Space Technology Research Grants (STRG) Program Overview

Space Technology Mission Directorate

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

Early Career Faculty
- 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
- 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

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

Accelerate development of groundbreaking high-risk/high-payoff low-TRL space technologies
STRG Portfolio – Awards To-Date
Universities

Awards: 539
States: 43
Territories: 1 (PR)
Universities: 106

Arizona State University
Auburn University
Boston University
Brigham Young University
Brown University
California Institute of Technology
Carnegie Mellon University
Case Western Reserve University
Clemson University
Colorado State University
Colorado School of Mines
Columbia University
Cornell University
Duke University
Florida Institute of Technology
Georgia Institute of Technology
Harvard University
Illinois Institute of Technology
Iowa State University
Johns Hopkins University
Massachusetts Institute of Technology
Michigan State University
Michigan Technological University
Mississippi State University
Missouri University of Science and Technology
Montana State University
New Jersey Institute of Technology
New Mexico State University
New York University
North Carolina State University
Northeastern University
Northwestern University
Ohio State University
Oregon State University
Pennsylvania State University
Portland State University
Princeton University
Purdue University
Rensselaer Polytechnic University
Rochester Institute of Technology
Rose-Hulman Institute of Technology
Rutgers University
South Dakota School of Mines and Technology
Stanford University
State University of New York, College of Nanoscale Science & Engineering
State University of New York, Stony Brook
Texas A&M University
Texas Tech University
Tufts University
University of Akron
University of Alabama, Huntsville
University of Alabama, Tuscaloosa
University of Alaska, Fairbanks
University of Arizona
University of Arkansas
University of California, Berkeley
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, San Diego
University of Central Florida
University of Colorado, Boulder
University of Connecticut
University of Delaware
University of Florida
University of Hawaii
University of Houston
University of Illinois, Chicago
University of Illinois, Urbana-Champaign
University of Iowa
University of Kentucky
University of Maine
University of Maryland
University of Massachusetts, Amherst
University of Massachusetts, Lowell
University of Michigan
University of Minnesota
University of Nebraska, Lincoln
University of New Hampshire
University of Notre Dame
University of Pennsylvania
University of Pittsburgh
University of Puerto Rico, Rio Pedras
University of Rochester
University of South Carolina
University of South Florida
University of Southern California
University of Tennessee
University of Texas, Austin
University of Texas, El Paso
University of Utah
University of Vermont
University of Virginia
University of Washington
University of Wisconsin, Madison
Utah State University
Vanderbilt University
Virginia Polytechnic Institute & State University
Washington State University
Washington University, St. Louis
Western Michigan University
West Virginia University
William Marsh Rice University
Worcester Polytechnic Institute
Yale University
Eligibility Requirements for NSTRF18

1. Pursuing or seeking to pursue advanced degrees directly related to space technology.

2. Are U.S. citizens or permanent residents of the U.S.

3. Are or will be enrolled in a full-time master’s or doctoral degree program at an accredited U.S. university in fall 2019.

4. Are early in their graduate careers.

Application Components

1. Application Cover Page
   (Program Specific Data Questions)

2. Personal Statement

3. Project Narrative

4. Degree Program Schedule

5. Curriculum Vitae

6. Transcripts

7. GRE General Test Scores

8. Three Letters of Recommendation

Award Value

<table>
<thead>
<tr>
<th>Fellowship Budget Category</th>
<th>Max value</th>
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<tbody>
<tr>
<td>Student Stipend</td>
<td>$36,000</td>
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<tr>
<td>Faculty Advisor Allowance</td>
<td>$11,000</td>
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<tr>
<td>Visiting Technologist Experience Allowance</td>
<td>$10,000</td>
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<tr>
<td>Health Insurance Allowance</td>
<td>$1,000</td>
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<tr>
<td>Tuition and Fees Allowance</td>
<td>$17,000</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$75,000</strong></td>
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STRG Opportunities to Propose
ECF and ESI

Technical Characteristics:

- Unique, disruptive or transformational space technologies
- Low TRL
- Specific topics tied to Technology Area Roadmaps and the NRC’s review of the roadmaps
- Big impact at the system level: performance, weight, cost, reliability, operational simplicity or other figures of merit associated with space flight hardware or missions

Eligibility Summary:

Both ECF and ESI proposals must be submitted by accredited U.S. universities

Early Career Faculty
- Untenured assistant professor and on tenure track
- U.S. citizen or permanent resident
- No current or former Presidential Early Career Awards for Scientists and Engineers (PECASE)
- No co-investigators

Early Stage Innovations
- PI must be from proposing university
- Co-investigators are permitted
- ≥ 50% of the proposed budget must go to the proposing university
- ≥ 70% of the proposed budget must go to universities


STRG Highlights and Plans

TA14- Corey Kruse, U Nebraska Lincoln: Using Femtosecond Laser Processing to improve heat transfer on bare stainless steel and copper surfaces by nearly 7x over traditional materials.

TA06- Heather Hava, CU Boulder: Developed in situ food (plant) production systems for space exploration, relevant for long duration missions; Completed the design of an intelligent pot (SmartPOT) that can be remotely monitored and controlled.

TA12- Scott Zavada, U Michigan: established the viability of using an in situ polymerizable liquid as an autonomic healing layer within a rigid structure, which was validated by ballistics testing.

**STRG is impacting all Technology Areas. Here are some examples.**

TA04- Jennifer King, Carnegie Mellon: Successfully expanded the types of tasks that can be performed by robots while reducing the need to hard-code task-specific action sequences. The algorithms use simple physics models (including estimates of friction, mass, etc.) to enable a robot to autonomously plan its interactions with the environment and perform manipulation tasks beyond just pick and place.

TA08- Kathleen Harrington, Johns Hopkins: successfully installed and operated Variable-delay Polarization Modulators (VPMs) on the Cosmology Large Angular Scale Surveyor (CLASS) telescope in Atacama, Chile.

**Recent Milestones**

<table>
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<th>Solicitation</th>
<th>Date</th>
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<tr>
<td>NSTRF</td>
<td>4/5/18: NSTRF18 announcement</td>
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<tr>
<td>ECF</td>
<td>2/7/18: ECF18 announcement</td>
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<tr>
<td>ESI</td>
<td>Early May 2018: ESI18 release</td>
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**Annual Solicitation Schedule**

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<tr>
<th></th>
<th>FYQ4</th>
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What is **NIAC?**

**NASA Innovative Advanced Concepts**

A program to support early studies of innovative, yet credible, visionary concepts that could one day “change the possible” in aerospace.
NIAC Awards, Scope, Criteria

- NIAC grant awards support 2 phases of study:
  - **Phase I**: up to $125K, ~9 months, for concept definition and initial analysis in a mission context
    - **Proposal Submission & Selection Process**: Two-step Process; Step A is fully-open; Step B by Invitation only; Independent Peer Review. ([https://www.nasa.gov/directorates/spacetech/niac/niac-phase-I-solicitation](https://www.nasa.gov/directorates/spacetech/niac/niac-phase-I-solicitation))
  - **Phase II**: up to $500K, 2 years, for further development of most promising Phase I concepts, comparative mission analysis, pathways forward
  - **Eligibility**: All categories of U.S organizations may apply. Non-U.S. organizations may partner in, or lead, NIAC studies on a no-exchange of funds basis, and subject to NASA’s policy on foreign participation. **How to Apply**: ([https://www.nasa.gov/feature/how-to-apply-to-niac](https://www.nasa.gov/feature/how-to-apply-to-niac))
  - **Goal**: Early studies of visionary aerospace architecture or mission concept
  - **Technology Readiness Level (TRL)**: TRL 2 or lower at start of award

- NIAC Key Dates: 2018 Phase I Proposals Due: 19 Sep ‘17; Selections: 28 Mar ‘18; 2018 Phase II Call for new proposals—Early Dec. 2018 (Planned); ([https://www.nasa.gov/content/key-dates-and-solicitations](https://www.nasa.gov/content/key-dates-and-solicitations))

- Scope of NIAC Phase I Studies:
  - **Aerospace architecture or mission concepts** (not focused tech.)
  - **Exciting**: offering a potential breakthrough or revolutionary improvement
  - **Unexplored**: novel, with basic feasibility and properties unclear
  - **Credible**: sound scientific/engineering basis and plausible implementation

- NIAC proposal evaluation criteria:
  - **Potential of the Concept** (all scope elements above, especially exciting)
  - **Strength of the Approach** (research objectives, technical issues, suitability of team and cost)
  - **Benefits of the Study** (concept definition, mission analysis, wider benefits, scientific/engineering contributions, notably new/different/inspiring)
NIAC Educational Institutions

UNIVERSITY PARTNERS: Inspiring Our Nation’s Innovators

- University of Colorado, Boulder
- Iowa State University
- University of Illinois at Urbana-Champaign
- Northwestern University
- Pennsylvania State University
- Rochester Institute of Technology
- Harvard University
- Massachusetts Institute of Technology
- Johns Hopkins University
- Virginia Polytechnic Institute & State University
- North Carolina State University
- Embry-Riddle Aeronautical University
- University of Miami

- University of Washington, Seattle
- University of California, Davis
- Stanford University
- University of California, Santa Barbara
- University of Southern California
- University of Arizona
- University of Oregon
- University of Hawaii
- University of Chicago
- University of California, Santa Barbara
- University of Missouri, Rolla
- University of Houston at Clear Lake
- California Polytechnic State University, San Luis Obispo
- University of Southern California
- University of California, Berkeley
- University of California, Los Angeles
- University of California, Irvine
- University of California, San Diego

Derleth

NIAC

Prof. Mel Ulmer, Northwestern University- His magnetic smart materials to build a large in-space telescope received add-on funding of $450,000 from another government agency. It has the potential to decrease size/cost of space telescopes and correct mirror shape/optics. He produced two notable technical papers related to APERTURE— a precise extremely large reflective telescope using re-configurable elements.


Prof. Christopher Walker, Univ. Arizona- a new Arizona company, FreeFall Aerospace, has been formed based on his NIAC study, Large Balloon Reflector. FreeFall develops next generation in-space telecom and remote sensing systems. www.freefallaerospace.com/

Siegfried Janson, Aerospace Corporation- is expanding space counter-collision studies with Brane Craft and developing carbon nanotube technology, radiation hardened photosensors and polymer matrix thin film “muscles” used to flex the spacecraft. Also had a notable article in Aviation Week & Space Technology.

Prof. Philip Lubin, University of California, Santa Barbara- was invited to Capitol Hill to meet with members of Congress/staffers. The $100M private funding created for his NIAC directed energy interstellar concept continues to advance and has notable media coverage in Science, Space.com, Scientific American, and the Discovery Channel. He has lectures about his photonics work nationwide and most recently at The Institute for Energy Efficiency.

Robert Hoyt, Tethers Unlimited- won 4 NASA contracts to develop orbital manufacturing and construction technology, a DARPA contract for in-space manufacture of high-throughput SATCOM satellite, selected to build FabLab for ISS and won an Army contract to develop gigabit-class data link for smallsats.