Exploration Research and Technology Programs

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University Partnerships/Small Sat Capabilities, UB-I
NASA Kennedy Space Center

Old Dominion University (ODU) REYES Program, June 26th, 2020
Agenda

• NASA’s Plans for going back to the Moon – Artemis
• Who we are (KSC Swamp Works)
• KSC Research & Technology Portfolio (focus areas)
• Programs that Research & Technology supports
• NSPIRES & KSC Research Opportunities
• Undergraduate, Graduate, and Post-Graduate Fellowships
# Integrated Artemis Manifest: 2019-2024

<table>
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<th>Year</th>
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<td><strong>Sustainable Low-Earth Capability</strong></td>
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<td>Commercial Crew Test Flights and Certification</td>
<td>Other LEO Commercialization Activities (in-wait)</td>
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<td><strong>Sustainable Lunar Surface Exploration</strong></td>
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- **CLPS opportunity**
- **Candidate Tech Insertion Opportunities**
- **Enhanced Science and Exploration Capability**
- **Human Lunar Landing**
- **3 CLVs & Surface Logistics**
- **HPSC, ISRU, NDL, ISRU, Nex, Detection, CFM, & TRN**
- **ISRU & Nuclear Surface Power**

**Current draft as of 5/21/2019**
Artemis Phase 1: Path to The Lunar Surface

Artemis I: First human spacecraft to the Moon in the 21st century

Artemis II: First humans to orbit the Moon in the 21st century

Artemis Support Mission: First high-power Solar Electric Propulsion (SEP) system

Artemis Support Mission: First pressurized module delivered to Gateway

Artemis Support Mission: Human Landing System delivered to Gateway

Artemis III: Crewed mission to Gateway and lunar surface

Commercial Lunar Payload Services - CLPS-delivered science and technology payloads

Early South Pole Mission(s)
- First robotic landing on eventual human lunar return and In-Situ Resource Utilization (ISRU) site
- First ground truth of polar crater volatiles

Large-Scale Cargo Lander - Increased capabilities for science and technology payloads

Humans on the Moon - 21st Century
First crew leverages infrastructure left behind by previous missions

LUNAR SOUTH POLE TARGET SITE

2020 - 2024
Gateway Enables Lunar and Mars Exploration

- Minimum systems required to support a 2024 human landing while also supporting Phase 2
- Command center and aggregation point for 2024 human landing
- Strategic presence around the Moon
- Resilience sustainability and robustness in the lunar architecture
- Open architecture and interoperability standards are building blocks for partnerships and future expansion
Let’s go. 
*The time is now.*

We have the capability
We have the purpose
We have the charge
We have the responsibility

Let’s create history
WHO WE ARE AND WHAT WE DO

SWAMP WORKS
Swamp Works is an Innovative Research Environment
that strives to use rapid, lean, cost effective approaches.

- 4 Laboratory Capabilities with different focus areas
- High bay lab area:
  - Technology incubator area — spaces for new project ideas to grow
  - Lunar Regolith (moon dirt) Test Bin
  - Machine Shop
  - Innovation Space — loft area with white boards for brainstorming
  - Outdoor rock yard for testing robots
Granular Mechanics and Regolith Operations (GMRO) Laboratory
Development of technologies for working with regolith (surface material) on other bodies in space and studying their basic physics and geology.

Applied Chemistry Laboratory (ACL)
Chemical solutions for in situ resource utilization, leak detection, precision cleaning, oxygen recovery, environmental remediation, and more.

Electrostatics and Surface Physics Laboratory (ESPL)
Investigation of electrostatics and surface physics with applications for spaceflight and planetary exploration. Detecting and preventing electrostatic discharge.

Advanced Materials and Systems Area
Polymer science, materials chemistry, and novel composite systems for space applications. Technologies include, among others, aerogel composites, smart thermal materials, chemochromatic gas sensing materials, and carbon nanotube and conductive polymers.

Applied Physics Laboratory (APL)
Development of instrumentation, sensors, and tools for spaceport ground processing on Earth and for in situ space resource utilization on the moon and Mars.

Corrosion Technology Area
Applied research and testing for all areas of corrosion, including material performance and degradation in various environments, and new corrosion detection and control technologies.

**AREAS OF FOCUS**

Our mission is to provide government and commercial space ventures with the technologies they need for working and living on the surfaces of the Moon, planets, and other bodies in our solar system.
KSC’s Research & Technology Portfolio

• Aligned to KSC Primary Center roles & Supporting Center roles (red letters A-W on the next two pages)
• Communicates to University PIs & Commercial entities, R&T areas that KSC is interested in collaborating
KSC R&T Portfolio Alignment to “Primary” Center Roles

HUMAN EXPLORATION & SPACE OPERATIONS
- Space Systems Development & Operations
  - Commercial crew systems development, including Commercial Crew Systems Program

SPACE & EARTH SCIENCE
- Flight Missions
  - Expendable Launch Vehicles for small, medium and large class missions

CROSSCUTTING TECHNICAL CAPABILITIES
- Discipline Capabilities
  - Propulsion: Chemical propulsion flight integration

Ground Operations and Services
- Acquisition of launch services, and commercial crew when development complete, including Launch Services Program
- Designing, developing, operating, sustaining flight and ground systems and support infrastructure, including Ground Systems Development and Operations Program
- Launch processing for launch vehicle and spacecraft: Processing, servicing, maintenance, command, control, telemetry, launch, landing, recovery; also includes support for processing crew (work to maximize shared equipment with GSFC/WFF)
- Launch range: Orbital (work to maximize shared equipment with GSFC/WFF)

ISS
- Payload and flight science experiments: process, integration, test

Gateway
- Logistics Element Management, including cislunar logistic systems development and services

Storage, distribution, and conservation of cryogenic fluids and commodities
- Tools and techniques for control, operation, inspection, analysis and repair
- Environmental and Green Technologies
- Health and Safety Systems for Operations
- Communications and Tracking Technologies
- Robotic, automated and autonomous systems and operations
- Operations Support and Advanced Studies leveraging Primary Center Role expertise
- Payload Processing & Integration Technologies (all class payloads)
- R&T Technologies on In-Space Platforms (e.g., ISS, Gateway, Human Habitats)
- Logistics
- Damage-resistant and self-healing materials

NOTE: R&T Focus Areas (A-K) are described in the R&T Portfolio Data Dictionary
KSC R&T Portfolio Alignment to "Primary" & "Supporting" Center Roles (Center Roles Per NPD 1003.E, “The NASA Organization”, Section 6.2 – June 2019)

HUMAN EXPLORATION & SPACE OPERATIONS

- Research
  - Plant Research and Production
    - Water/nutrient recovery and management
    - Plant habitats and Flight Systems
- Technology and Development
  - Biological Sciences (Plant Research and Production)
  - Food production and waste management
  - Robotic, automated and autonomous food production
- Space Systems Development & Operations
  - In Situ Resource Utilization (ISRU)
    - Habitation
      - Plant habitats: manual and autonomous
      - Robotic, automated and autonomous food production

CROSSCUTTING TECHNICAL CAPABILITIES

- Discipline Capabilities
  - Materials: Polymer matrix composites processing for center mission needs only
  - Damage-resistant and self-healing materials
  - Automated and autonomous detection and repair
- Service Capabilities
  - Propulsion: Chemical Propulsion flight integration (human transportation)
- Space Environments Test: Right/West Altitude Chamber

NOTE: R&T Focus Areas (K-Z) are described in the R&T Portfolio Data Dictionary

Scientific Instruments

- Resource Acquisition – Regolith/Trash & Gases Liquids
  - Distribution and Storage of In Situ Resources
  - In Situ Construction such as Landing pads, Roads and Berms
- Resource Assessment/Prospecting

Exploration Research and Technology Programs
8/10/2019
Programs Supported

- International Space Station (ISS) Program
- Space Technology Mission Directorate (STMD)
- Space Life and Physical Sciences Research and Applications
- Human Research Program (HRP)
- Advanced Exploration Systems (AES)
International Space Station (ISS) Program
Wingspan End-to-End -- **361 feet**
Operating Altitude -- **220 mile average**
Length -- **199 feet (pressurized modules)**
Weight -- **Approx. 925,000 lbs.**

Inclination -- **51.6 degrees to the equator**
Volume -- **Approx 34,000 c.f. of pressurized living space**
Crew -- **Up to 6 people**
Atmosphere -- **14.7 pounds per square inch (same as Earth)**
Speed -- **17,500 mph orbiting the Earth 16 times a day**

https://spotthestation.nasa.gov
Sizemodo: How big is the International Space Station?

- 20 m.

- Colonial Viper Mk II: 8.7 meters

- International Space Station: 107.4 meters

- Corellian corvette: 150 meters

- USS Enterprise (NCC-1701-A): 268.6 meters

- Battlestar Galactica (New Series): 615 meters
Space Station Processing Facility

- High Bay
  - 38,000 ft\(^2\) Class 100K clean work area
  - 8 footprints, completely reconfigurable
  - Available commodities include 208V/480V power, chilled water, GN\(_2\), GHe, LN\(_2\)
  - Two 30-ton electrical bridge cranes with 50-ft hook height

- Intermediate Bay
  - 17,000 ft\(^2\) Class 100K clean area
  - Two 5-ton electrical bridge cranes with 25-ft hook height

- Airlock
  - 5000 ft\(^2\) Class 300K clean area
  - 15-ton electrical bridge crane with 50-ft hook height

- Administrative Space
  - Office Space for approximately 1000 employees
  - 25 Conference Rooms

- Specialty Areas
  - Off-Line Processing Rooms
    - 21 Science Labs/Hardware Labs, 3 Central Services Labs
    - 9 control rooms located on raised floor areas
  - Vapor Containment Facility to house liquid anhydrous ammonia

- Special Provisions
  - Uninterruptable Power Supplies
  - Redundant Power Feeds
  - Dual Automatic Starting Backup Generators
  - Portable Backup HVAC Chiller
ISS Orbital Replacement Unit (ORU) Processing and Logistics Support

- ORU/Payload Processing

- KSC is the primary Logistics Depot for the ISS Program
  - Maintenance and Repair
  - Tool Crib, Inventory Management
  - Handling and Storage, Materials and consumables
  - Flight and non-flight cable design and build

- KSC provides shipping and transportation (including international) for ISS flight hardware, equipment, and materials
  - Packaging, Shipping and Receiving, Transportation

- Procurement, Property Management, Logistics Engineering, Training
Nitrogen & Oxygen Recharge System (NORS)
Lithium Ion Batteries
Orbital ATK (now NG) in SSPF High-Bay
Orbital ATK (now NG) in SSPF High-Bay
Space Technology Mission Directorate (STMD)
Space Technology Mission Directorate (STMD)

**Low TRL Technology Research & Development**
- Space Technology Research Grants Program
- NASA Innovative Advanced Concepts (NIAC) Program
- Center Innovation Fund Program

**Mid TRL Technology Development**
- Game Changing Development Program
- Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) Program

**High TRL Technology Capability Demonstrations**
- Flight Opportunities Program
- Technology Demonstration Missions Program
- Centennial Challenges Prize Program
- Small Spacecraft Technologies Program
Continues maturation of promising low TRL technologies from CIF, SBIR, etc...

**Technology Development**
- Game Changing Development (GCD)

**Technology Demonstrations**
- Technology Demonstration Systems
- Small Spacecraft Technologies

**Commercial Partners Portfolio**
- Flight Opportunities (FO)
- Centennial Challenges (CC)
- SBIR/STTR
- Reg. Economic Development (RED)

**STMD Technology Pipeline**

**Early Stage Portfolio**
- NASA Innovative Advanced Concepts (NIAC)
- Space Technology Research Grants (STRG)
- Center Innovation Fund (CIF)

**Technology Demonstrations**
- Technology Demonstration Systems
- Small Spacecraft Technologies
In-Situ Resource Utilization (ISRU)

Like explorers before us, we don’t need to carry everything with us. In-situ resource utilization, or ISRU, is the idea of harnessing resources available at our destination, whether it is the Moon, Mars, an asteroid, or elsewhere.
A unique indoor facility featuring 120 tons of regolith simulant to support surface systems testing, especially in the area of robotic mining.
In Situ Resource Utilization (ISRU)

- There is a great expense required to lift mass into orbit and beyond; how can we explore with less launched-mass?
- The solar system contains abundant resources; the atmosphere and soils of Planetary bodies. And sunlight!
- ISRU will mine these resources and convert them to mass saving commodities.
- We also look at converting wastes to useful commodities.
- If we want to pioneer in the solar system, we must use the resources that are in abundance!
Regolith & Atmosphere-Derived Resources

The primary resources and products that we have studied:

- Oxygen from regolith
- Water from soil volatiles
- CO₂ from atmosphere (Mars)
- Construction materials based on regolith (radiation shielding, landing pads)
- Berms, trenches and other excavation structures
- Regolith for greenhouse soils
- Metals from regolith
- Plastics from soil volatiles
- Food and oxygen from plants
Space Life and Physical Sciences Research and Applications (SLPSRA)
KSC Space Biology Support

- Provide management of NASA Research Announcement (NRA) awarded PI grants and Project Scientist support - NRA period of performance is typically 3 years

- Provide science support for GeneLab and Microbial Observatory

- Support science management/planning
  - Cost to develop Experiment Unique Equipment (EUE), Science support, PI grants, and science management
  - Science research requirements – Science Requirements Envelope Documents (SRED), Experiment Requirements Documents (ERD)
  - Payload experiment specific hardware and software development, Research results reporting science return

- Provide capability to support KSC Space biology pre-flight and ground control testing.

- Provide hardware capability responsive to Science requirements
  - Multi Spectrum Fluorescence Imager, BRIC LED Upgrade, Advanced Plant Habitat
  - Food Production for Gateway and Transit Vehicle, Science support for alternate platforms
Growing Food in Space

Red Lettuce
Swiss Chard
Radish
Snow Pea
Dwarf Chinese Cabbage
Packaged Foods Commonly Used on ISS

Fresh Foods that Could be Grown *In Situ*

- Dwarf Tomato and Pepper
- Leafy Greens
  - Chard, Lettuce
  - Chin. Cabbage, Mizuna
From VEGGIE to Planetary Surface

VEGGIE 0.15 m²

Surface System Food Production Module (20 m²)

Double Rack Type Growth Unit (2.0 m²)

MPLM-like Module (10 m²)
Human Research Program (HRP)
HRP Elements Click here

- Human Factors and Behavioral Performance (HFBP)
  - Characterizing & mitigating human factors and behavioral risks

- Exploration Medical Capability (ExMC)
  - Identifying & testing next-generation medical care

- Human Health Countermeasures (HHC)
  - Countermeasures for detrimental effects on human health

- Research Operations & Integration
  - Assessing long-duration spaceflight for optimal crew performance

- Space Radiation
  - Assessing safe working in space without exceeding acceptable radiation limits
KSC Support - HRP Baseline Microbial Assessment of Fresh Produce

- Microbial assessment of produce
  - Compare commercially available (right) field or greenhouse grown to growth chamber grown (below)
  - Conduct for tomato, lettuce, and pepper
  - Develop baseline for microbial standards
Advanced Exploration Systems (AES)
AES FY20 KSC Activities

Habitation Systems Domain
- NextSTEP Habitation Systems

Robotic Systems Domain
- MSOLO to VIPER

Vehicle Systems Domain
- Tank Health Monitoring

Foundational Systems Domain
- KARNAC- Ka band Array Radar for NEO Accurate Characterization

Strategic Operations Domain
- CubeSat Launch Initiative
Small Satellite capabilities

- We are open for business
  - Small class vehicle vertical launch capability
  - Horizontal launch and re-entry
  - Launch Control Center
  - Launch Telemetry and Communication Services
  - Launch Imagery Products and Analysis
- Processing Resources
  - Technical Facilities and laboratories, including clean-room facilities
  - Vehicle Integration and Processing Facilities
  - Flight Hardware Assembly, Launch equipment integrated testing
  - Mock-ups, fit checks, simulations, Test and checkout services
  - Pre-flight inspections and check-out
Small Satellite capabilities (cont.)

- Processing Resources (cont.)
  - Closeout inspections and Crew equipment interface test
  - Fluid Services
  - Payload and spacecraft fueling

- Scheduling, Coordination, and Unique Kennedy Services
  - Integrated scheduling, Range coordination
  - Permitting, Site Planning
  - Transportation, Heavy equipment
  - Safety and engineering
  - Ordnance storage and transport
  - Environmental planning and equipment support
  - Guest operations and media support

- Consulting Services
  - 50 years of operational experience
  - Customer advocates to help you navigate
  - Unmatched scientific and technical support
  - Science and technology objectives
  - Payload development, test, and check-out
  - Payload processing, integration, and on-orbit operations
We Want YOU To get Involved!
NSPIRES

- NASA solicits research through the release of various research announcements in a wide range of science and technology disciplines
- All research solicitations advertise and receive proposals through NSPIRES, although other solicitations do go thru: [https://beta.sam.gov](https://beta.sam.gov) (e.g. CSLI) and others thru Small Business Innovative Research (SBIR) [https://sbir.nasa.gov](https://sbir.nasa.gov)
- Subscribe to NSPIRES to stay up-to-date on current and future opportunities
  - Learn about previous awardees and read successful abstracts
- Register and access NSPIRES here: [http://nspires.nasaprs.com/](http://nspires.nasaprs.com/)
- Additional information here: [https://science.nasa.gov/researchers/sara/how-to-guide/nspires-registration](https://science.nasa.gov/researchers/sara/how-to-guide/nspires-registration)
ROSES & You

• Research Opportunities in Space and Earth Science (ROSES), an omnibus solicitation for proposals
•Typically released on Valentine’s Day, February 14
•Includes opportunities for Basic and Applied Research, Technology Development, Guest Investigator Programs, and Early Career Programs in support of NASA Science
•Contains many individual program elements, each with its own due date and topics
•Subscribe to NSPIRES RSS feed and mailing lists for updates, amendments, and clarifications to program elements
•ROSES How To Guide can be found at https://science.nasa.gov/researchers/sara/how-to-guide
Peer Review Panels

• NASA Science makes decisions based on competition and peer review

• Volunteering on a review panel is highly encouraged
  o Opportunity to learn how to write successful proposals
  o NASA provides honorarium for participants

• More information on how to volunteer here: https://science.nasa.gov/researchers/volunteer-review-panels
Funding Opportunities: Grant Solicitations

- Table 2 with all program elements organized by due date may be found at [http://solicitation.nasaprs.com/ROSES2019table2](http://solicitation.nasaprs.com/ROSES2019table2).
- Table 3 with all program elements organized by subject matter may be found at [http://solicitation.nasaprs.com/ROSES2019table3](http://solicitation.nasaprs.com/ROSES2019table3).
- The FAQ on what’s new in ROSES-2019 has been posted at [http://science.nasa.gov/researchers/sara/faqs/#1](http://science.nasa.gov/researchers/sara/faqs/#1).
- We have a few ways for proposers to keep up to date with changes to ROSES-19. You may:
  - Subscribe to the SMD NSPIRES mailing lists (by logging in at [http://nspires.nasaprs.com/](http://nspires.nasaprs.com/) and checking the appropriate boxes under Account Management and Email Subscriptions).
  - Subscribe to the relevant ROSES-2019 due date Google calendars. Instructions have been posted at [http://science.nasa.gov/researchers/sara/library-and](http://science.nasa.gov/researchers/sara/library-and).
NSPIRES Proposals/NOIs due in the next 30 days

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

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<td>NNH20ZDA001N-ACT</td>
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<td>NNH20ZDA001N-DALI</td>
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## NSPIRES Proposals/NOIs due in the next 30 days

[https://nspires.nasaprs.com/external/](https://nspires.nasaprs.com/external/)

| C.4 Planetary Data Archiving, Restoration, and Tools | NNH20ZDA001N-PDART | 02/14/2020 | – | 07/24/2020 |
| Commercial SmallSat Data Analysis | NNH20ZDA001N-CSDA | 02/14/2020 | 07/01/2020 | 09/01/2020 |
| D.2 Astrophysics Data Analysis | NNH20ZDA001N-ADAP | 02/14/2020 | – | 07/16/2020 |
| D.4 University Leadership Initiative (ULI) | NNH19ZEA001N-ULI | 06/30/2019 | – | 06/30/2020 |
| Ecological Forecasting | NNH20ZDA001N-ECOF | 02/14/2020 | 07/17/2020 | 08/14/2020 |
| Fermi Guest Investigator Cycle 13 | NNH19ZDA001N-FERMI | 03/14/2019 | – | 07/17/2020 |
| Health and Air Quality Applied Sciences Team | NNH20ZDA001N-HAQ | 02/14/2020 | – | 06/30/2020 |
| Heliophysics Data Environment Enhancements | NNH20ZDA001N-HDEE | 02/14/2020 | – | 07/01/2020 |
NSPIRES Proposals/NOIs due in the next 30 days

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

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<td>NASA Innovative Advanced Concepts (NIAC) Phase I</td>
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<td>04/29/2020</td>
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<td>80HQTR20NOA01-20STMD_001</td>
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NASA Challenges

NASA Solve [Click here]

- One-stop-shop website is where you’ll find opportunities to participate in challenges, prize competitions, and citizen science activities that develop solutions for problems related to NASA’s mission.

[Images of Growing Beyond Earth Maker Contest, Artemis Student Challenges, and 2020 Revolutionary Aerospace Systems Concepts]
This effort will seek a potential partner who will provide service in support of developing technology. The cooperative agreement award recipient is expected to cooperatively share in the development cost of the technology that meets the specified NASA interest, and interact with the appointed KSC contact on a regular basis.

Eligibility: U.S. organizations, including educational institutions, industry and nonprofit institutions

Key Dates:

- Next funding opportunity: Fall/Winter 2021
- Approximate Award Duration: 12 months; Expected Typical Award Amount: $30K
NASA Research Opportunities

**NASA Small Business Innovative Research (SBIR)/Small Business Technology Transfer (STTR)**

[https://sbir.nasa.gov/](https://sbir.nasa.gov/)

- The SBIR and STTR Solicitations are produced annually in partnership with NASA’s Mission Directorates and Centers to focus on the Agency’s priority mission needs.

- Twenty-four (24) SBIR/STTR Research Topics
  - Focus Area 8 – In-Situ Resource Utilization
  - Focus Area 16 – Ground & Launch Processing
  - Focus Area 24 – Dust Mitigation

**Key Dates:**

- **Solicitation Open:** January 21\(^{st}\) to April 20\(^{th}\), 2021
NASA Research Opportunities

• NASA 2020 STMD SmallSat Technology Partnerships (STP) solicitation
  o https://tinyurl.com/NASA-20STP-S1

Goal/Intent: This appendix supports the development and/or demonstration of new technologies and capabilities for small spacecraft by U.S. colleges and universities in collaboration with NASA through award of cooperative agreements. Projects may be for ground-based technology development or development of spacecraft or payloads for suborbital, balloon or orbital space flight technology demonstrations.

Partnering between the university team and a NASA center or Jet Propulsion Laboratory (JPL) is required in all funded Smallsat Technology Partnership projects.

Key Dates:

The STP solicitation came out Wednesday, 9/11/2019
NOIs due: 10/4/2019
Proposals due: 11/6/2019
Technical Evaluations begin: 11/8/2019
Selections publicly announced (target): 1/22/2020
Awards issued (target): 3/25/2020
NASA Research Opportunities

- **ROSES-19 Amendment 36, Program Element D.12 Astrophysics Science Smallsat Studies**
  - [https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7bC27DE928-1E00-A5C1-D184-EC7AA4143196%7d&path=&method=init](https://nspires.nasaprs.com/external/solicitations/summary.do?solId=%7bC27DE928-1E00-A5C1-D184-EC7AA4143196%7d&path=&method=init)

**Goal/Intent:** This program element solicits proposals for 6-month studies of spaceflight mission concepts that can be accomplished for low cost using small spacecraft in standard form factors, including CubeSats, CubeSat constellations, and secondary (RideShare) payloads launched as ESPA and ESPA-grande ring compatible spacecraft.

Relevance of the proposed mission concept’s science investigation to NASA astrophysics objectives as demonstrated by linkages between the mission concept objectives and the 2014 NASA Science Plan [https://science.nasa.gov/about-us/science-strategy/](https://science.nasa.gov/about-us/science-strategy/)

**Key Dates:**
Notices of intent to propose are not requested.
The due date for proposals is December 19, 2019.
NASA Research Opportunities

- **NASA CubeSat Launch Initiative (CSLI)**
  - [https://www.fbo.gov/index?s=opportunity&mode=form&tab=core&id=0a3d394f81862b775dfeba69176f219](https://www.fbo.gov/index?s=opportunity&mode=form&tab=core&id=0a3d394f81862b775dfeba69176f219)

- The CubeSat Launch Initiative (CSLI) will provide or facilitate flight opportunities as secondary payloads on launches, as well as deployments from the International Space Station, currently planned for 2020-2023.

**Key Dates:**

- Solicitation Number: NNH19ZCQ001O
- Reference Number: N/A
- NAIS Posted Date: ~Aug 5, 2020
- Posted Date: ~Aug 5, 2020
- **Response Date: ~Nov, 2020**
NIAC Phase I

- [https://nspires.nasaprs.com/external/](https://nspires.nasaprs.com/external/)

NASA Innovative Advanced Concepts (NIAC) Phase I seeks proposals for early stage feasibility studies of visionary concepts that address national government and commercial aerospace goals. Concepts are solicited from any field of study that offers a radically different approach or disruptive innovation that may significantly enhance or enable new human or robotic science and exploration missions. Comparatively high risk and far term, NIAC concepts are transformational investments in future NASA and commercial space capabilities. The entry Technology Readiness Level (TRL) for Phase I concepts should be TRL 2 or lower.

**Key Dates:**

- **Proposer’s Virtual Forum:** June 18th, 2020
- **Step A Proposal Due:** July 22nd, 2020
- **Step B Invitations Issued:** August 25th, 2020 (Target)
- **Step B Proposal Due:** September 29th, 2020 (Target)
- **Selection Announcement:** February 12th, 2021 (Target)

**Approximate Award Duration:** 9 months; **Expected Typical Award Amount:** $125K; **Expected # of Awards:** 12-16
Undergraduate and Graduate Research Opportunities

**NASA Internships** allow students to work directly with NASA. Many of these positions provide stipends and opportunities are available throughout the academic year.

- One term internship opportunity: For more information, visit: [http://Intern.nasa.gov](http://Intern.nasa.gov)
  - Application Deadline: Fall 2020 – July 6th, 2020

- Pathways: For more information, visit: [https://www.nasa.gov/careers/pathways-program](https://www.nasa.gov/careers/pathways-program)
  - Application Deadline: Throughout the year

**Full Time Job:** Go to [https://usajobs.gov](https://usajobs.gov)

**NASA's Summer Undergraduate Program for Planetary Research (SUPPR)** is an eight-week summer internship that provides undergraduates the opportunity to participate in NASA planetary geosciences research under the direction of a NASA-sponsored investigator. For more information, visit: [https://www.lpi.usra.edu/suppr/](https://www.lpi.usra.edu/suppr/)

- Application Deadline: ~January, 2021
Undergraduate and Graduate Research Opportunities

**NASA’s Student Airborne Research Program (SARP)** is an eight-week summer program for rising seniors to acquire hands-on research experience onboard NASA Earth-observing aircraft. For more information, visit: [https://airbornescience.nasa.gov](https://airbornescience.nasa.gov)

- Application Deadline: January 20th, 2020

**Future Investigators in NASA Earth and Space Science and Technology (FINESST)** invites proposals for graduate student-developed research or technology projects. [Click here](#)

- Application Deadline: February 4th, 2020
Undergraduate and Graduate Research Opportunities

Florida Universities - Senior Design Projects for Kennedy Space Center - Professors teaching/administering these courses can find suitable topics/projects which lend themselves to completion in either one semester (15 weeks) or two (30 weeks).

- The projects listed have been proposed by KSC engineers and scientists and are available to Florida colleges and universities. However, only US citizens are eligible to participate in the senior design project.

- To choose one of the listed projects and to qualify for NASA funding, your team and faculty advisor must first complete a one/two-page proposal using the template and send it to: Dr. Jaydeep Mukherjee, Director of the Florida Space Grant Consortium (FSGC) at jaydeep.mukherjee@ucf.edu by September 2020.
Undergraduate and Graduate Research Opportunities

NASA Fellowship Activity [Click here]

- Solicits proposals from accredited U.S. institutions for research training grants to begin in the 2020-2021 Academic Year. This NRA is designed to support independently conceived research projects by highly qualified graduate students, in disciplines needed to help advance NASA’s mission, thus affording these students the opportunity to directly contribute to advancements in STEM-related areas of study.

- Fellowship (Training grant) is 3 to 4 years (3 years with a possibility of a fourth year for doctoral Fellows)

**Key Dates:**

- Pre-proposal conference: February 5th, 2020, TBD for 2021
- Application Deadline: February 21st, 2020, TBD for 2021
Post-Doc & Early Career Research Opportunities

The NASA Postdoctoral Program (NPP) offers fellowships to pursue research at NASA Centers or NASA-affiliated institutions. Although primarily for recent doctoral graduates, ‘senior’ NPP fellowships may also be awarded. For more information, visit: https://npp.usra.edu

- Application Deadline: March 1st, 2020

NASA DEVELOP is a training program that allows recent graduate and early career professionals to apply NASA Earth observations to interdisciplinary projects involving government, nonprofits, and other organizations, while being mentored by NASA science advisors. For more information, visit: https://develop.larc.nasa.gov

- For Summer 2020 Term: Application Deadline: February 28th, 2020

The NASA Hubble Fellowship Program (NHFP) supports postdoctoral scientists to pursue independent research in any area of NASA Astrophysics, using theory, observation, experimentation, or instrumental development. For more information, visit: http://nhfp.stsci.edu

- Application Deadline: November 4th, 2019
Post-Doc & Early Career Research Opportunities

The Roman Technology Fellowship in Astrophysics provides early career researchers the opportunity to develop skills necessary to develop and lead astrophysics flight instruments/projects. Solicitation for 2019 is closed, keep an eye out on NSPIRES early 2020 (Jan/Feb).

The New Investigator Program in Earth Science, Heliophysics Early Career Investigator Program, Early Career Award Program, and Early Career Fellowship Startup Program for Named Fellows support research and leadership development for early career scientists and engineers in these disciplines. Opportunities will be announced at https://nspires.nasaprs.com/external.

The NASA Space Technology Graduate Research Opportunities – Fall 2020 (NSTGR020) For the tenth consecutive year, the National Aeronautics and Space Administration’s (NASA) Space Technology Mission Directorate (STMD) seeks to sponsor U.S. citizen, U.S. national and permanent resident graduate student research that has significant potential to contribute to NASA’s goal of creating innovative new space technologies for our Nation’s science, exploration, and economic future.

- [https://tinyurl.com/NSTGRO20](https://tinyurl.com/NSTGRO20)
- Application Deadline: November 5th, 2019
Mission Principal Investigator (PI) Development

• Seek to increase the diversity of mission principal investigators and develop the next generation of mission leaders to ensure that new ideas and mission concepts are brought forward

• Based on feedback from November 2018 workshop, NASA Science
  • Developed a consolidated PI resources webpage at [https://science.nasa.gov/researchers/new-pi-resources](https://science.nasa.gov/researchers/new-pi-resources)
  • Introduced a pre-reviews of mission peer review panels to ensure diversity and reduce conflicts of interest
  • Added a code of conduct requirement for SMD-funded conferences to ROSES 2019
  • Restarted proposal writing workshops at major science conferences
  • Included career development positions and associated evaluation criteria as part Discovery and New Frontiers Announcement Opportunities (AOs)
  • Lessons learned presentation on characteristics and key mistakes associated with proposal success
    • Video: [https://www.youtube.com/watch?v=xoLYRjm48-U](https://www.youtube.com/watch?v=xoLYRjm48-U)

• Upcoming activities include:
  • Information sessions at science conferences and stand-alone workshops to support people developing first proposal
  • First workshop was held November 18-20th, 2019 in Tucson, AZ and information on how to register will be forthcoming [https://science.nasa.gov/researchers/pi-launchpad](https://science.nasa.gov/researchers/pi-launchpad)
  • Sign up to learn more at [https://lists.hq.nasa.gov/mailman/listinfo/hq-smdpi-workshop-outreach](https://lists.hq.nasa.gov/mailman/listinfo/hq-smdpi-workshop-outreach)
Get Involved!

- NASA Solicitation Website: https://nspires.nasaprs.com/external/
- 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
- Summer Internships: https://intern.nasa.gov
EXPLORATION CAMPAIGN

Earth

Moon

Mars

In LEO
Commercial & International partnerships

In Cislunar Space
A return to the moon for long-term exploration

On Mars
Research to inform future crewed missions

Notional Commercial Platform
ISS
Commercial launch Vehicles
Orion
SLS
Robotic Surface Missions
Commercial Lunar Lander
Lunar Orbital Platform - Gateway
PPE - Habitat – Airlock – Logistics
Mars robotic exploration, technology development
TRISH is seeking research projects to identify and test effective countermeasures against high linear energy transfer (LET) ionizing radiation using cutting-edge technology. Projects funded by this solicitation shall aim to:

1. Determine if complex human in vitro or ex vivo models could be an effective human analog for radiation studies; and

2. Test and characterize countermeasures for efficacy

- Award: Up to $1 million per year for the first two years, and up to $1.3 million total for the third year

- Eligibility: U.S.-based institutions

- Key Dates:

  - Proposals due: February 14th, 2020
NASA Research Opportunities

NASA Request for Information (RFI) for Grand Challenges in Soft Matter and Opportunities for Microgravity Research [Click here]

- Workshop to develop a roadmap of the fundamental questions and challenges in soft matter with particular emphasis on the role of microgravity. The roadmap, along with new discoveries, will influence the future of the field and address the resources that will be needed for future research in soft matter and complex fluids under two Space Policy Directives:
  1. Research that will enable human expansion across the solar system, and
  2. A better understanding of soft matter systems in space for use on Earth and in space.

Potential topics of interest for the workshop include:
- Active matter, Aerosols and particulates, Biological materials, Colloids, Emulsions, Fluids, Foams, Gels, Glasses and disordered matter, Rheologies, Surface phenomena
- Eligibility: U.S.-based institutions
- Key Dates:
  - Proposals due: February 20th, 2020