

**RFA****Research Focus Areas (title)**

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- RFA-002 Advanced Lithium-Ion Battery Cells: Wide operating temperature, low temperature, high temperature, high specific energy/high energy density cells, specialized electrolytes
- RFA-003 Advanced Primary Battery Cells: Includes Lithium carbon monofluoride, lithium thionyl chloride, lithium sulfur dioxide, lithium iron sulfide, high temperature cells, ultra-low temperature cells.
- RFA-005 Algorithm development for, and applications of, optical/thermal imagery for studying freshwater and coastal regions
- RFA-006 Alternative materials for magnetized liner z-pinch implosions
- RFA-007 Analytical and methodological pipelines that investigate organic molecular patterns to identify the source and physicochemical history of naturally occurring suites of compounds and developing metrics that can differentiate between biological and abiotic reaction products.
- RFA-008 Analytical and methodological pipelines that investigate the stoichiometry, elemental abundances, fluid chemistry and size distribution patterns of entrained particles in order to determine the probability for biological origin.
- RFA-009 Application of advanced materials and manufacturing to achieve above.
- RFA-010 Application of Machine Learning to LNO<sub>x</sub> Estimation from Satellite Lightning Mappers
- RFA-011 Arctic phytoplankton ecology, ocean color remote sensing and optical properties, particularly the Chukchi Sea.
- RFA-012 Artificial Intelligence (AI)/Machine Learning (ML) for Small Spacecraft Swarm Trajectory Control
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- RFA-014 Autonomous System-Level Fault Diagnosis and Mitigation
- RFA-015 Autonomy and GNC for multi-agent systems including formation flying, and spacecraft swarms
- RFA-016 Bacteria, Archaea, and Fungi are capable of altering terrestrial materials as a way to acquire organic carbon and or trace nutrients.

- RFA-017 Balloon-based remote sensing of geophysical activity on Venus using infrasound
- RFA-018 Beyond Lithium-Ion Cell Chemistries: Includes fluoride-ion, magnesium-ion, calcium-ion cell chemistries.
- RAF-102 Building Bridges in Biosciences: Creating novel teams of researchers and technologists that collaborate to advance one or more of the following space life sciences topical areas: instrumentation, facilities, databases, artificial intelligences/machine learning, and mission concepts. Proposals must demonstrate benefit to both the astrobiology and space biology communities.
- RFA-019 Charting a successful course for field campaigns on behalf of NASA missions, including coordinating and supporting laboratory analysis of field samples (particle absorption, carbon) and data processing and collection and analysis of plankton images using in-flow imaging cytometry.
- RFA-020 Chemical Heat Sources: High specific enthalpy systems including lithium-sulfur hexafluoride reactors for long-lived heat for planetary and lunar missions
- RFA-021 CO<sub>2</sub> Reduction: Electrochemical conversion of CO<sub>2</sub> to various products including carbon monoxide and ethylene.
- RFA-022 Compound screening techniques to assess efficacy in modulating responses to radiation exposure
- RFA-023 Current & projected autonomous performance capabilities and limitations
- RFA-024 Design, Development, & Implementation of Highly Automated / Autonomous Systems to abide by ethical decision making policy, standards, guidelines, and laws
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- RFA-027 Development of Characterization Techniques to Determine Rate and Temperature Dependent Composite Material Properties for the LS-DYNA MAT213 Model
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- RFA-029 Development of high-temperature refractory alloys and coatings
- RFA-030 Development of materials for extreme environments

- RFA-031 Development of Uranium based Fuels for Nuclear Thermal Rocket Propulsion
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- RFA-040 GNC:Mature guidance, navigation, and controls algorithms and hardware applied to small satellites performing inspection and rendezvous maneuvers; perform statistical studies and simulations to formulate damage probability metrics in support of a damage aware control system  
 - Mature Verification &Validation of GNC algorithms for RPOC capabilities  
 - Innovative reliable flight-ready low-cost sensors to enable rendezvous and proximity operations
- RFA-041 GNSS radio occultation (RO) for PBL
- RFA-042 High capacity anode and high capacity/high voltage cathode
- RFA-043 High power density power grids, power electronics, motors, and electromechanical powertrains
- RFA-044 High reliability and robustness for safety-critical propulsion systems including but not limited to a) arc fault protection; b) EMI/filtering; c) fault tolerant architectures; d) power management.
- RFA-045 High Temperature Batteries: Includes primary and secondary cells up to 460oC.

- RFA-046 Improved Understanding of Solar Microflares using Data Science
- RFA-099 Improvements for Entry, Descent and Landing
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- RFA-048 Inflammasome role in radiation-associated health impacts
- RFA-101 Inorganic Solid-electrolytes Processing and Scale-Up
- RFA-049 Laser Communication
- RFA-050 LEO manufacturing support (additive, advanced materials, thin layer processing)
- RFA-051 Li-ion and beyond Li-ion battery technologies such as metal-air
- RAF-103 Low Earth Orbit Downmass Concepts: Development of small, unmanned re-entry vehicle concepts that provide small volume and downmass capabilities designed to deliver products created on the International Space Station to the Earth.
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- RFA-100 Multifunctional Structural Materials for Extreme Space Environments
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- RFA-071 Printed sensors (environmental, biosensors, structural health monitoring)
- RFA-072 Propulsion : Develop propulsion technology for small satellite proximity operations maneuvers; Provide propulsion performance to meet inspection time and coverage requirements; Ensure propulsion fault tolerance for reliability

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- RFA-078 Small Spacecraft High-Bandwidth Interoperable Space Layer and Networking for Cislunar and Deep Space
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## **Mission Directorates**

**Aeronautics Research Mission Directorate (ARMD)** - 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.

**Exploration Systems Mission Directorate (ESMD)** - building the capabilities to send humans deeper into space than ever before. ESMD makes full use of the Agency's human capital expertise, with its programs, projects, elements, and integration responsibilities distributed across all NASA Centers.

**Science Mission Directorate (SMD)** - engages the Nation's science community, sponsors scientific research, and develops and deploys satellites and probes in collaboration with NASA's partners around the world to answer fundamental questions requiring the view from and into space.

**Space Operations Mission Directorate (SOMD)** - responsible for enabling sustained human exploration missions and operations in our solar system. SOMD manages NASA's current and future space operations in and beyond low-Earth orbit (LEO), including commercial launch services to the International Space Station.

**Space Technology Mission Directorate (STMD)** - responsible for developing the crosscutting, pioneering, new technologies and capabilities needed by NASA

## **NASA Centers**

NASA Headquarters, in Washington, D.C., provides overall guidance and direction to the agency. Ten field centers and a variety of installations around the country conduct the day-to-day work in laboratories, on airfields, in wind tunnels, and in control rooms. Together, this skilled, diverse group of scientists, engineers, managers, and support personnel share the vision, mission, and values that are NASA.

### **Ames Research Center (ARC)**

Since 1939, NASA's Ames Research Center (Moffett Field, California) has led NASA in conducting world-class research and development in aeronautics, exploration technology and science aligned with the center's core capabilities. Ames is home to unique facilities and capabilities including the world's largest wind tunnel, NASA's fastest supercomputers, NASA's only arc jet facility for re-entry testing and the world's largest motion-based flight simulator.

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

The Armstrong Flight Research Center (Edwards, California) is NASA's primary center for high-risk, atmospheric flight research and test projects. The center has the facilities and requisite expertise to conceive, design, analyze, fabricate, integrate, maintain and conduct disciplinary research, flight research and flight test on modified or unique research vehicles and systems.

### **Glenn Research Center (GRC)**

The NASA Glenn Research Center (Cleveland, Ohio) designs and develops innovative technology to advance NASA's missions in aeronautics and space exploration. Glenn's expertise is focused on research and development of innovative technologies for both aeronautics and space exploration. Its unique facilities enable NASA, other government agencies, and academic and industry partners to perform specialized research and testing.

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

NASA's Goddard Space Flight Center (Prince Georges County, Maryland) plays a pivotal role across all aspects of the agency's missions, from development to de-orbit. Goddard's missions support multiple scientific disciplines, including Earth science, solar science and the sun-Earth environment, planetary studies and astrophysics. Goddard is the operational home of the venerable Hubble Space Telescope. Goddard also surveys the Moon with LRO and watches our Sun with the Solar Dynamics Observatory and Parker Solar Probe.

The NASA Goddard Space Flight Center's Wallops Flight Facility (Wallops Island, Virginia) is the agency's premier location for conducting research using suborbital vehicles (i.e., aircraft, scientific balloons and sounding rockets). As NASA's only rocket launch range, Wallops has launched more than 16,000 rockets carrying aircraft models, space and earth science experiments, technology development payloads, and satellites. Partnering with academia, industry and other government facilities, Wallops is a test site for the development of unmanned aerial vehicle use in the national airspace system.

### **Jet Propulsion Laboratory (JPL)**

The Jet Propulsion Laboratory (Pasadena, California) is a unique national research facility that carries out robotic space and Earth science missions. JPL developed the first Earth-orbiting science satellite, created the first successful interplanetary spacecraft, and deployed robotic missions to study all of the planets in the solar system, as well as



asteroids, comets and the moon. JPL also developed and manages NASA's Deep Space Network, a worldwide system of antennas that communicates with interplanetary spacecraft.

### **Johnson Space Center (JSC)**

NASA's Lyndon B. Johnson Space Center (JSC) is the home of mission control and astronaut training (Houston, Texas). In its early days, the center led the Gemini, Apollo, Apollo-Soyuz and Skylab projects. JSC was the home of NASA's Space Shuttle Program from 1981 to 2011, and currently leads International Space Station operations and missions, development of the Orion spacecraft and NASA's Gateway outpost program, as well as numerous other advanced human exploration projects. The center also plays an important role in NASA's Commercial Crew program.

### **Kennedy Space Center (KSC)**

The John F. Kennedy Space Center (Cape Canaveral, Florida) has been NASA's primary launch center of human spaceflight. Launch operations for the Apollo, Skylab and Space Shuttle programs were carried out from Kennedy Space Center on the east coast of Florida. Additionally, the center manages launch of robotic and commercial crew missions and researches food production.

### **Langley Research Center (LaRC)**

The oldest of NASA's field centers, Langley Research Center (Hampton, Virginia) focuses on aeronautical research that is helping researchers improve aviation, advance understanding of Earth's atmosphere, and expand technology for space exploration. Langley Research Center performs critical research on aeronautics, including wake vortex behavior, fixed-wing aircraft, rotary wing aircraft, aviation safety, human factors and aerospace engineering.

### **Marshall Space Flight Center (MSFC)**

For more than six decades, NASA's Marshall Space Flight Center (Huntsville, Alabama) has delivered propulsion systems and hardware, launch vehicles, space systems, engineering technologies, and research projects that are making space exploration possible. Today, Marshall engineers, scientists and researchers are advancing developments in the areas of space transportation and propulsion, space habitats and planetary landers, as well as breakthroughs in complex space systems and scientific research.

### **Stennis Space Center (SSC)**

John C. Stennis Space Center (Hancock County, Mississippi) is one of 10 NASA field centers in the United States. Because of its important role in engine testing, Stennis is NASA's program manager for rocket propulsion testing with total responsibility for conducting and/or managing all NASA propulsion test programs. Stennis is the premier test complex where engines for all manned Apollo and space shuttle flights have been tested, as well as next-generation engines and rocket stages for NASA's new Space Launch System (SLS) that will carry humans aboard deeper into space than ever before.