

Collaborating with NASA

WSU Office of Research NASA Workshop

September 8th, 2022



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Research Chemical Engineer

Materials Chemistry and Physics Branch

NASA Glenn Research Center, Cleveland OH



NASA Headquarters



Ames Research Center



Dryden Flight Research Center



Glenn Research Center



Goddard Space Flight Center



Jet Propulsion Laboratory



Johnson Space Center



Kennedy Space Center



Langley Research Center



Marshall Space Flight Center



Michoud Assembly Facility



Plum Brook Station



Stennis Space Center



Wallops Flight Facility



White Sands Test Facility

NASA centers and facilities

www.nasa.gov

PS-00030-0610

NASA Centers and Facilities

NASA consists of its Headquarters in Washington, DC, field centers, and facilities. Each center's Outreach and Educational programs have been assigned a geographic region of responsibility. On the reverse side is a map of the United States color coded to show the states and the assigned NASA center. For additional information go to <http://www.nasa.gov/about/sites/index.html>.



NASA Headquarters

NASA Headquarters, located in Washington, DC, exercises management over the space flight centers, research centers, and other installations that constitute NASA.



Jet Propulsion Laboratory

The Jet Propulsion Laboratory, managed by the California Institute of Technology is NASA's lead center for robotic exploration of the solar system.



Michoud Assembly Facility

Michoud Assembly Facility is a world-class manufacturing facility providing vital support to NASA exploration and discovery missions.



Ames Research Center

Ames Research Center specializes in research geared towards creating new knowledge and technologies that span the spectrum of NASA interests.

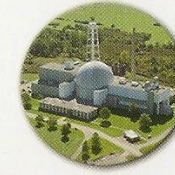
Alaska, Northern California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming



Johnson Space Center

From the early Gemini, Apollo, and Sky Lab projects to today's Space Shuttle and International Space Station programs, Johnson Space Center continues to lead NASA's effort in Human Space Exploration.

Colorado, Kansas, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas



Plum Brook Station

Plum Brook Station facilities can simulate environmental conditions found on Earth, in low Earth orbit, on planetary surfaces, and in deep space.



Dryden Flight Research Center

As the lead for flight research, Dryden continues to innovate in aeronautics and space technology. The newest, fastest, and highest—all have made their debut in the vast, clear desert skies over Dryden.

Arizona, Southern California



Kennedy Space Center

Kennedy Space Center is America's Gateway to the Universe—leading the world in preparing and launching missions around the Earth and beyond.

Florida, Georgia, Puerto Rico, Virgin Islands



Stennis Space Center

Stennis is responsible for NASA's rocket propulsion testing and for partnering with industry to develop and implement remote sensing technology.

Mississippi



Glenn Research Center

Glenn Research Center develops and transfers critical technologies that address national priorities through research, technology development, and systems development for safe and reliable aeronautics, aerospace, and space applications.

Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin



Langley Research Center

Langley continues to forge new frontiers in aviation and space research for aerospace, atmospheric sciences, and technology commercialization to improve the way the world lives.

Kentucky, North Carolina, South Carolina, Virginia, West Virginia



Wallops Flight Facility

Located on Virginia's Eastern shore, Wallops is NASA's premier site for sub-orbital and small orbital flight projects, Earth Science research, and technology development and is home to NASA's only owned and operated launch range.



Goddard Space Flight Center

The mission of the Goddard Space Flight Center is to expand knowledge of the Earth and its environment, the solar system, and the universe through observations from space.

Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont



Marshall Space Flight Center

Bringing people to space; bringing space to people. Marshall Space Flight Center is the world leader in access to space and use of space for research and development to benefit humanity.

Alabama, Arkansas, Iowa, Louisiana, Missouri, Tennessee



White Sands Test Facility

White Sands Test Facility conducts simulated mission duty-cycle testing to develop numerous full-scale propulsion systems and evaluates upgraded or redesigned shuttle orbiter components to extend service life, enhance performance, and improve mission safety.



Research Centers



WE'RE GOING BACK!

Artemis Program: Return to moon-2024

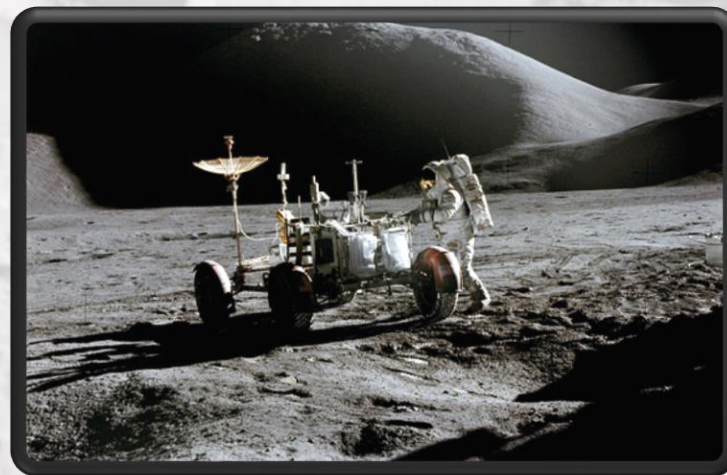


<https://www.nasa.gov/specials/artemis/>

Apollo Program ran from 1961 to 1972

Moon Landing Missions:

- **Apollo 11 (1969)** Neil Armstrong (Commander), Buzz Aldrin, Michael Collins
- **Apollo 12 (1969)** Charles "Pete" Conrad (Commander), Alan Bean, Richard Gordon
- ***Apollo 13 (1970)** James Lovell (Commander), Jack Swigert, Fred Haise
- **Apollo 14 (1971)** Alan Shepard (Commander), Edgar Mitchell, Stuart Rosa
- **Apollo 15 (1971)** David Scott (Commander), James Irwin, Alfred Worden
- **Apollo 16 (1972)** John Young (Commander), Charles Duke, Thomas Mattingly
- **Apollo 17 (1972)** Eugene Cernan (Commander), Harrison Schmitt, Ronald Evans



Apollo 15-Astronaut James B. Irwin, lunar module pilot, works on the Lunar Roving Vehicle

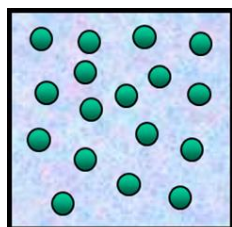
NASA is now preparing for an ambitious new era of sustainable human spaceflight and discovery

AST (Aerospace Technology) Research Chemical Engineer, Aerospace Polymeric Materials for Extreme Environments

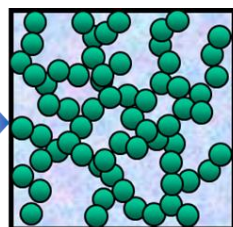
The Wonderful World of Polymer Aerogels!

An open-celled, light weight, porous material derived from a gel in which the liquid is replaced by gas while maintaining the self-assembled three-dimensional structure

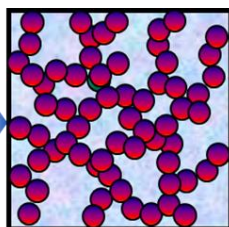
- High porosity ($> 90\%$)
- Nano-scale pore sizes (10-40 nm)
- Large surface areas (400 – 850 m^2/g)
- Low density (0.05-0.2 g/cm^3)
- Low thermal conductivity ($\sim 20 \text{mW}/\text{m}\cdot\text{K}$)
- Low dielectric (1.1)
- Low refractive index (1.02-1.09)



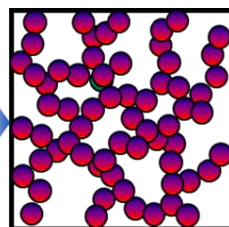
Monomers



Polyamic
Acid Gel



Polyimide
Gel



Polyimide
Aerogel



Polyimide Aerogels made using sol-gel synthesis and supercritical fluid extraction



NASA

Awards/Grants/Cooperative Agreements



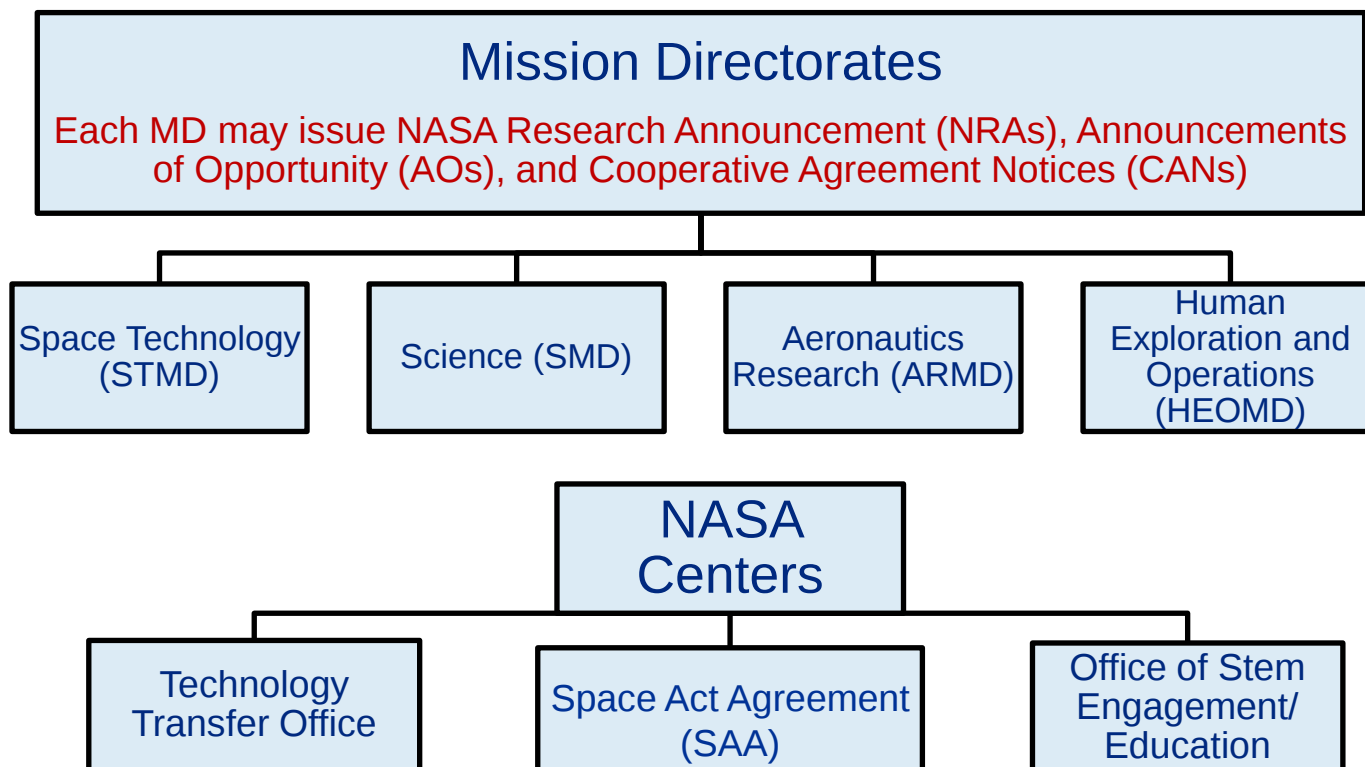
NASA Solicitation and
Proposal Integrated Review
and Evaluation System
(NSPIRES)

<https://nspires.nasaprs.com/external>

NASA Established Program to
Stimulate Competitive
Research(EPSCoR)



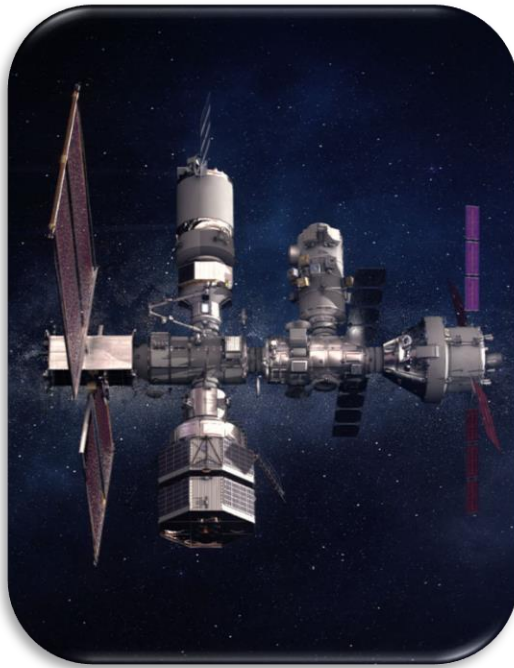
<https://www.nasa.gov/stem/epscor/home/index.html>





Human Exploration and Operations Mission Directorate (HEOMD)

Provides the Agency with leadership and management of NASA space operations related to human exploration in and beyond low-Earth orbit



Gateway



Artemis

Exploration activities beyond low Earth orbit include the management of Commercial Space Transportation, Exploration Systems Development, Human Space Flight Capabilities and Advanced Exploration Systems



Opportunities and Announcements -HEOMD

NASA Human Exploration Research Opportunities (HERO)

- Applied research supporting NASA's Human Research Program (HRP) which contains 6 elements
 1. Space Radiation
 2. Human Health and Countermeasures
 3. Exploration Medical Capability
 4. Behavioral Health and Performance
 5. Space Human Factors and Habitability
 6. International Space Station Medical Project

Awards generally range from under \$100K per year for focused, limited efforts (e.g., data analysis) to \$1M per year for extensive activities (e.g., development of scientific hardware) and will be made as grants.

NASA HEOMD Emerging Frontiers in Research and Innovation - Engineering Living Systems Solicitation –NSF Collaborative Opportunity



Space Technology Mission Directorate (STMD)

Develops transformative space technologies to enable NASA's future missions

CENTER INNOVATION FUND (CIF)

-Stimulate and encourage creativity and innovation within the NASA Centers to address technology needs of NASA and the nation

GAME CHANGING DEVELOPMENT (GCD)

-Mature high-impact capabilities and technologies to revolutionize future space missions

- Announcement of Collaborative Opportunity (ACO)
- Tipping Point

LUNAR SURFACE INNOVATION CONSORTIUM (LSIC)

-Enable human and robotic exploration on the Moon and future operations on Mars

NASA INNOVATIVE ADVANCED CONCEPTS (NIAC)

-Study early, innovative, technically credible, advanced concepts that could one day change the possible in aerospace

SPACE TECHNOLOGY RESEARCH GRANTS (STRG)

-Development of high risk/high payoff technologies to support the future space science and exploration needs of NASA, other government agencies and the commercial space sector

-STRG challenges the spectrum of academic researchers - from graduate students to tenured faculty members - to examine the theoretical feasibility of ideas and approaches that are critical to making science, space travel, and exploration more effective, affordable, and sustainable. STRG consists of competitively-selected research grants from five solicitations: Early Career Faculty (ECF), Early Stage Innovations (ESI), Lunar Surface Technology Research (LuSTR) Opportunities, Space Technology Research Institutes (STRI) and NASA Space Technology Graduate Research Opportunities (NSTGRO)

Space Technology Research Grants (STRG)



Engage Academia: *tap into spectrum of academic researchers, from graduate students to senior faculty members, to examine the theoretical feasibility of ideas and approaches that are critical to making science, space travel, and exploration more effective, affordable, and sustainable.*

NASA Space Technology Graduate Research Opportunities (NSTGRO)

- Graduate student research in space technology; research conducted on campuses and at NASA Centers and not-for-profit R&D labs

Early Career Faculty (ECF)

- Focused on supporting outstanding faculty researchers early in their careers as they conduct space technology research of high priority to NASA's Mission Directorates

Early-Stage Innovations (ESI)

- University-led, possibly multiple investigator, efforts on early-stage space technology research of high priority to NASA's Mission Directorates
- Paid teaming with other universities, industry, and non-profits permitted

Lunar Surface Technology Research (LuSTR) Opportunities

- University-led efforts addressing high priority lunar surface challenges
- Short duration, high value grants with emphasis on technology development and potential infusion
- Paid teaming with other universities, industry, and non-profits encouraged

Space Technology Research Institutes (STRI)

- University-led, integrated, multidisciplinary teams focused on high-priority early-stage space technology research for several years



NASA Selects Early Career Faculty at US Universities for Multi-Year Space Tech Research



Science Mission Directorate (SMD)

To discover and expand knowledge for the benefit of humanity

SMD MISSION

Discover the secrets of the universe. Search for life elsewhere. Protect and improve life on Earth.

Science Leadership Priorities

To achieve our goals, SMD relies on four cross-cutting priorities:



SMD science division—[Astrophysics](#), [Biological and Physical Sciences](#), [Earth Science](#), [Heliophysics](#), and [Planetary Science](#)



Opportunities and Announcements - SMD

Science Plan, Science 2020-2024: A Vision for Scientific Excellence, which may be downloaded at <https://science.nasa.gov/about-us/science-strategy>

Research Opportunities in Space and Earth Sciences(ROSES)
The Third Stand Alone Missions of Opportunity Notice (SALMON-3)

*Most Opportunities
through NSPIRES
Solicitations*



The Astrophysics Probe solicitation: far-infrared and X-ray mission designed to complement the European Space Agency's Athena mission

Research Resources: <https://science.nasa.gov/researchers>

Review Panel Volunteers: <https://science.nasa.gov/researchers/volunteer-review-panels>

Technology Resources: <https://science.nasa.gov/technology>

Flight Mission Resources: <https://soma.larc.nasa.gov>

Student Resources: <https://science.nasa.gov/learners/learner-opportunities>



Aeronautics Research Mission Directorate (ARMD)

Focused on transforming aviation to make it more sustainable and more accessible

Advanced Air Vehicles

Airspace Operations and Safety

Integrated Aviation Systems

Transformative Aeronautics Concepts

Strategic Implementation Plan

Strategic Thrust 1: Safe, Efficient Growth in Global Operations

Strategic Thrust 2: Innovation in Commercial Supersonic Aircraft

Strategic Thrust 3: Ultra-Efficient Subsonic Transports

Strategic Thrust 4: Safe, Quiet, and Affordable Vertical Lift Air Vehicles

Strategic Thrust 5: In-Time System-Wide Safety Assurance

Strategic Thrust 6: Assured Autonomy for Aviation Transformation



NASA's aeronautics research is primarily conducted at four NASA centers: *Ames Research Center* and *Armstrong Flight Research Center* in California, *Glenn Research Center* in Ohio, and *Langley Research Center* in Virginia. NRAs originate from these centers.



Opportunities and Announcements - ARMD

Advanced Air Mobility

- Request for Information (RFI) from public, private, and academic organizations to determine technical needs and community interests that may lead to future solicitations regarding AAM research and development
- Announcement of Collaboration (AOC) emphasizing commitment to support for the Advanced Air Mobility (AAM) industry and community by addressing key safety and integration barriers



Electrified Powertrain Flight Demonstration

- Flight demonstrations to rapidly mature Electrified Aircraft Propulsion (EAP) technologies and associated EAP-based vision systems for introduction into the US fleet no later than 2035

Research Opportunities in Aeronautics (ROA)-2021 NRA

- ARMD uses the NASA Research Announcement (NRA) process to solicit proposals for foundational research and is open to both industry and academia
- University Student Research Challenge

Research Opportunities in Aeronautics (ROA)

University Student Research Challenge (USRC)

- Challenge students to propose new aeronautics ideas/concepts that are relevant to NASA Aeronautics.
- USRC will provide students, from accredited U.S. colleges or universities, with grants for their projects and includes the challenge of raising a modest amount of cost share funds through crowdfunding platform.

<https://www.nasa.gov/aeroresearch/solicitations>

ARMD Resources

- Educator Resources
- NASA Internships
- Museum in a Box
- K-12 Student/Teachers
- Artifact Loan Opportunities
- Design Challenges / Competitions
- Beginners Guide to Aeronautics

<https://www.nasa.gov/aeroresearch/resources>





Office of STEM Engagement/Education

A Universe of NASA Opportunities



INTERNSHIPS

COLLEGE STEM EXPERIENCES

FELLOWSHIPS

CHALLENGES



EDUCATOR PROFESSIONAL DEVELOPMENT

NASA Glenn Faculty Fellowship Program (NGFFP)

10-week residential research program open to full-time science, technology, engineering, and mathematics (STEM) faculty members who are U.S. citizens teaching at accredited U.S. universities and colleges

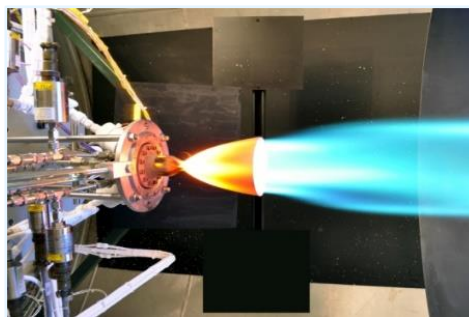
Research is aligned with one or more of NASA Glenn's six Areas of Expertise and/or cross-cutting disciplines:

Cross-Cutting Engineering Disciplines

- Fluid and Cryogenic Systems
- Thermal Systems
- Systems Engineering
- Computer Systems and Networks



Air-Breathing Propulsion



**In-Space Propulsion and
Cryogenic Fluids Management**



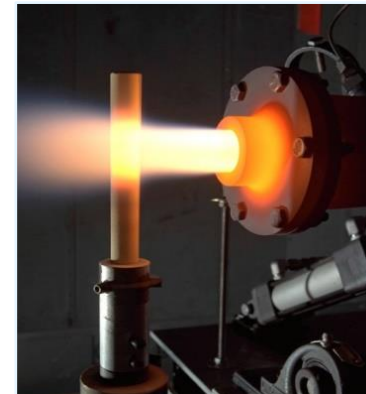
**Physical Sciences and
Biomedical Technologies in Space**



**Communications Technology
and Development**



**Power, Energy Storage and
Conversion**



**Materials and Structures
for Extreme Environments**



NASA's Office of STEM Engagement

NASA OSE, in collaboration with the Mission Directorates and Offices, issue notice of funding opportunities (NOFOs) that solicit evidence-based projects that:

- Foster formal and/or informal STEM education
- Contribute to participation by underrepresented or underserved students and education organizations that predominantly (or historically) serve individuals traditionally underrepresented in STEM careers or underserved in STEM higher education, including but not limited to minorities, women, and persons with disabilities
- Engage self-directed learners

Programs

- NASA Post Doctoral Program (NPP)
- Established Program to Stimulate Competitive Research (EPSCoR)
- Minority University Research and Education Project (MUREP)
- Engagement Opportunities in NASA STEM (EONS)
- National Space Grant and Fellowship Project
- Next Gen STEM

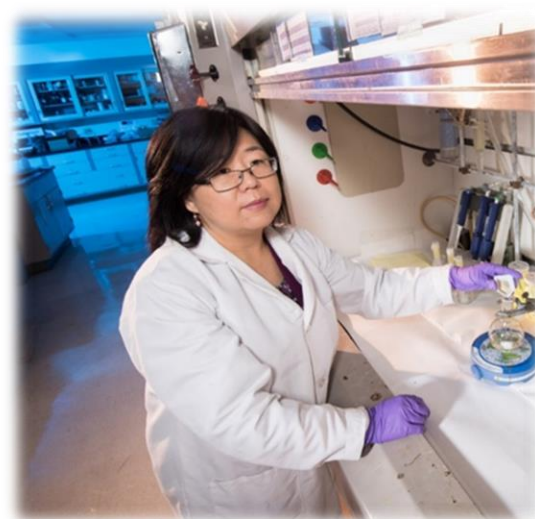




GRC Aerogel Laboratories Team



Dr. Stephanie Vivod
Polymer aerogel lead



Dr. Haiquan Guo
Senior Research Scientist



Dr. Sadeq Malakooti
NASA Post-Doc

NASA employees
Contract employees
Student interns
Summer faculty
Post Doctoral Fellows



Ariel Tokarz
Pathways Intern

Partnering with NASA



License NASA's Patents

- NASA's patents can be browsed on the Technology Transfer Program website: technology.nasa.gov
- Patents are sorted into industrially relevant categories
- Licenses come with a variety of terms depending on intended use:
 - Research license: allows licensee to "test drive" commercial viability of NASA's technologies with minimal risk
 - Government use license: allows licensee to leverage NASA technologies for government funded projects
 - Commercial license: Secure rights to make and sell products based on NASA technologies

Use NASA's Software

- NASA's software can be accessed and used for no cost via a Software Usage Agreement
- To search NASA's available software, visit the NASA Software website: software.nasa.gov

Access NASA's Facilities and Subject Matter Experts

- NASA can participate in cooperative research and development using the Space Act Agreement (SAA)
- SAAs are individually negotiated

Please reach out to NASA Glenn Research Center's Technology Transfer Office to discuss your needs:

grc-techtransfer@mail.nasa.gov

<https://technology.grc.nasa.gov>



**NASA TECHNOLOGY
TRANSFER PROGRAM**

BRINGING NASA TECHNOLOGY DOWN TO EARTH



Participate with NASA Solve

Opportunities to provide solutions to NASA and win cash awards, internships, and more



Run-way Functions: Predict Reconfigurations at US Airports

Award: \$40,000 in total prizes



Award: \$200,000 in total prizes

Opportunities to contribute ideas and help NASA with research and data



NASA is preparing for its next spaceflight simulation study and is seeking healthy participants to live together with a small crew in isolation for eight months in Moscow, Russia.





Just a few things NASA has planned for 2022



Receiving the first images from the James Webb Space Telescope



Sending the first uncrewed Artemis mission around the Moon



Flying our first quiet, supersonic plane X-59 Quiet SuperSonic Technology (QueSST)



Test new planetary defense technology Double Asteroid Redirection Test (DART) mission



GUIDE TO KEY DOCUMENTS AND SITES

- NASA Grants and Cooperative Agreements Compliance and Policy
<https://www.nasa.gov/offices/ocfo/gpc>
- NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES) can be found at the following URL: <https://nspires.nasaprs.com>
- Find NASA/OGA research grant award information : <https://www.research.gov>
- Track the progress of a grant and/or cooperative agreement prepared by the NASA Shared Services Center (NSSC) on behalf of one of the NASA Centers/HQ:
<https://www.nssc.nasa.gov/grantstatus>
- Find the NASA Online Directives Information System (NODIS) Library at the following URL:
<http://nodis3.gsfc.nasa.gov>
- Discover on-going research at GRC: <https://technology.grc.nasa.gov/>
- Glenn areas of expertise: <https://www.nasa.gov/centers/glenn/about/aboutgrc.html>
- Glenn faculty fellowship and intern opportunities:
<https://www.nasa.gov/centers/glenn/stem/nasa-glenn-faculty-fellowship-program>;
<https://intern.nasa.gov/>
- NASA Strategic Plan: [NASA Strategic Plan 2018](#)
- College/University STEM opportunities: <https://www.nasa.gov/stem/highereducation/index.html>



National Aeronautics and
Space Administration

2022

PLAN YOUR LIFE WITH
NASA SCIENCE