

FY 2018 Year 4 Extension Annual Performance Document

Kentucky Space Grant Consortium

Lead Institution: University of Kentucky

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Consortium URL: nasa.engr.uky.edu

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Lines of Business (LOBs): NASA Internships, Fellowships, and Scholarships; STEM Engagement; Institutional Engagement; Educator Professional Development

A. PROGRAM DESCRIPTION:

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Kentucky Space Grant Consortium is a Designated Consortium funded at a level of \$760,000 for fiscal year 2018.

B. PROGRAM GOALS:

NASA Kentucky Space Grant Consortium goals are to develop expertise and capacity for aeronautics, space and science research and education in Kentucky. In fulfilling its mission, the NASA Kentucky program serves several constituencies – NASA, the U.S., and Kentucky, including Kentucky's university/college faculty, students, teachers, and the general public. The NASA Kentucky mix of program elements and emphases offers “Pathways of Opportunities” serving the educational and economic needs of Kentucky and its constituents, aligned with NASA's mission.

The NASA Kentucky Space Grant Consortium objectives are to promote a strong STEM education base by preparing students and teachers; to maintain a network of universities contributing to aeronautics and space; to encourage collaborations among universities, aerospace industry, and government; to support aerospace training, research and public outreach; and to recruit and train U.S. citizens, especially women, minorities and disabled persons.

NASA Kentucky has developed SMART Objectives for each of five program areas: 1) NASA Internships, Fellowships and Scholarships (NIFS); 2) Higher Education; 3) Research

Infrastructure; 4) Pre-College; and 5) Informal Education. NASA Kentucky has also established SMART Objectives for student, faculty and institutional diversity.

SMART objectives for the FY 2018 Space Grant Extension proposal include quantitative targets for Year 4 in each program area as follows: 1) NIFS: 3 NASA Center Internships (NCI), 5 Graduate Fellowships (GF), 4 Undergraduate Fellowships (UF), 6 Team Fellowships (TF), and 5 Kentucky Industry Internships (KII); 2) Higher Education: 4 Higher Education Enhanced Mini-Grants (EMG-HE); 3) Research Infrastructure: 4 Research Initiation Awards (RIA); 4) Pre-College: 3 Mini-Grant awards (MG) and 3 Enhanced Mini-Grant award (EMG); 5) Informal Education: 1.6 Mini-Grant awards (MG) and 2 Enhanced Mini-Grant award (EMG). Diversity objectives for students receiving direct support under Year 4 NIFS programs are at least 35% for female students and 14.6% ($\pm 2\%$) for underrepresented minority students. Diversity objectives for Year 4 project mentorship are at least 35% for female PIs and 14.6% ($\pm 2\%$) for underrepresented minority PIs. Institutional diversity objectives are 80% Consortium participation for Affiliate institutions.

C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS:

NASA Kentucky research fellowships advance graduate and undergraduate student training in technology development projects and scientific investigations relevant to NASA missions and Kentucky research programs by partnering with the Agency, academic and scientific institutions, and commercial aerospace companies. NASA KY Graduate Fellowships (GF) must demonstrate collaboration with a NASA or aerospace industry partner. In Year 4 of the current NASA KY Space Grant cycle, 8 Graduate Fellowship proposals were received from 3 Kentucky affiliate institutions with letters of support from 5 NASA Centers (ARC, GSFC, JSC, LaRC, MSFC) and the Space Telescope Science Institute. Six proposals were selected for award in research areas of dark matter astrophysics, remote sensing/ecosystem management, energy storage, spacecraft thermal protection systems, and UAV flight formations. NASA and industry collaboration is key to success of these awards, providing strategic guidance to Kentucky faculty mentors and graduate students. NASA personnel provide support to these projects by offering to host faculty and students for technical visits to NASA Centers, providing feedback and review of research direction and progress, and serving as co-authors on scientific papers for research results. The results of NASA KY Graduate Fellowship projects can be incorporated into NASA missions, helping to advance current work towards NASA technical solutions or scientific understanding. NASA KY Undergraduate Fellowships (UF) allow students working towards a bachelor's degree to also participate in advanced research programs and contribute to NASA research goals. These projects provide the student with a 1-on-1 mentored research opportunity aligned with NASA technical directions and utilizing NASA resources, such as datasets, modeling, and source code. In Year 4 of the current NASA KY Space Grant cycle, 4 Undergraduate Fellowships were awarded for projects in the areas of astronaut health/medical technology, nanotechnology, energy storage, and spacecraft thermal protection systems.

The NASA Kentucky Team Fellowship (TF) program, which provides support for student groups participating in higher education technical and design competitions, continued its history of supporting successful projects during Year 4 of the current NASA KY Space

Grant award. Seven proposals were received from 4 Kentucky affiliate institutions, including 1 community college, and 7 were awarded to begin work on NASA-related team design projects. Examples of these projects include a Year 4 TF that was awarded to support Owensboro Community and Technical College (OCTC) to participate in the NASA Human Exploration Rover Challenge. The team designed, built and operated a human-powered rover as an extracurricular activity associated with the OCTC Advanced Manufacturing degree program. After placing in the Top 25 and then Top 10 their first two years of competition, OCTC again improved upon their success by placing two teams in the Top 10 this year at the Rover Challenge in Huntsville, AL, racing their rover over a simulated lunar surface course to achieve real-world performance goals against competition that included 4-year institutions and engineering schools. Another example of a Year 4 TF was awarded to support the University of Louisville River City Rocketry program in their quest to build on past success in the NASA Student Launch Initiative and participate in a new competitive challenge in New Mexico's Spaceport America Cup. After finishing in the Top 5 several years and winning the 2017 NASA Student Launch Competition, the team hopes to carry its success forward to this new competition. The NASA KY TF program encourages teams to establish project infrastructure and mentor younger students who will continue team projects into future years. University of Kentucky students, utilizing previous Team Fellowship support, coordinated multiple cohorts of senior design teams to develop and build the body and subsystems for a unique spacecraft that will be launched in space for the third time this year. KRUPS – Kentucky Re-entry Universal Payload System – was launched in 2017 and 2018 from the NASA Wallops launch range and will be launched from there again this year as part of the 2019 RockSat-X payload, in preparation for launch from an ISS Cargo Re-supply Mission.

D. PROGRAM ACCOMPLISHMENTS:

- NASA Internships, Fellowships, and Scholarships (NIFS):

NASA Kentucky objectives for NIFs awards in the Year 4 Space Grant Extension include: 3 NASA Center Internships, 5 Graduate Fellowships, 4 Undergraduate Fellowships, 6 Team Fellowships, and 5 Kentucky Industry Internships, with 35% diversity for female student participation and 14.6% ($\pm 2\%$) for underrepresented minority student participation among NIFs programs. The Year 4 RFP received 34 NIFs proposals from Kentucky Space Grant Consortium affiliate institutions.

All Year 4 NIFs award targets were met or exceeded. NASA KY awarded support for 6 GF, 4 UF, and 7 TF projects. In addition to programs funded through the annual NASA KY Space Grant RFP, NASA Kentucky awarded 5 Kentucky Industry Internships and partnered with NASA to support 3 NASA Center Internships from Year 4 funding, selected from among 91 Kentucky students who applied through the NASA Intern system and were eligible for Summer 2019 internships. NIFs proposals and internships indicated participation from 6 different academic affiliate institutions among all NIFS project categories, including one community college. Self-reported demographic information from direct student awards in Year 4 NIFs programs indicate 39% female student participation, exceeding the target objective, and 11% underrepresented minority student participation, within 2% of the objective.

- Higher Education projects:

NASA Kentucky objectives for Higher Education projects in the Year 4 Space Grant Extension are for 4 Higher Education Enhanced Mini-Grant (EMG-HE) awards. The Year 4 RFP received and awarded 2 EMG-HE proposals from Kentucky Space Grant Consortium institutions. The 2 EMG-HE awards in Year 4 bring the total number of projects awarded under the Higher Education category to 88% of award objectives cumulative through Year 4. Year 4 saw continuation of performance for Higher Education projects that began in previous years, including the LSST project, which addressed needs of the Consortium to support one of its main strategic themes of “Big Data” and computer science education.
- Research Infrastructure projects:

NASA Kentucky objectives for Research Infrastructure projects in the Year 4 Space Grant Extension are for 4 Research Initiation Awards (RIA). The Year 4 RFP received 9 RIA proposals from Kentucky Space Grant Consortium institutions and awarded 6 based on merit review. This exceeded the awards target for Year 4 and caught up cumulative awards through Year 4 from a low number of RIA proposals in previous years. Awards in the Research Infrastructure category included 1 additional affiliate institution not already participating in other categories.
- Pre-college projects:

NASA Kentucky objectives for Pre-college projects in the Year 4 Space Grant Extension include 3 Enhanced Mini-Grant awards (EMG) and 3 Mini-Grant awards (MG). The Year 4 RFP received 6 EMG proposals and 3 MG proposals in the Pre-college category. Three EMG proposals and 3 MG proposals were awarded, which met the annual target for these awards. Proposals in the Pre-college category indicated participation of an additional 4 affiliate institutions not already participating in other categories, including Kentucky State University (MSI). Diversity results of self-reported demographic information from PIs in Year 4 for these awards indicate 33% female participation (3 of 9 PIs) and 22% underrepresented minority participation (2 of 9 PIs). Several projects include outreach to underserved rural and urban school districts in regions across the state.
- Informal Education projects:

NASA Kentucky objectives for Informal Education projects in the Year 4 Space Grant Extension include 2 Enhanced Mini-Grant awards (EMG) and 1.6 Mini-Grant awards (MG). The Year 4 RFP received 2 EMG proposals and 1 MG proposal in the Informal Education category. Two EMG proposals and 1 MG proposals were awarded, which met the annual target for Informal Education EMG awards. Proposals in the Informal Education category indicated participation of an additional 2 affiliate institutions not already participating in other categories, marking a total of 12 different institutions applying for award funding under the Year 4 RFP program year. Diversity results of self-reported demographic information from PIs in Year 4 for Informal Education awards indicate 100% female participation (2 of 2 PIs) and 50% underrepresented minority participation (1 of 2 PIs).

E. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS:

- **Diversity:**

Institutional diversity is measured as the number of affiliate institutions participating in Consortium programs. Affiliate participation in Consortium activities has a target of 80% participation. Target met – 96% of Kentucky Space Grant Consortium affiliates (25 of 26) participated in proposal reviews, meetings or other Consortium business; PIs from 12 different affiliates across the state submitted proposals for the Year 4 RFP; PIs and students from 13 different affiliates received Year 4 awards.

Project leadership diversity is measured as the number of female and underrepresented minorities participating as PIs across all awards. Objectives in Year 4 include supporting at least 35% female PIs and 14.6% ($\pm 2\%$) underrepresented minorities. Participation of female PIs was 29.4% and participation of underrepresented minorities PIs was 11.8% across all proposals awarded under the RFP.

Student diversity is measured as the number of female and NCEES underrepresented minorities receiving direct awards in NIFs programs, including Graduate Fellowships (GF), Undergraduate Fellowships (UF), NASA Center Internships (NCI), and Kentucky Industry Internships (KII). Objectives include funding at least 35% female student participation in Year 4 and 14.6% ($\pm 2\%$) underrepresented minority students. Targets were met for female participation and slightly under target for minority participation – self-reported demographic information from students receiving direct funding in Year 4 NIFs programs indicate 38.9% female student participation and 11.1% underrepresented minority student participation.

- **Minority Serving Institution Collaborations:**

Collaboration continued with Consortium affiliate Kentucky State University (KSU), an HBCU minority-serving 4-year university. KSU was selected in Year 4 for a Pre-college Enhanced Mini-Grant (EMG) award to support an intensive STEM conference for 150 minority middle/high school males, with objectives to expose students to careers in STEM and provide experiential and hands-on learning experiences using 3-D design, App Development, and GIS mapping, along with workshop activities for STEM educators to develop soft skills which are necessary to effectively teach diverse groups of students.

- **Office of Education Annual Performance Indicators:**

- API 3.3.3: STEM-18-1 18 awards
- API 3.3.5: STEM-18-5 55 pres/pubs

F. IMPROVEMENTS MADE IN THE PAST YEAR:

Improvements made in the last year include development of an administrative awards database that more effectively organizes project information, including PIs, participants, and other project details. Efforts were made to streamline financial information as well, to more efficiently track expenditures, subawards, and cost-share.

G. CURRENT AND PROJECTED CHALLENGES:

Current and projected challenges include managing a shortened final year of the grant cycle to effectively administer awards and leverage award funding to generate sub-recipient cost-share in Year 5. The solution to this issue is to start Year 5 awards while Year 4 awards are continuing and closely track the progress of sub-recipient projects in order to bring them all to completion by the end of 2019, prior to the end date of the current Space Grant cycle.

H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION:

Academic Affiliates:

Ashland Community and Tech. College	Community/Technical College
Bellarmino University	Private, Parochial University
Berea College	Private, Work College
Bluegrass Community and Tech. College	Community/Technical College
Centre College	Private College
Eastern Kentucky University	Public Comprehensive University
Hopkinsville Community College	Community/Technical College, MSI
Kentucky State University	Public Comprehensive University, MSI
Morehead State University	Public Comprehensive University
Murray State University	Public Comprehensive University
Northern Kentucky University	Public Comprehensive University
Owensboro Community and Tech. College	Community/Technical College
Thomas More College	Private, Parochial College
University of Kentucky	Public Doctoral Granting University
University of Louisville	Public Doctoral Granting University
University of Pikeville	Private, Parochial University
West Kentucky Community and Tech. Coll.	Community/Technical College
Western Kentucky University	Public Comprehensive University

Non-Academic Affiliates:

Aviation Museum of Kentucky	Museum (STEM)
Faradine Systems	Industry
Innoviator, LLC	Industry
Kentucky Science and Technology Corp.	Non-profit Organization
Kentucky Science Center	Museum (STEM)
The Living Arts and Science Center	Museum (STEM)
Space Tango, Inc	Industry
Tribo Flow Separations, LLC	Industry