion below should not be construed as any indication of priority or relative weighting. Rather, the bullets are provided for clarity and facilitation of proposal development. **Note:** *Each proposer shall provide specific information on how it determined the relevance of the proposed effort to NASA and the jurisdiction.*

5.1 Intrinsic Merit (35% of score)

- Proposed research shall have clear goals and objectives; address the expectations described in the announcement; and be consistent with the budget, effectively utilize the program management, and demonstrate a high probability for successful implementation.
- Proposals shall provide a detailed narrative of the proposed research activity, including the scientific and/or technical merit of the proposed research, unique and innovative methods, approaches, concepts, or advanced technologies, and the potential impact of the proposed research on its field.
- Existing research proposals shall provide baseline information about current research activities within the jurisdiction in the proposed research area, including projects currently funded under NASA EPSCoR.

5.2 NASA Alignment and Partnerships (35% of score)

- Proposals shall discuss the value of the proposed research to NASA and to the jurisdiction's research priorities.
- Proposals shall describe the use of NASA content, people, or facilities in the execution of the research activities.
- Proposals shall describe current and/or previous interactions, partnerships, and meetings with NASA researchers, engineers, and scientists in the area of the proposed research, and discuss how future partnerships between the institution's researchers and NASA personnel at the Mission Directorates, Centers, and/or JPL will be fostered.

- The name(s) and title(s) of NASA researchers with whom the proposers will partner shall be included. NASA shall consider the utilization of NASA venues for recipients to publish their accomplishments.
- In particular, proposers shall explain how this proposed research is related to the strategic plan for NASA EPSCoR-related research in the jurisdiction.
- Proposals shall state how they plan to develop research competitiveness both in the jurisdiction and nationally.

5.3 Management and Evaluation (15% of score)

NOTE: The following information does not count toward the 15-page limit for the Scientific, Technical, or Management section of table 2.

This section shall describe the management structure for the proposed research and coordination with the jurisdiction's NASA EPSCoR project management. The following elements shall be included:

- Personnel: The proposal shall include a list of the personnel participating in this research program, including the Principal Investigator, Science-Investigator, and all Co-Investigators, Research Associates, Post-Doctoral Fellows, Research Assistants, and other research participants. The credentials of the researchers are important; however, EPSCoR includes the concept of encouraging and helping new researchers.
- Research Project Management: A description shall be included of the Science-I's management structure of the proposed research project, and the extent to which the project's management and research team will lead to a well-coordinated, efficiently-managed, and productive effort.
- Multi-Jurisdiction Projects: If the proposed research is a collaboration between more than one NASA EPSCoR jurisdiction, one jurisdiction shall be identified as the lead jurisdiction with additional partners identified as sub-awardees (i.e., those that receive awards made by the award recipient). The proposal shall detail the inter-jurisdiction management structure of the proposed research project, including a list of the participating jurisdictions, and the participating universities and agencies within each jurisdiction.
- Project Evaluation: Proposals shall document the intended outcomes and offer metrics to demonstrate progress toward and achievements of these outcomes. They shall discuss metrics to be used for tracking and evaluating project progress. Milestones and timetables for achievement of specific objectives during the award period shall be presented. The proposal also shall describe an appropriate evaluation plan/process to document outcomes and demonstrate progress toward achieving objectives of proposed project elements. The evaluation methodology shall be based upon reputable models and techniques appropriate to the content and scale of the project. Projects shall implement improvements throughout the entire period of performance based on ongoing evaluation evidence.

- Results of Prior NASA EPSCoR Research Support: Examples of accomplishments commensurate with the managerial and administrative expectations of the award shall be provided. The EPSCoR Director will not be assessed on their expertise in the specific proposed research area since the Science-PI is tasked with managing the scientific/technical development progress. The following information shall be provided: the NASA EPSCoR award number(s), the title of the projects(s); and period(s) of performance; primary outcomes resulting from the NASA EPSCoR award, including a summary discussion of accomplishments compared to the proposed outcomes from the original proposal; coordination with the research and technical development priorities of NASA, and contribution(s) to the overall research capacity of the jurisdiction.
- Proposals shall describe the use of NASA content, people, or facilities if involved in the execution of the research activities. Specifically, they shall describe current and/or previous interactions, partnerships, and meetings with NASA researchers, engineers, and scientists in the area of the proposed research, and discuss how future partnerships between the institution's researchers and personnel at the Mission Directorates and/or Centers, and JPL will be fostered. The name(s) and title(s) of NASA researchers with whom the proposers will partner shall be included. NASA shall consider the utilization of NASA venues for recipients to publish their accomplishments.

5.4 Budget Justification: Narrative and Details (15% of score)

- The proposed budget shall be adequate, appropriate, reasonable, and realistic, and demonstrate the effective use of funds that align with the content and text of the proposed project. Preparation guidelines for the budget can be found in the *NASA Guidebook for Proposers*, Section 3.18 and Appendix C.
- A detailed budget, including both NASA provided and any cost-share funds (not required), is required. This section shall include detailed budgets for each of the three years of the funding and a summary budget for all three years. All sources of cost-sharing (if voluntarily offered) shall be thoroughly described and documented. However, extra credit will not be assessed for proposals that offer cost-sharing.
- The budget will be evaluated based upon the clarity and reasonableness of the funding request. A budget narrative shall be included that discusses relevant budgetary issues such as the extent and level of jurisdiction, industrial, and institutional commitment and financial support, including resources (e.g., staff, facilities, laboratories, indirect support, and waiver of indirect costs).

6.0 Certification of Compliance

Recipients receiving awards under this NOFO shall comply with the provision set forth in the NASA Plan for Increasing Access to the Results of Scientific Research (http://www.nasa.gov/sites/default/files/files/NASA_Data_Plan.pdf), including the responsibility

for-

a. Submitting as approved peer-reviewed manuscripts and metadata to a designated repository; and
b. Reporting publications with the annual and final progress reports.

The Authorized Organization's Representative (AOR's) signature on the Proposal Cover Page serves as a certification that the proposing organization has read and is in compliance with all certifications, assurances, and representations as detailed in the NASA GCAM Appendix C, Section C1. The GCAM is available at the following site:
https://www.nasa.gov/offices/ocfo/gpc/regulations_and_guidance

Note: On February 2, 2019, the System for Award Management (SAM) implemented a new process that allows financial assistance registrants to submit common Federal Government-wide certifications and representations. This new process is required effective January 1, 2020. Guidance on the new process and system change is available at:
https://interact.gsa.gov/blog/certifications-and-representation-improvements-sam.

6.1 Statement on Nondiscrimination

NASA recognizes and supports the benefits of having diverse and inclusive scientific, engineering, and technology communities and fully expects the reflection of such values in the composition of all panels and teams, including peer review panels, proposal teams, science definition teams, and mission and instrument teams. Per federal statutes and NASA policy, no eligible applicant shall experience exclusion from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NASA on the grounds of their race, color, creed, age, sex, national origin, or disability. NASA welcomes proposals from all qualified and eligible sources, and strongly encourages proposals from Historically Black Colleges and Universities (HBCUs), Minority Serving Institutions (MSIs), small disadvantaged businesses (SDBs), veteran-owned small businesses, service-disabled veteran-owned small businesses (SDVOSB), HUBZone small businesses, and women-owned small businesses (WOSBs), as eligibility requirements allow.

6.2 Collection of Science, Technology, Engineering, and Math (STEM) Information

NASA is implementing a process to collect demographic data from grant applicants for the purpose of analyzing demographic differences associated with its award processes. NASA continually monitors the operation of its review and award processes to identify any inequities based on gender, ethnicity, race, or disability.
Therefore, we are requesting additional demographic data to ensure compliance with Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d et seq., Title IX of the Education Amendments of 1972, 20 U.S.C. § 1681 et seq., Section 504 of the Rehabilitation Act of 1973, 29 U.S.C. § 701 et seq., and NASA's implementing regulations at 14 CFR §§1250, 1251, and 1253. Submission of the requested information on NASA Form 1839 is voluntary and will not affect the organization's eligibility for an award. Any individual not wishing to submit some or all the information should check the box provided for this purpose.

Appendix A: NASA Points of Contact

A.1 Additional information regarding NASA EPSCoR can be obtained from the following:

Dr. Mitch Krell
Deputy Project Manager, NASA EPSCoR
Building 1100, Room 108
Stennis Space Center, MS 39529
Telephone: (228) 688-1821
Cell Phone: (228) 342-7462
E-mail: mitch.krell@nasa.gov

A.2 NASA EPSCoR Research Liaisons

There is a NASA EPSCoR Research Liaison within each Mission Directorate and at each Center. These liaisons can assist with activities ranging from site visits for establishing collaborations to resolving issues after the award. Technical and scientific questions about research opportunities in this announcement may be directed to the appropriate contact below. Discussions of research with the appropriate NASA EPSCoR Research Liaison (Mission Directorate, Center, or JPL) personnel are strongly encouraged.

A.3 Mission Directorates

NASA Mission Directorate Contacts	
Aeronautics Research Mission Directorate *Dave Berger* OSTEM Embed for Aeronautics P: 661.276.5712 M**:** 661.810.8429 E: dave.e.berger@nasa.gov	**Science Mission Directorate** *Kristen Erickson* Director, Science Engagement & Partnerships NASA Headquarters P: (202) 358-1017 E: kristen.erickson@nasa.gov
Human Exploration & Operations Mission Directorate *Francis P Chiaramonte* HEOMD Science Program Management NASA Headquarters P: (202) 358-0693 E: francis.p.chiaramonte@nasa.gov	**Space Technology Mission Directorate** *Damian Taylor* SBIR and STTR Mission Directorate Liaison NASA Headquarters P: (202) 358-1432 E: damian.taylor@nasa.gov

A.4 NASA Centers

Johnson Space Center	**Stennis Space Center**
Nick Skytland Office of Chief Technologist P: (281) 792-7792 M: (832) 388-4226 E: nicholas.g.skytland@nasa.gov	*Ramona Pelletier Travis* Office of Chief Technologist P: (228) 688-3832 M: (228) 342-5295 E: ramona.e.travis@nasa.gov

Ames Research Center *Harry Partridge* Office of Chief Technologist P: (650) 604-5236 E: harry.partridge@nasa.gov	**Glenn Research Center** *Kurt Sacksteder* Office of Chief Technologist P: (216) 849-8549 M: (216) 849-8549 E: kurt.sacksteder@nasa.gov or *Mark David Kankam* Technical Resources Management Office P: (216) 433-6143 M: (216) 308-0619 E: Mark.D.Kankam@nasa.gov
Armstrong Flight Research Center *Timothy Risch* Associate Director for Research P: (661) 276-6720 M: (661) 857-3721 E: timothy.k.risch@nasa.gov	**Langley Research Center** *Neyda Abreu* Science Technology Utilization & Communication (LARC-A) P: (757) 864-4319 E: neyda.m.abreu@nasa.gov
Goddard Space Flight Center *Heather Bradshaw* Office of Chief Technologist P: (301) 286-4913 E: gsfc-chief-technologist@mail.nasa.gov or *James Harrington* Computer Research & Development P: (301) 286-4063 M: (301) 806-2382 E: james.l.harrington@nasa.gov	**Kennedy Space Center** *Delvin van Norman* Technology Transfer Program P: (321) 867-6927 E: delvin.vannorman@nasa.gov or *Jose Nunez* Engineering Project Management Office P: (321) 867-5922 M: (321) 289-2479 E: jose.l.nunez@nasa.gov
Jet Propulsion Laboratory *Fred Y. Hadaegh* Office of Chief Technologist Senior Research Scientist and Technical Fellow P: (818) 354-8777 E: fred.y.hadaegh@jpl.nasa.gov	**Marshall Space Flight Center** *John Dankanich* Office of Chief Technologist In-Space Transportation Capability Lead (SCLT) P: (256) 544-3441 M: (256) 425-4053 E: john.dankanich@nasa.gov

Appendix B: Definitions

- Center – Refers to one of the nine NASA Centers located in the United States. For purposes of collaboration in NASA EPSCoR, the NASA Jet Propulsion Laboratory (JPL) (NASA's only Federally- Funded Research and Development Center) is included in the NASA Center category.
- Cooperative Agreement – An award of federal assistance used to carry out a public purpose of support or stimulation authorized by a law. A cooperative agreement is similar to a grant with the exception that NASA and the award recipient are each expected to be substantially involved for the performance of the project. Cooperative agreements are managed pursuant to the policies set forth in 2 CFR Part 200, 2 CFR Part 1800, and the NASA Grant and Cooperative Agreement Manual (GCAM).
- Directorate – One of NASA's Mission Directorates—Aeronautics Research (ARMD), Human Exploration & Operations (HEOMD), Space Technology (STMD), and Science (SMD).
- Jurisdiction – States or commonwealths that are eligible to submit proposals in response to this NOFO.
- NASA Research Contact – The NASA Research Contact is the primary NASA point of contact during the proposal writing stage for the proposed research area. If the proposer has contacted and received permission from a NASA scientific or technical person, that individual may be listed in the proposal as the NASA Research Contact. Otherwise the NASA Research Contact is the Office of Chief Technologist at the Center, or the NASA Mission Directorate contact at NASA Headquarters. (See Appendix A.)
- Partnership – A reciprocal and voluntary relationship between the project personnel and NASA, industry, or other partners, to cooperatively achieve the goals of the proposed research.
- Principal Investigator (PI) – For this EPSCoR NOFO, the PI is the jurisdiction's EPSCoR director. The PI has an appropriate level of authority and is responsible for proper conduct of the research, including appropriate use of funds and administrative requirements such as the submission of the scientific progress reports to the Agency. The PI is the administrator for the proposal.
    - Science-I – For this NOFO, one Co-I shall be designated as the Science-I for those cases where the person leading the scientific direction of the proposed work is not the PI. The formally stated PI will still be held responsible for the overall direction of the effort and use of funds.
    - Co-Investigator (Co-I) – A Co-I is a member of the proposal's investigation team who is a critical "partner" for the conduct of the investigation through the contribution of unique expertise and/or capabilities.
    - Co-I/Institutional-PI – A Co-I at an organization other than that of the PI's institution, who is making a major contribution to the proposal and serves as the point of contact at the Co-I's institution, may also be designated as the Co-

I/Institutional-PI. For this NOFO, the Science-I may also serve as a Co-I/Institutional-PI. In these cases, the individual shall be identified as the Science- I in the proposal cover page.

- Research Area – One of the areas of research interest for the NASA Mission Directorate(s).
- Research Group – A group of researchers that undertakes one of the specific research areas proposed.
- Research Assistant – A student (undergraduate, graduate, or postdoctoral) who receives a research appointment in direct support of the NASA EPSCoR research in the research proposals.
- Technical Monitor – A NASA scientific or technical person designated by the NASA EPSCoR office to monitor the research project.

Appendix C: Proposal and Submission Information

C.1 Proposal Instructions and Requirements

All information needed to respond to this solicitation is contained in this Notice of Funding Opportunity (NOFO) and in the companion *NASA Guidebook for Proposers* located at https://www.nasa.gov/sites/default/files/atoms/files/2021_ed._nasa_guidebook_for_proposers.pdf.

Proposers are responsible for understanding and complying with the *NASA Guidebook for Proposers*' procedures for the successful, timely preparation and submission of their proposals. Proposals that do not conform to its standards may be declared noncompliant and rejected without review.

The introductory material, as well as the appendices, of the *NASA Guidebook for Proposers* provide additional information about the entire NOFO process, including NASA policies for the solicitation of proposals, guidelines for writing complete and effective proposals, and NASA's general policies and procedures for the review and selection of proposals and for issuing and managing the awards to the institutions that submitted selected proposals.

C.2 Content and Form of the Proposal Submission

Electronic Proposal Submission

All proposals submitted in response to this NOFO must be submitted in a fully electronic form. **No hard copy proposals will be accepted.** Electronic proposals shall be submitted by the authorized organization representative (AOR) at the proposal Principal Investigator's (PI) institution. Electronic submission by the AOR serves as the required original signature by an authorized official of the proposing institution.

Proposers shall submit proposals in response to this NOFO via electronic proposal submission through NSPIRES, located at http://nspires.nasaprs.com (see below). NASA plans to use the NSPIRES system to facilitate the review process.

Carefully note the following requirements for submission of an electronic proposal via NSPIRES:

- Every institution intending to submit a proposal to NASA in response to this NOFO shall be registered in NSPIRES. Registration for the proposal data system shall be performed by an institution's electronic business point-of-contact (EBPOC) having a valid registration with the System for Award Management (SAM) [formerly known as the Central Contractor Registry (CCR)].
- Any institution requesting NASA funds through the proposed investigation shall be listed on the Proposal Cover Page. NASA will not fund institutions that are not included on the Proposal Cover Page.
- Each individual team member named on the proposal's electronic cover page shall be individually registered in NSPIRES.
- Each individual team member named on the proposal's electronic cover page shall specify an institutional affiliation. The institutional affiliation specified shall be the

institution through which the team member is participating in the proposed investigation. If the individual has multiple affiliations, then this institution may be different from the individual's primary employer or preferred mailing address.

Generally, an electronic proposal consists of one or more electronic forms, including an electronic cover page and one or more attachments. The attachments contain all sections of the proposal, including the project description as well as all required and allowed appendices; see the "Proposal Format and Contents" section below for further requirements.

Submission of electronic proposals via NSPIRES requires several coordinated actions from the proposing institution. In particular, when the PI has completed entry of the data requested in the required electronic forms and attachment of the allowed PDF attachments, including the project description section, an official at the PI's institution who is authorized to make such a submission, referred to as the AOR, shall submit the electronic proposal (forms plus attachments). Coordination between the PI and his/her AOR on the final editing and submission of the proposal materials is facilitated through their accounts in NSPIRES. Note that if one individual is acting in both the PI and AOR roles, he/she shall ensure that all steps in the process are taken, including submitting the institution's proposal.

Proposal Format and Contents

All proposals submitted in response to this NOFO shall include the appropriate required electronic forms available through NSPIRES.

The project description and other required sections of the proposal shall be submitted as *SEARCHABLE*, unlocked PDF files that are attached to the electronic submission in NSPIRES. Proposers shall comply with any format requirements specified in this NOFO and in the *NASA Guidebook for Proposers*, Section 3. Only appendices/attachments that are specifically requested in either this NOFO or in the NASA *Guidebook for Proposers* for Proposers will be permitted; proposals containing additional appendices/attachments may be declared noncompliant. The *NASA Guidebook for Proposers*, Section 3, provides detailed guidelines on the content of proposals applicable to this NOFO. Additionally, this NOFO's Section 3.1. on Proposal Preparation provides a listing of required content elements.

In the event the information in this NOFO is different from or contradicts the information in the *NASA Guidebook for Proposers*, the information in this NOFO takes precedence.

Important note on creating PDF files for upload: It is essential that all PDF files generated and submitted meet the NASA requirements below. This will ensure that the submitted files can be transferred into NSPIRES. At a minimum, it is the proposer's responsibility to: (1) ensure that all PDF files are unlocked and that edit permission is enabled – this is necessary to allow NSPIRES to concatenate submitted files into a single PDF document; and (2) ensure that all fonts are embedded in the PDF file and that only Type 1 or TrueType fonts are used. In addition, any proposer who creates files using TeX or LaTeX is required to first create a DVI file and then convert the DVI file to Postscript and then to PDF. See http://nspires.nasaprs.com/tutorials/PDF_Guidelines.pdf for more information on creating PDF documents that are compliant with NSPIRES. PDF files that do not meet the NASA requirements may be declared noncompliant and not submitted to peer review for evaluation.

Additional Requirement for Budget Format

In addition to the budget summary information provided in NSPIRES:

Cover Page forms: all proposers shall include more detailed budgets and budget justifications, including detailed subcontract/subaward budgets, in a format of their own choosing in the *Budget Justification*. For this NOFO, this additional budget must be divided into two parts, the "*Budget Justification: Narrative*" and the "*Budget Justification: Details*," both as described in the *NASA Guidebook for Proposers,* Section 3.18. The overall budget should also include the flight costs (with facilities and administrative (F&A) costs) in addition to the research costs (with F&A).

The *Budget Justification: Narrative* includes the *Table of Proposed Work Effort* and the description of facilities and equipment, as well as the rationale and basis of estimate for all components of cost including procurements, travel (destination, purpose and number of travelers), publication costs, and all subawards/subcontracts. The *Table of Proposed Work Effort* shall include the names and/or titles of all personnel (including postdoctoral fellows and graduate students, where known) necessary to perform the proposed investigation, regardless of whether these individuals require funding from the current proposal. The number of person-months each person is expected to devote to the project must be given for each year.

The *Budget Justification: Details* shall include the detailed proposed budget including all of the Other Direct Costs and Other Applicable Costs specified in the *NASA Guidebook for Proposers*.

A proposer's failure to provide sufficient budget justification and data in the *Budget Justification: Narrative* (including the *Table of Proposed Work Effort*) and the *Budget Justification: Details* will prevent the peer review from appropriately evaluating the cost realism of the proposed effort. A finding by the peer review of "insufficient information to properly evaluate cost realism" shall be considered a proposal weakness. Inconsistent information between these budget descriptions and the proposal text shall also be considered a proposal weakness.

Submission of Proposals via NSPIRES, the NASA Proposal Data System

In order to submit a proposal via NSPIRES, this NOFO requires that the proposer register key data concerning the intended submission with NSPIRES; NSPIRES is accessed at http://nspires.nasaprs.com. Potential applicants are strongly urged to access this site well in advance of the proposal due date(s) of interest to familiarize themselves with its structure and enter the requested identifier information.

It is especially important to note that every individual named on the proposal's electronic *Cover Page* form (see below) as a proposing team member in any role, including Co-Investigators (Co-I's), shall be registered in NSPIRES and that such individuals shall perform this registration themselves; no one may register a second party, even the PI of a proposal in which that person is committed to participate. This data site is secure and all information entered is strictly for NASA's use only.

All proposals submitted via NSPIRES in response to this NOFO shall include a required electronic *Cover Page* form that is accessed at http://nspires.nasaprs.com. This form

comprises several distinct sections: a *Cover Page* that contains the identifier information for the proposing institution and personnel; a *Proposal Summary* that provides an overview of the proposed investigation that is suitable for release through a publicly accessible archive if the proposal is selected; and a *Budget Summary* of the proposed research effort. Unless specified in the program description itself, no other forms are required for proposal submission via NSPIRES. See the *NASA Guidebook for Proposers* for further details.

The required elements of the proposal, including the project description, shall be submitted as one PDF document that is attached to the *Cover Page* using the tools in NSPIRES. The complete proposal is submitted as a single, *SEARCHABLE*, unlocked PDF document that contains the complete proposal, including the project description section and budget justification, assembled in the order provided in this NOFO and uploaded using the tools in NSPIRES. One advantage of submitting the proposal as one PDF document is that it is easy to upload.

NSPIRES will provide a list of all elements that make up an electronic proposal, and the system will conduct an element check to identify any item(s) that is (are) apparently missing or incomplete. The element check may produce warnings and/or identify errors. Uploading the proposal in one PDF file is likely to create warnings as part of the element check. Please ignore these warnings since such warnings do not prevent proposal submission.

Proposers are encouraged to begin their submission process early. Tutorials and other NSPIRES help topics may be accessed through the NSPIRES online help site at http://nspires.nasaprs.com/external/help.do. For any questions that cannot be resolved with the available on-line help menus, requests for assistance may be directed by e-mail to nspires- help@nasaprs.com or by telephone to (202) 479-9376, Monday through Friday (except Federal holidays), 8:00 a.m. – 6:00 p.m. Eastern Time.

C.3 Notice of Intent to Propose

A Notice of Intent (NOI) is not requested/required.

C.4 Certifications, Assurances, and Representations

The AOR's signature on the Proposal Cover Page automatically certifies that the proposing organization has read and is in compliance with all certifications, assurances, and representations as detailed in *NASA Grant and Cooperative Agreement Manual* (GCAM).

Appendix D: Useful Web Sites

- NASA http://www.nasa.gov
- NASA Office of STEM Engagement http://stem.nasa.gov
- NASA EPSCoR http://www.nasa.gov/offices/education/programs/national/epscor/home/index.html
- NASA STMD http://www.nasa.gov/spacetech
- STMD/FO, Flight Opportunities program https://www.nasa.gov/flightopportunities
- Vision for Space Exploration http://www.nasa.gov/missions/solarsystem/explore_main.html
- NASA Centers & Facilities http://www.nasa.gov/offices/education/centers/index.html
- Guidebook for Proposers Responding to a NASA Notice of Funding Opportunity (NOFO) https://www.nasa.gov/sites/default/files/atoms/files/2021_ed._nasa_guidebook_for_proposers.pdf
- NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) http://nspires.nasaprs.com
- NASA Grant and Cooperative Agreement Manual (GCAM) https://www.nasa.gov/sites/default/files/atoms/files/nasa_gcam_-_revised_nov_12_2020.pdf
- NPR 5810.1A, Standard Format for NASA Research Announcement and Other Announcements for Grants and Cooperative Agreements https://nodis3.gsfc.nasa.gov/npg_img/N_PR_5810_001A_/N_PR_5810_001A_.pdf
- Electronic Code of Federal Regulations (2 CFR 200, 2 CFR 1800) https://ecfr.federalregister.gov/current/title-2

Appendix E: Possible Research Areas

Note: Researchers may choose from the topics included in this appendix. However, research topics are NOT limited to this list.

Biological and Physical Sciences (BPS)

NASA's Biological and Physical Sciences (BPS) program seeks advances in the biological and physical sciences through space-based research, and studies the behavior and adaptation of physical processes, living organisms, and ecosystems to environments beyond Earth. In July 2020, NASA's biological and physical sciences research formerly known as Space Life and Physical Sciences Research & Applications Division (SLPSRAD), moved from the Human Exploration and Operations Mission Directorate (HEOMD) into the Biological and Physical Sciences (BPS) Division in the Science Mission Directorate (SMD).

The mission of BPS is two-pronged:

- Pioneer scientific discovery in and beyond low Earth orbit to drive advances in science, technology, and space exploration to enhance knowledge, education, innovation, and economic vitality.
- Enable human spaceflight exploration to expand the frontiers of knowledge, capability, and opportunity in space.

Execution of this mission requires both scientific research and technology development.

BPS administers NASA's:

- Space Biology Program, which solicits and conducts research to understand how biological systems accommodate to spaceflight environments. This program focuses on the effects of short and long duration spaceflight environment exposure on the biology of animals and plants. NASA Space Biology goals are to: 1) effectively use microgravity and other space environment characteristics to enhance our understanding of the adaptation and function of basic biological processes in spaceflight, 2) develop a scientific and technological knowledge base that will contribute to a safe, productive human presence in space during exploration, and 3) apply the knowledge and technologies gained to improve our nation's competitiveness, education, and the quality of life on Earth.
- Physical Sciences Program, which solicits and conducts research to understand how physical systems respond to spaceflight environments, particularly microgravity. The Physical Sciences Research program conducts experiments in space, in Earth-based reduced-gravity platforms and ground facilities, and conducts computational and theoretical investigations, to advance scientific knowledge in the disciplines of physical science, and to understand the effects of gravity and the space environment on physical systems.

BPS partners with the research community and a wide range of organizations to accomplish its mission. Grants to academic, commercial and government laboratories are the core of BPS's research and technology development efforts.

Additional information on BPS can be found at: https://science.nasa.gov/biological-physical

Specific research of interest to the Physical Sciences Program for this Suborbital Flight Opportunity solicitation includes the following:

1) Research Title: Spacecraft Fire Safety for Lunar Missions

Research Overview:

NASA's Artemis program calls for human crewed missions to the lunar surface. The cabin atmosphere for these missions is a higher concentration of oxygen (0.34 mole fraction for Artemis vs. 0.21 for ISS) at a lower cabin pressure (to minimize pre-breathe time for an EVA). Research by NASA researchers and their research partners over the last 40 years has highlighted how these cabin atmospheres on the lunar surface may represent a 'worst-case' scenario with respect to spacecraft fire safety. The expected buoyant flows associated with lunar gravity are associated with a minimum limiting oxygen index for a solid material, a maximum in the heat release and flame spread rate. When coupled with the increased oxygen concentration, the risk to the crew from an accidental fire is increased during the Artemis missions.

While the previous research indicates the increased risk, there is little direct data to fully quantify the risk to the crew in the Artemis-relevant environments (gravity level, oxygen concentration and pressure). NASA is seeking high quality research proposals that can help quantify the increased risk to the crew from accidental fires during the Artemis program.

Research Focus:

This Combustion Science Emphasis requests proposals for hypothesis-driven experiments and/or analysis that that will help determine: 1) changes in material flammability, fire growth and spread in Artemis-relevant environments; 2) implementation strategies for safe, reliable fire detection in lunar landers and habitats.

BPS Contact:

a. Name: Daniel L. Dietrich
b. Organization: NASA John H. Glenn Research Center
c. Work Phone: 216-433-8759
d. Email: Daniel.L.Dietrich@nasa.gov

Additional Information:

All publications that result from an awarded EPSCOR study shall acknowledge NASA Biological and Physical Sciences (BPS).

2) Research Title: Reduced Gravity Joining

Research Overview:
Joining processes, such as welding and brazing, are enabling in-space manufacturing technologies for sustained and deep space exploration since they allow realization of novel metallic vehicles and structures. Such processes, however, induce significant metallurgical changes to parent material that can degrade properties and introduce defects. Information on in-space welding is very limited as there have been few experiments (e.g., Soyuz-6 USSR 1969, Skylab NASA 1973, Salyut-7 USSR 1984). The last (and only) NASA experiments on Skylab were nearly 50 years ago. Data from these experiments falls short of describing fundamental structure-property-processing relationships needed for development of robust welding processes and process models that will enable critical one-shot space joints necessary for space hardware. To enable reduced gravity joining and related processes, experimental data in a relevant gravity are needed, especially those that will identify and elucidate the physical phenomena associated with the microgravity environment. In particular, the absence of convection as the primary mixing phenomenon in a weld pool, and the subsequent solidification and development of weld shape and properties need to be studied to enable reduced gravity joining and inform ground-based process modeling efforts.

Suborbital flights are ideally suited for generating empirical conditions to study such phenomena, particularly for highly transient beam welding processes such as laser beam and electron beam welding where physics occur at the millisecond time scale. Suborbital flight data will inform and validate computational models for predicting critical one-shot space welds since extensive in-space process development studies are not possible.

Research Focus:
Welding in space is subject to 1) reduced gravity, 2) vacuum/reduced pressure, and 3) large temperature variations compared to terrestrial welding. Currently, there are no weld process parameters that account for these physical changes, and thus, critical in-space welds cannot be performed.

The goal of this NASA Physical Sciences Program research emphasis is to study reduced gravity welding and joining processes in relevant gravity to increase understanding of their structure-property-processing relationships at relevant gravity. Investigators are expected to provide hardware necessary to perform these experiments.

BPS Contact:

a. Name: Michael SanSoucie
b. Organization: NASA MSFC
c. Work Phone: 256-544-5269
d. Email: michael.p.sansoucie@nasa.gov

Additional Information:

All publications that result from an awarded EPSCOR study shall acknowledge NASA Biological and Physical Sciences (BPS).

Specific research of interest to the Space Biology Program for this Suborbital Flight Opportunity solicitation includes the following:

1) Research Title: Effects of Gravity Transitions on Neurobehavioral Responses

Research Overview:

Suborbital flights provide the opportunity to study immediate responses of biological systems to gravitational transitions. Neurobehavioral responses in multicellular animals occur quickly and are important when defining the responses of organisms to altered gravity regimes during spaceflight.

BPS's Space Biology Program is interested in proposals for studies that utilize vertebrate and/or invertebrate animal models that will measure neurobehavioral changes in real-time during gravity shifts. Ideally, these measurements would be coupled with the collection of complementary molecular and histological samples for research analyses.

Research Focus:

The study should use vertebrate and/or invertebrate organisms with a defined Central Nervous System (CNS) that can be utilized for neurobehavioral measurements during fast gravity transitions in suborbital flights. If feasible, it is encouraged that samples are collected for complementary molecular biological and cellular/tissue analyses in conjunction with the neurobehavioral measurements to provide a holistic analysis of the effects of gravity transitions in the CNS.

BPS Contact:

a. Name: Sharmila Bhattacharya
b. Organization: NASA Headquarters, Space Biology Program
c. Email: spacebiology@nasaprs.com

Additional Information:

All publications that result from an awarded EPSCOR study shall acknowledge NASA Space Biology Program. If the NASA GeneLab Data Systems (genelab.nasa.gov) is used, GeneLab shall be referenced in the resulting publication and included in the keyword list. All omics data obtained from this study shall be uploaded to the NASA GeneLab.