National Aeronautics and Space Administration

OFFICE OF THE CHIEF TECHNOLOGIST

SPACE TECHNOLOGY RESEARCH FELLOWSHIPS

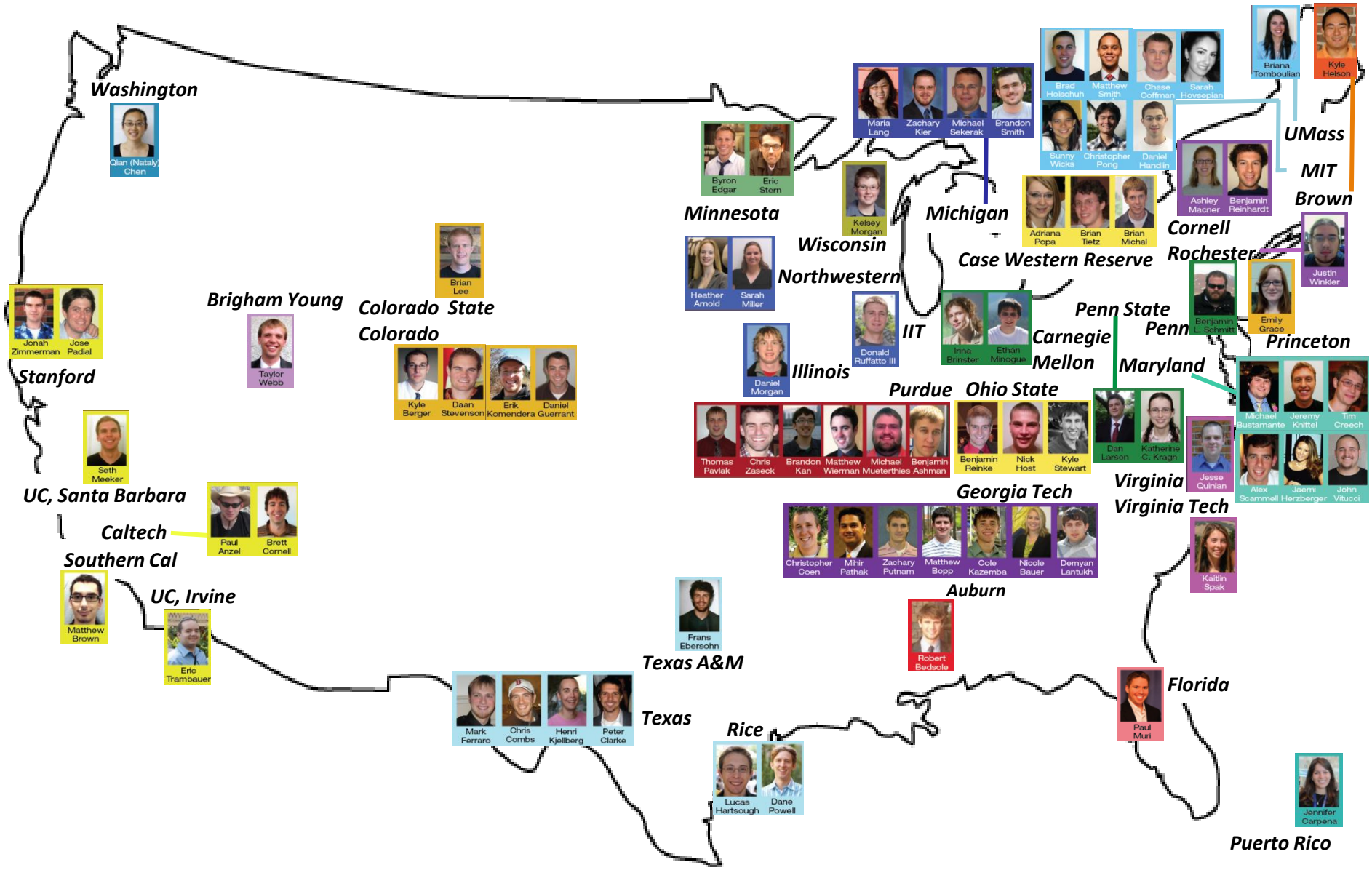
Presentation at the Astrophysics Subcommittee Meeting

Oct. 20, 2011

Claudia Meyer
Space Technology Research Grants Program Executive

National Asset: The Inaugural Class of NSTRF

80 Students - 37 Universities - 22 States and U.S. Territories



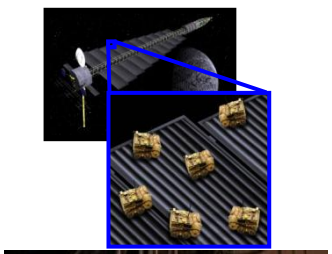
NSTRF Core Values

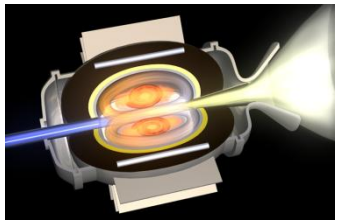
"NASA Space Technology Fellows will perform innovative space technology research while building the skills necessary to become future technological leaders."

July 27, 2011
RELEASE : 11-246
NASA Awards Space Technology Research Fellowship Grants
http://www.nasa.gov/home/hqnews/2011/jul/HQ_11-246_STRF_Awards.html

Space Technology Research Grants - Program Overview

Level II Program Office: GRC



Objective: Accelerate the development of push technologies through innovative efforts with high risk/high payoff

- **Early Stage Innovation -Space Technology Research Opportunities (ESI-STRO):** Low TRL technology portfolio for groundbreaking research in advanced space technology
- **NASA Space Technology Research Fellowships (NSTRF):** Competitive selection of U.S Citizen / permanent resident graduate students developing promising technologies in support of future NASA missions and strategic goals

Acquisition Strategy

- **ESI-STRO**: NRA solicitation expected annually. Awards are grants, cooperative agreements, contracts or intra-agency transfers.
- **NSTRF:** Annual solicitation consistent with academic calendar. Awards are training grants to accredited U.S. universities. Selected candidates perform graduate student research on their respective campuses, at NASA Centers and not-for-profit Research and Development (R&D) labs.

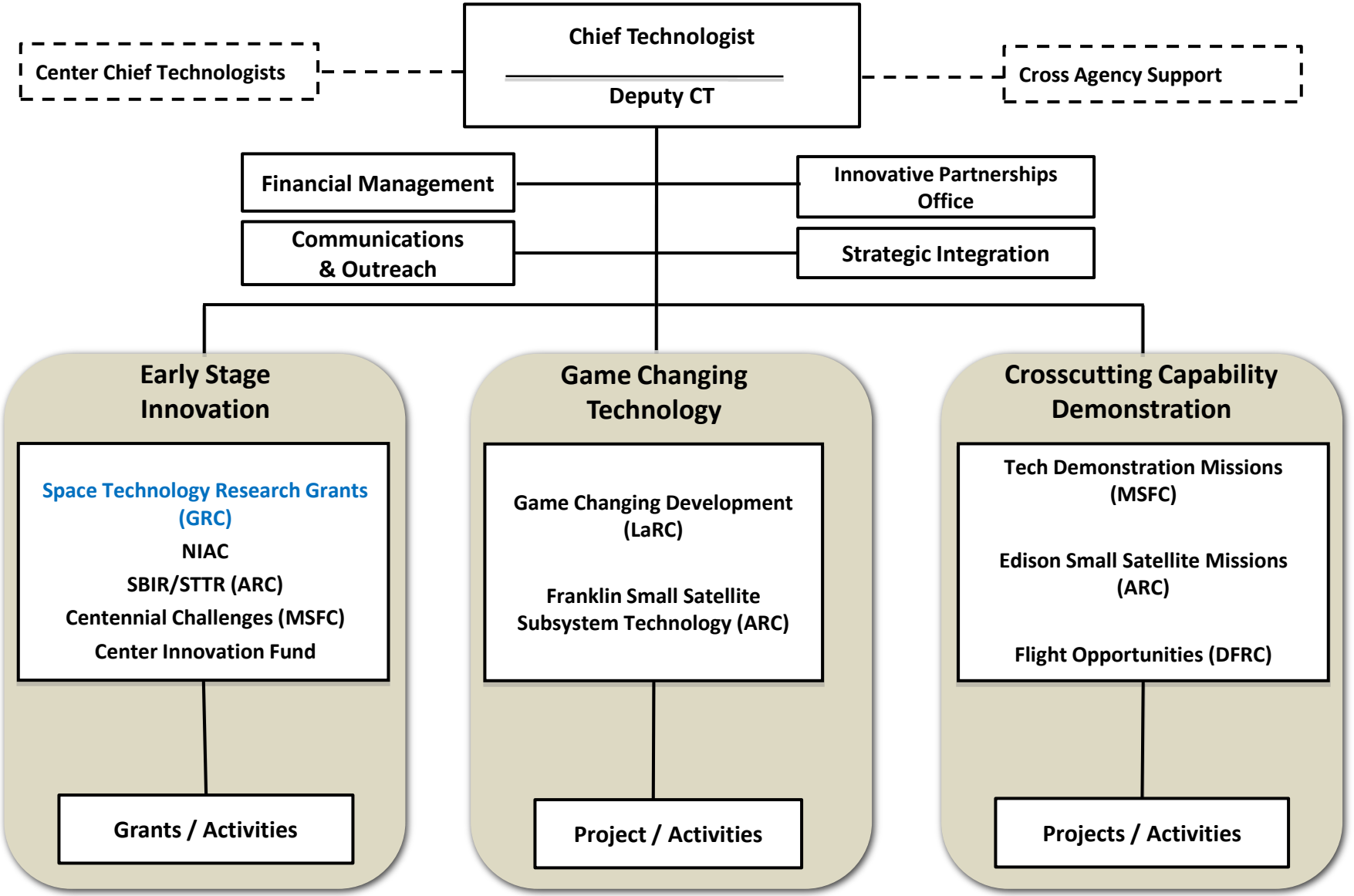
Awards

- **ESI-STRO**: Typical 12 months awards at $250K. 100+ per year.
- **NSTRF:** Building up to 500 active students per year.

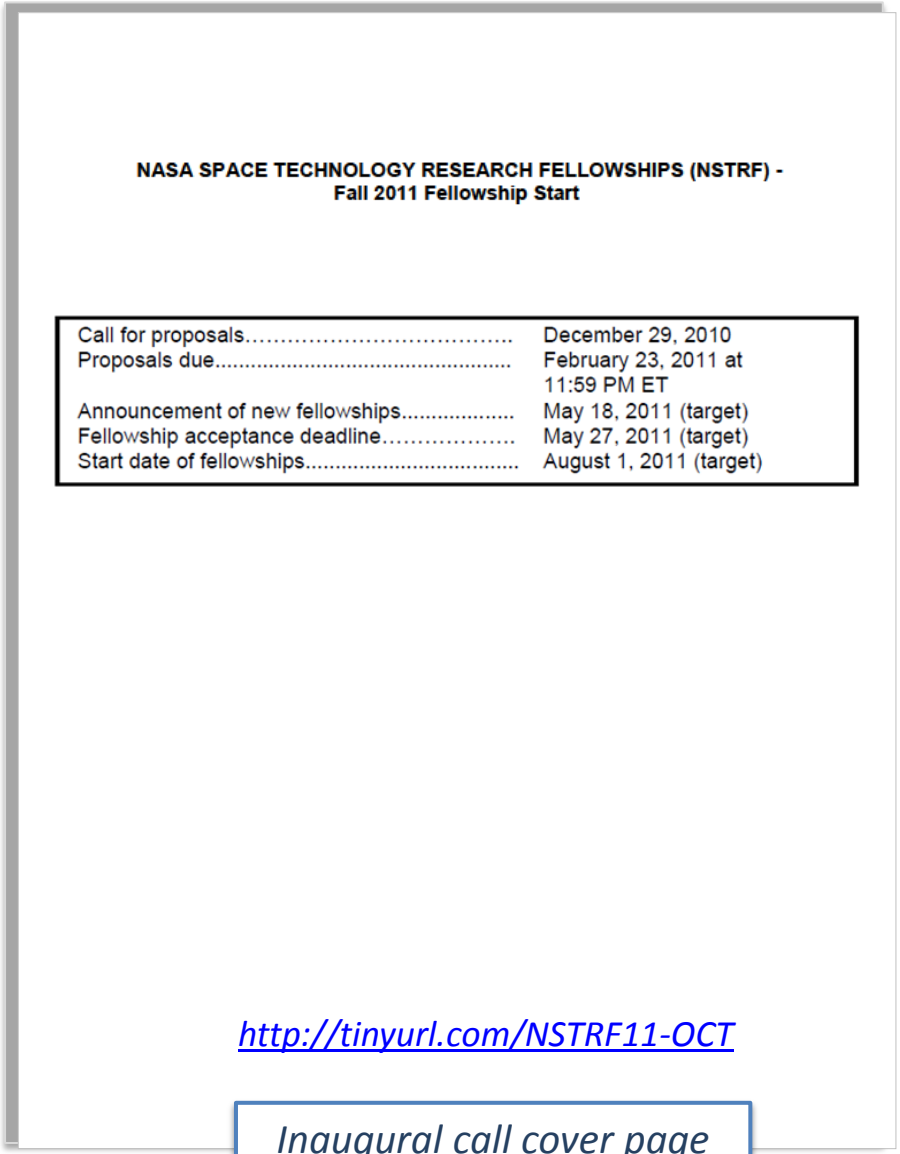
Collaboration

- **ESI-STRO:** Proposals welcome from all sources, including academia, industry, all U.S. government agencies and non-profit organizations; teaming encouraged
- **NSTRF:** Each student is matched with a professional advisor at NASA Centers or R&D Lab

Office of the Chief Technologist Organization



The Inaugural Solicitation and Eligibility Requirements



NASA SPACE TECHNOLOGY RESEARCH FELLOWSHIPS (NSTRF) -
Fall 2011 Fellowship Start

Call for proposals.....	December 29, 2010
Proposals due.....	February 23, 2011 at 11:59 PM ET
Announcement of new fellowships.....	May 18, 2011 (target)
Fellowship acceptance deadline.....	May 27, 2011 (target)
Start date of fellowships.....	August 1, 2011 (target)

http://tinyurl.com/NSTRF11-OCT

Inaugural call cover page

Minimum Eligibility Requirements for NSTRF11

1. U.S. citizen or permanent resident.
2. Completed no more than twelve months of full-time graduate study in pursuit of the degree that would be supported by the fellowship.
3. Must be enrolled as a full-time Master's or Doctoral student at the proposing U.S. university for the Fall 2011 term.
4. An individual accepting this award may not concurrently receive any other Federal fellowship or traineeship.

The Solicitation - Proposal Components

The student shall be the principal author of the Educational Research Area of Inquiry and Goals, with minimal assistance from the current/prospective faculty advisor.

1 Educational Research Area of Inquiry and Goals

- summary of educational program objectives
- research interests with associated relevant hypotheses and possible approaches
- benefits of proposed research
- benefits of on-site NASA experience (option of indicating Center preference)

2 Schedule of degree program

- proposed start and completion dates
- anticipated milestones

3 Curriculum Vitae (one page)

- faculty advisor
- student

4 Statement from faculty advisor (one page)

- planned use of faculty advisor allowance
- If applicable, brief description of ongoing or pending research awards from NASA that are related to the student's Educational Research Area of Inquiry and Goals.

5 Four signed letters of recommendation

- from academic advisor
- from other faculty members or professionals with detailed knowledge of student's abilities

6 Transcripts

- undergraduate
- graduate

7 GRE general test scores

A Basis for Inspiration

TA01 • LAUNCH PROPULSION SYSTEMS

Solid Rocket Propulsion Systems
- Propellants
- Case Materials
- Nozzle Systems
- Hybrid Rocket Propulsion Systems
- Fundamental Solid Propulsion Technologies

Liquid Rocket Propulsion Systems
- LH_2/LOX Based
- RP/LOX Based
- CH_4/LOX Based
- Detonation Wave Engines (Closed Cycle)
- Propellants
- Fundamental Liquid Propulsion Technologies

Air Breathing Propulsion Systems
- TBCC
- RBCC
- Detonation Wave Engines (Open Cycle)
- Turbine Based Jet Engines (Flyback Boosters)
- Ramjet/Scramjet Engines (Accelerators)
- Deeply-cooled Air Cycles
- Air Collection & Enrichment System
- Fundamental Air Breathing Propulsion Technologies

Ancillary Propulsion Systems
- Auxiliary Control Systems
- Main Propulsion Systems (Excluding Engines)
- Launch Abort Systems
- Thrust Vector Control Systems
- Health Management & Sensors
- Pyro & Separation Systems
- Fundamental Ancillary Propulsion Technologies

Unconventional / Other Propulsion Systems
- Ground Launch Assist
- Air Launch / Drop Systems
- Space Tether Assist
- Beamed Energy / Energy Addition
- Nuclear
- High Energy Density Materials/Propellants

TA02 • IN-SPACE PROPULSION TECHNOLOGIES

Chemical Propulsion
- Liquid Storable
- Liquid Cryogenic
- Gels
- Solid
- Hybrid
- Cold Gas/Warm Gas
- Micro-propulsion

Non-Chemical Propulsion
- Electric Propulsion
- Solar Sail Propulsion
- Thermal Propulsion
- Tether Propulsion

Advanced (TRL <3) Propulsion Technologies
- Beamed Energy Propulsion
- Electric Sail Propulsion
- Fusion Propulsion
- High Energy Density Materials
- Antimatter Propulsion
- Advanced Fission
- Breakthrough Propulsion

Supporting Technologies
- Engine Health Monitoring & Safety
- Propellant Storage & Transfer
- Materials & Manufacturing Technologies
- Heat Rejection
- Power

TA03 • SPACE POWER & ENERGY STORAGE

Power Generation
- Energy Harvesting
- Chemical (Fuel Cells, Heat Engines)
- Solar (Photo-Voltaic & Thermal)
- Radioisotope
- Fission
- Fusion

Energy Storage
- Batteries
- Flywheels
- Regenerative Fuel Cells

Power Management & Distribution
- FDIR
- Management & Control
- Distribution & Transmission
- Wireless Power Transmission
- Conversion & Regulation

Cross Cutting Technology
- Analytical Tools
- Green Energy Impact
- Multi-functional Structures
- Alternative Fuels

TA04 • ROBOTICS, TELE-ROBOTICS & AUTONOMOUS SYSTEMS

Sensing & Perception
- Stereo Vision
- LIDAR
- Proximity Sensing
- Sensing Non-Geometric Terrain Properties
- Estimating Terrain Mechanical Properties
- Tactile Sensing Arrays
- Gravity Sensors & Celestial Nav.
- Terrain Relative Navigation
- Real-time Self-calibrating of Hand-eye Systems

Mobility
- Simultaneous Localiz. & Mapping
- Hazard Detection Algorithms
- Active Illumination
- 3-D Path Planning w/ Uncertainty
- Long-life Extr. Enviro. Mechanisms
- Robotic Jet Backpacks
- Smart Tethers
- Robot Swarms
- Walking in Micro-g

Manipulation
- Motion Planning Alg., High DOF
- Sensing & Control
- Robot Arms (light, high strength)
- Dexterous Manipul., Robot Hands
- Sensor Fusion for Grasping
- Grasp Planning Algorithms Robotic Drilling Mechanisms
- Multi-arm / Finger Manipulation
- Planning with Uncertainty

Human-Systems Integration
- Crew Decision Support Systems
- Immersive Visualization
- Distributed Collaboration
- Multi Agent Coordination
- Haptic Displays
- Displaying Range Data to Humans

Autonomy
- Spacecraft Control Systems
- Vehicle Health, Prog/Diag Systems
- Human Life Support Systems
- Planning/Scheduling Resources
- Operations
- Integrated Systems Health Management
- FDIR & Diagnosis
- System Monitoring & Prognosis
- V&V of Complex Adaptive Sys's
- Automated Software Generation
- Software Reliability
- Semi Automatic Systems

Auton. Rendezvous & Docking
- Rendezvous and Capture
- Low impact & Androgenous Docking Systems & Interfaces
- Relative Navigation Sensors
- Robust AR&D GN&C Algorithms & FSW
- Onboard Mission Manager
- AR&D Integration & Standardiz.n

RTA Systems Engineering
- Human safety
- Refueling Interfaces & Assoc. Tools
- Modular / Serviceable Interfaces
- High Perf., Low Power Onboard Computers
- Environment Tolerance
- Thermal Control
- Robot-to-Suit Interfaces
- Common Human-Robot Interfaces
- Crew Self Sufficiency

TA05 • COMMUNICATION & NAVIGATION

Optical Comm. & Navigation
- Detector Development
- Large Apertures
- Lasers
- Acquisition & Tracking
- Atmospheric Mitigation

Radio Frequency Communications
- Spectrum Efficient Technologies
- Power Efficient Technologies
- Propagation
- Flight & Ground Systems
- Earth Launch & Reentry Comm.
- Antennas

Internetworking
- Disruptive Tolerant Networking
- Adaptive Network Topology
- Information Assurance
- Integrated Network Management

Position, Navigation, and Timing
- Timekeeping
- Time Distribution
- Onboard Auto Navigation & Maneuver
- Sensors & Vision Processing Systems
- Relative & Proximity Navigation
- Auto Precision Formation Flying
- Auto Approach & Landing

Integrated Technologies
- Radio Systems
- Ultra Wideband
- Cognitive Networks
- Science from the Comm. System
- Hybrid Optical Comm. & Nav. Sensors
- RF/Optical Hybrid Technology

Revolutionary Concepts
- X-Ray Navigation
- X-Ray Communications
- Neutrino-Based Navigation & Tracking
- Quantum Key Distribution
- Quantum Communications
- SQIF Microwave Amplifier
- Reconfigurable Large Apertures

TA06 • HUMAN HEALTH, LIFE SUPPORT & HABITATION SYSTEMS

Environmental Control & Life Support Systems & Habitation Sys.
- Air Revitalization
- Water Recovery & Management
- Waste Management
- Habitation

Extravehicular Activity Systems
- Pressure Garment
- Portable Life Support System
- Power, Avionics and Software

Human Health & Performance
- Medical Diagnosis / Prognosis
- Long-Duration Health
- Behavioral Health & Performance
- Human Factors & Performance

Environmental Monitoring, Safety & Emergency Response
- Sensors: Air, Water, Microbial, etc.
- Fire: Detection, Suppression
- Protective Clothing / Breathing
- Remediation

Radiation
- Risk Assessment Modeling
- Radiation Mitigation
- Protection Systems
- Space Weather Prediction
- Monitoring Technology

TA07 • HUMAN EXPLORATION DESTINATION SYSTEMS

In-Situ Resource Utilization
- Destination Reconnaissance, Prospecting, & Mapping
- Resource Acquisition
- Consumables Production
- Manufacturing & Infrastructure Emplacement

Sustainability & Supportability
- Logistics Systems
- Maintenance Systems
- Repair Systems

"Advanced" Human Mobility Systems
- EVA Mobility
- Surface Mobility
- Off-Surface Mobility

"Advanced" Habitat Systems
- Integrated Habitat Systems
- Habitat Evolution

Mission Operations & Safety
- Crew Training
- Environmental Protection
- Remote Mission Operations
- Planetary Safety

Cross-Cutting Systems
- Modeling, Simulations & Destination Characterization
- Construction & Assembly
- Dust Prevention & Mitigation

TA08 • SCIENCE INSTRUMENTS, OBSERVATORIES & SENSOR SYSTEMS

Remote Sensing Instruments / Sensors
- Detectors & Focal Planes
- Electronics
- Optical Components
- Microwave / Radio
- Lasers
- Cryogenic / Thermal

Observatories
- Mirror Systems
- Structures & Antennas
- Distributed Aperture

In-Situ Instruments / Sensor
- Particles: Charged & Neutral
- Fields & Waves
- In-Situ

TA09 • ENTRY, DESCENT & LANDING SYSTEMS

Aeroassist & Atmospheric Entry
- Rigid Thermal Protection Systems
- Flexible Thermal Protection Systems
- Rigid Hypersonic Decelerators
- Deployable Hypersonic Decelerators
- Instrumentation & Health Monitoring
- Entry Modeling & Simulation

Descent
- Attached Deployable Decelerators
- Trailing Deployable Decelerators
- Supersonic Retropropulsion
- GN&C Sensors
- Descent Modeling & Simulation

Landing
- Touchdown Systems
- Egress & Deployment Systems
- Propulsion Systems
- Large Body GN&C
- Small Body Systems
- Landing Modeling & Simulation

Vehicle Systems Technology
- Architecture Analyses
- Separation Systems
- System Integration & Analyses
- Atmosphere & Surface Characterization

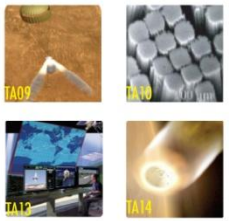
TA10 • NANOTECHNOLOGY

Engineered Materials & Structures
- Lightweight Structures
- Damage Tolerant Systems
- Coatings
- Adhesives
- Thermal Protection & Control

Energy Generation & Storage
- Energy Storage
- Energy Generation

Propulsion
- Propellants
- Propulsion Components
- In-Space Propulsion

Sensors, Electronics & Devices
- Sensors & Actuators
- Nanoelectronics
- Miniature Instruments



TA11 • MODELING, SIMULATION, INFORMATION TECHNOLOGY & PROCESSING

Computing
- Flight Computing
- Ground Computing

Modeling
- Software Modeling & Model-Checking
- Integrated Hardware & Software Modeling
- Human-System Performance Modeling
- Science & Engineering Modeling
- Frameworks, Languages, Tools & Standards

Simulation
- Distributed Simulation
- Integrated System Lifecycle Simulation
- Simulation-Based Systems Engineering
- Simulation-Based Training & Decision Support Systems

Information Processing
- Science, Engineering & Mission Data Lifecycle
- Intelligent Data Understanding
- Semantic Technologies
- Collaborative Science & Engineering
- Advanced Mission Systems

TA12 • MATERIALS, STRUCTURES, MECHANICAL SYSTEMS & MANUFACTURING

Materials
- Lightweight Structure
- Computational Design
- Flexible Material Systems
- Environment
- Special Materials

Structures
- Lightweight Concepts
- Design & Certification Methods
- Reliability & Sustainment
- Test Tools & Methods
- Innovative, Multifunctional Concepts

Mechanical Systems
- Deployables, Docking and Interfaces
- Mechanism Life Extension Systems
- Electro-mechanical, Mechanical & Micromechanisms
- Design & Analysis Tools and Methods
- Reliability / Life Assessment / Health Monitoring
- Certification Methods

Manufacturing
- Manufacturing Processes
- Intelligent Integrated Manufacturing and Cyber Physical Systems
- Electronics & Optics Manufacturing Process
- Sustainable Manufacturing

Cross-Cutting
- Nondestructive Evaluation & Sensors
- Model-Based Certification & Sustainment Methods
- Loads and Environments

TA13 • GROUND & LAUNCH SYSTEMS PROCESSING

Technologies to Optimize the Operational Life-Cycle
- Storage, Distribution & Conservation of Fluids
- Automated Alignment, Coupling, & Assembly Systems
- Autonomous Command & Control for Ground and Integrated Vehicle/Ground Systems

Environmental and Green Technologies
- Corrosion Prevention, Detection, & Mitigation
- Environmental Remediation & Site Restoration
- Preservation of Natural Ecosystems
- Alternate Energy Prototypes

Technologies to Increase Reliability and Mission Availability
- Advanced Launch Technologies
- Environment-Hardened Materials and Structures
- Inspection, Anomaly Detection & Identification
- Fault Isolation and Diagnostics
- Prognostics Technologies
- Repair, Mitigation, and Recovery Technologies
- Communications, Networking, Timing & Telemetry

Technologies to Improve Mission Safety/Mission Risk
- Range Tracking, Surveillance & Flight Safety Technologies
- Landing & Recovery Systems & Components
- Weather Prediction and Mitigation
- Robotics / Telerobotics
- Safety Systems

TA14 • THERMAL MANAGEMENT SYSTEMS

Cryogenic Systems
- Passive Thermal Control
- Active Thermal Control
- Integration & Modeling

Thermal Control Systems
- Heat Acquisition
- Heat Transfer
- Heat Rejection & Energy Storage

Thermal Protection Systems
- Entry / Ascent TPS
- Plume Shielding (Convective & Radiative)
- Sensor Systems & Measurement Technologies

Space Technology Roadmaps **STR • TABS**

TECHNOLOGY AREA BREAKDOWN STRUCTURE

http://www.nasa.gov/offices/oct/strategic_integration/technology_roadmap.html

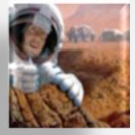
Another Source for Inspiration: Space Technology Grand Challenges

Cutting-edge technological solutions that solve important space-related problems, radically improve existing capabilities or deliver new space capabilities altogether.

Expand human presence in space


Economical Space Access


Space Health and Medicine


Telepresence in Space

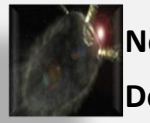

Space Colonization

Manage in-space resources


Affordable Abundant Power

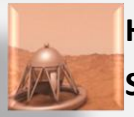

Space Way Station


Space Debris Hazard Mitigation


Near-Earth Object Detection and Mitigation

Enable transformational space exploration and scientific discovery


Efficient In-Space Transportation


High-Mass Planetary Surface Access


All Access Mobility

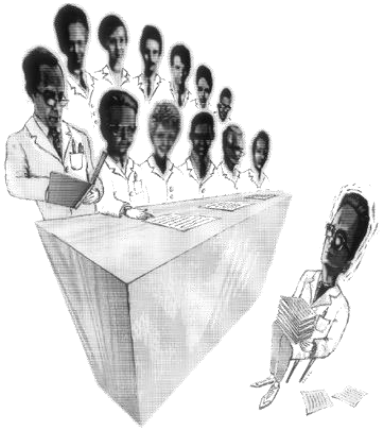

Surviving Extreme Space Environments


New Tools of Discovery

Details about the Space Technology Grand Challenges are available at http://www.nasa.gov/offices/oct/strategic_integration/grand_challenges_detail.html

Proposal Evaluation and Selection

All eligible fellowship applications will undergo a technical review by experts.



Criteria for Evaluation

Merit of the Applicant's Proposed Educational Research Area of Inquiry and Goals

Relevance of the proposed research to NASA's Space Technology goal and associated outcomes

Academic excellence based upon an applicant's transcripts, GRE scores, four signed letters of recommendation by the student's proposed academic advisor and other faculty members or professionals with detailed knowledge of the student's abilities, and a curriculum vitae that describes relevant work experience, publications and honors and awards.

Factors

- candidate's potential in terms of scientific curiosity, creativity, acumen, and success in research appropriate to his/her educational level, as indicated in their planned course of study
- research area description, knowledge of relevant research literature and relevance to the strategic goal stated in Section 3
- technical merit as appropriate to the candidate's educational level
- organizational, analytical, and written skills

NOTE: Subsequent to the technical review, candidates deemed excellent will be submitted to the Office of the Chief Technologist at NASA Headquarters for final consideration and selection.

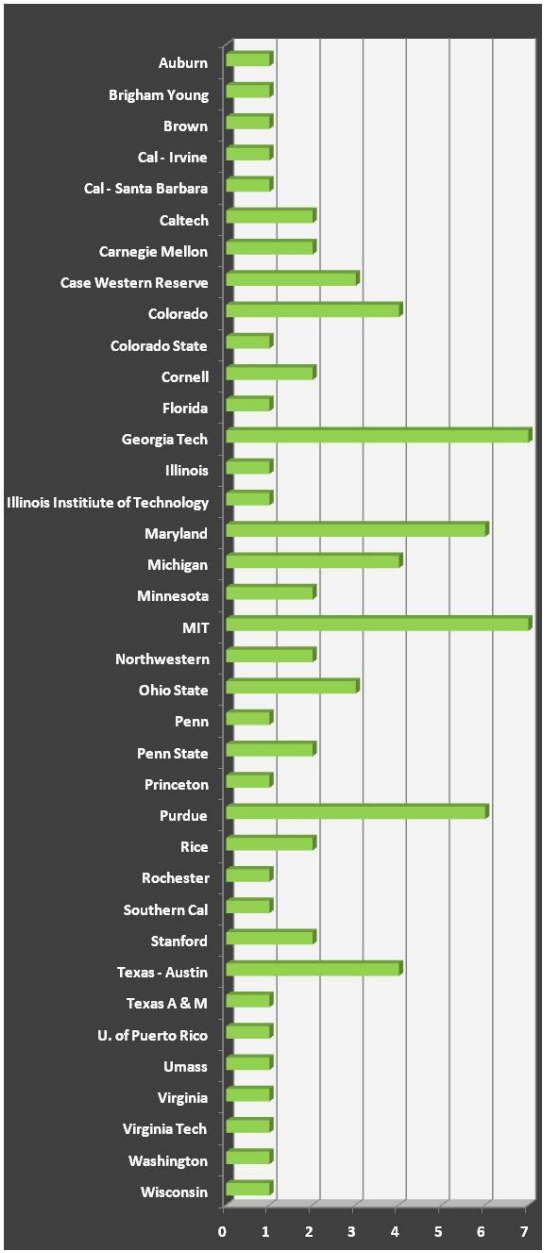
NSTRF11 Annual Award Values

Category	Maximum value – M.S. candidate*	Maximum value – Ph.D. candidate**
Student Stipend	$30,000	$36,000
Faculty Advisor Allowance	$9,000	$9,000
On-site NASA Center/R&D lab experience Allowance	$10,000	$10,000
Health Insurance Allowance	$1,000	$1,000
Tuition and Fees Allowance	$10,000	$10,000
TOTAL	**$60,000**	**$66,000**

*NSTRF M.S. Support – up to 2 years
**NSTRF Ph.D. Support – up to 4 years

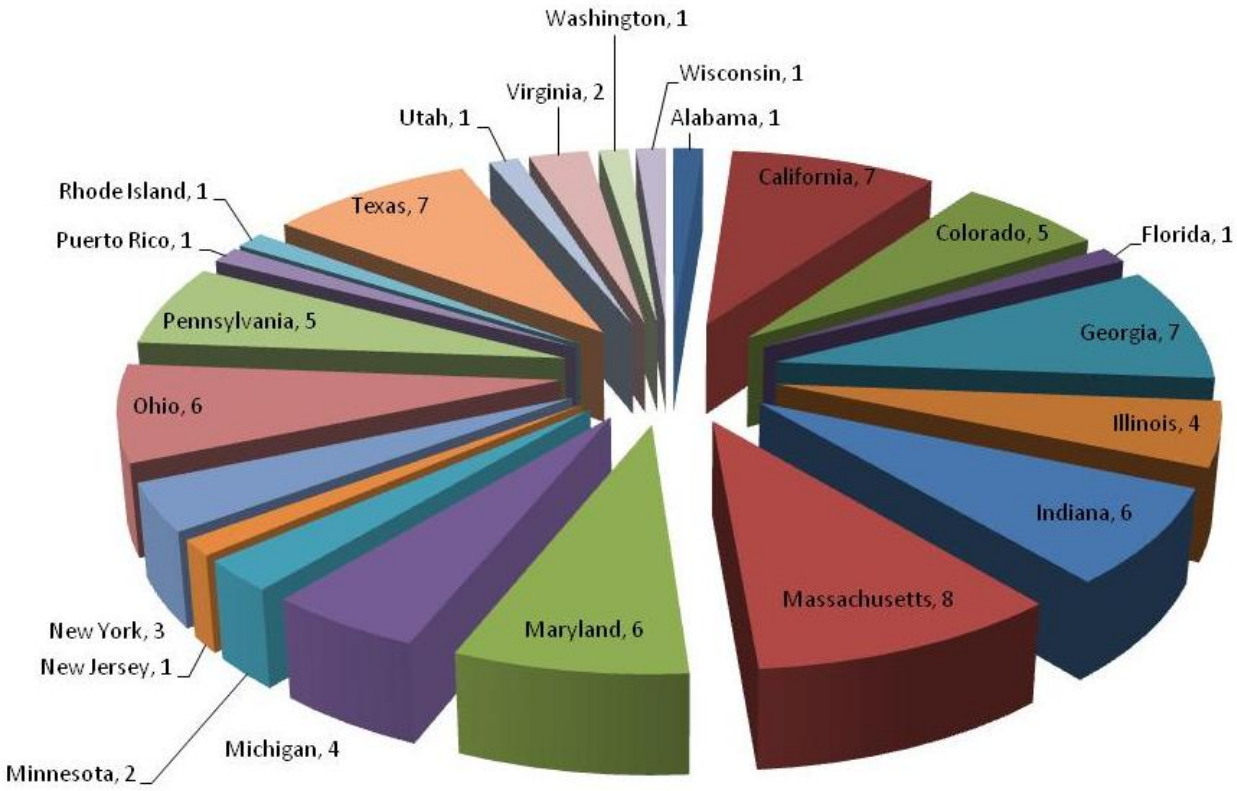
- A fellowship award is issued as a training grant to the student's host university.
- Separate from the awards, the Program has allocated resources to cover mentor time and also costs associated with hosting/interacting with the Fellow.

NSTRF11 Awards by University and State



Number of Awards by University

Number of Awards by State



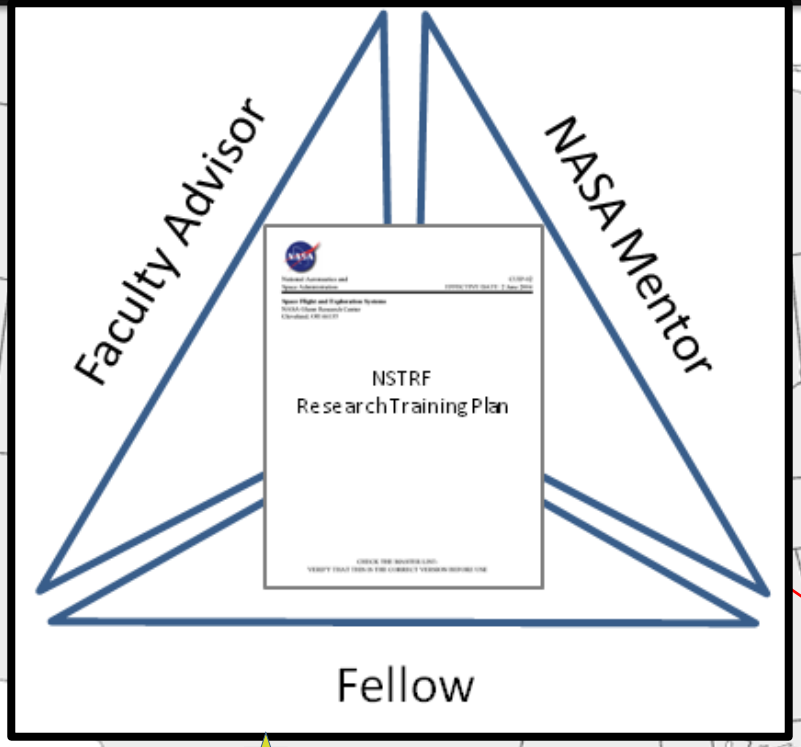
NSTRF11 Awards by Technology Area

TA:	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Launch Propulsion	In-Space Propulsion	Space Power/Storage	Robotics	Comm./Navigation	Human Health	Human Expl. Dest.	Sci. Instr./Sensors	EDL	Nanotechology	Modeling/Simulation	Materials/Structures	Ground Operations	Thermal
	●●●●●●	●●●●●●●●●●●●●●●●	●●●●●	●●●●●●●●●●●●●●●●	●●●●●	●●	●●	●●●●●●●●●●●●	●●●●●●	●●●●●●	●●●●●	●●●●●		●●●●

Completing the Vision: Mentors

We've lined the future space technology stars up with the best mentors…

Space Technology Research Fellowships:
A Nationwide Community of University Students, Professors, and R&D Lab Mentors

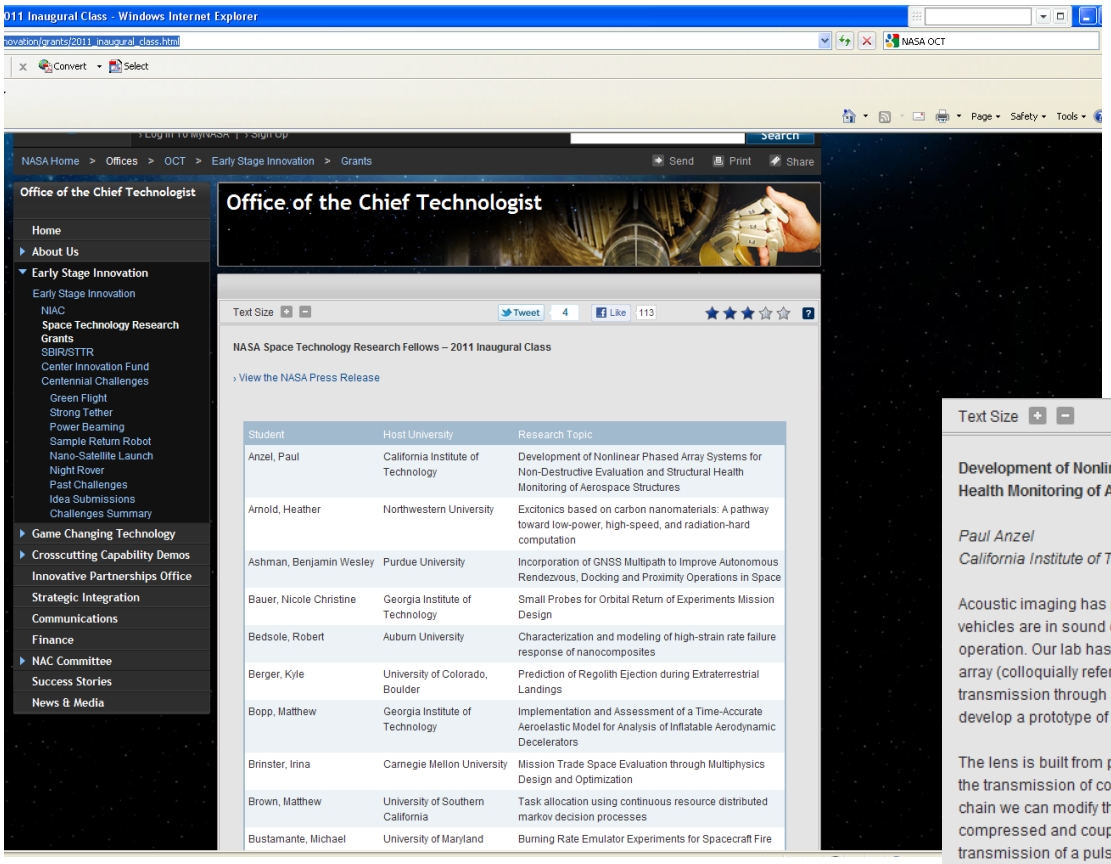


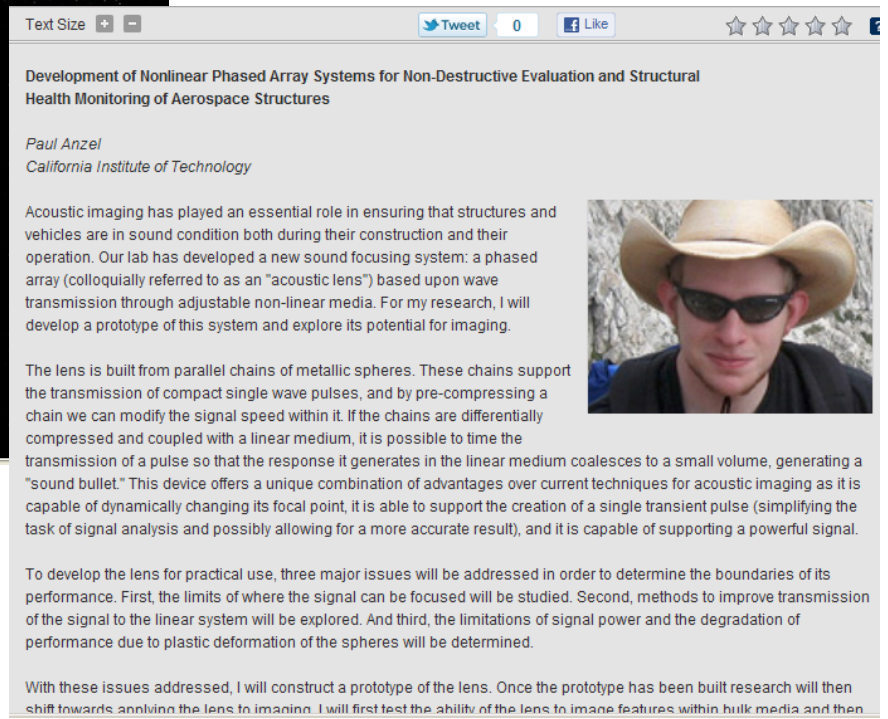
Ames
Dryden
JPL
Glenn
Goddard
Langley
Marshall
Johnson
Stennis
Kennedy

Locations of hypothetical Fellow host universities

NASA Center

Find Out More About the Awards





Developing the technological foundation for NASA's future science and exploration missions…providing the nation with a pipeline of highly skilled engineers and technologists to improve U.S. competitiveness.

The full listing of NSTRF11 awarded proposals with abstracts is available on the NASA OCT website at http://www.nasa.gov/offices/oct/early_stage_innovation/grants/2011_inaugural_class.html