

NASA Kentucky Space Grant Consortium  
University of Kentucky  
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## 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 NASA Kentucky Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2011.

## PROGRAM GOALS

The **NASA Kentucky Space Grant** goals are to serve the needs and emphases of NASA's National Space Grant College and Fellowship Program while serving the specific needs of the Commonwealth of Kentucky, through a program that enhances capabilities for aeronautics- and space-related research and education in Kentucky, and develops future workforce for NASA, Kentucky, and the Nation.

**Objectives:** The NASA and Kentucky Space Grant 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. Kentucky Strategic Themes and Kentucky Emphases compliment NASA Educational Outcome Objectives and NASA Emphases while guiding definition of the 2010-2014 KSGC programs.

**NKSG Strategic Theme #1: Pathways of Opportunities** – Programs will build on Kentucky's space science specialization, start immediately and span the full five years of the plan to: 1) Provide integrated progressions of opportunities for STEM workforce development to meet NASA priorities, 2) Mirror NASA's Education Framework to Inspire, Engage, Educate, Employ, 3) Incorporate recognized local scientific sites (planetaria and observatories) as statewide outposts for teacher training, student internships, diversity engagement and KSGC Affiliate leadership and involvement, 4) Be

a catalyst for higher education recruitment, and 5) Enhance in-state employment in Kentucky's aerospace industry.

**NKSG Strategic Theme #2: NextGen Partnerships** - Programs will be developed early in the 5-year cycle then phased-in to provide: 1) A new in-state aerospace engineering degree option, 2) An emphasis on aeronautics R&D, 3) New links to the Kentucky Community and Technical College System (KCTCS), and 4) A new high-school-to-higher-education pathway combining aviation and aerospace inspiration supporting NASA's NextGen Air Transport initiative.

### PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, OR 3)

**Undergraduate Scholarships (Outcome 1):** Mr. Aaron Bell (mentor: Dr. Steven Gibson) and Mr. Andrew Gott (mentor: Dr. Louis Strolger), undergraduate Physics & Astronomy students at Western Kentucky University supported by NASA Kentucky Space Grant awards, each won the prestigious Chambliss Astronomy Achievement Student Award for their poster presentations at the 219th American Astronomical Society meeting in Austin, Texas 8-12 January 2012. Their posters, respectively, were titled, "Dust Infrared Emission in an H<sub>2</sub>-Forming, Perseus-Arm Cloud" and "UBVRI Optical monitoring of Supernova 2011fe in Pinwheel Galaxy with the 1.3-meter Robotically Controlled Telescope."

**NextGen Partnerships Bridging Pre-College to Higher Education (Outcome 2):** A 6-minute documentary video was filmed and edited to present the motivation and inspirational outcomes of the first Kentucky Institute for Aerospace Education (KIAE) Wing Design Competition. KIAE is a network of 12 high schools offering aviation courses including pilot's training, maintenance training, airport management and, with this competition – aircraft design. This video was shown at the 2011 Fall Space Grant Director's Meeting as part of a presentation by Taylor County High School's Dylan Skaggs (student) and Deborah Hinton (teacher) about their experience in and leading up to the competition. The video has also been distributed to legislators, businesses and educators across Kentucky, as well as to others within NASA and nationally. A second year of the competition is planned to finalize aspects for distribution as model to other states. Interest has been expressed in offering this as a regional competition among several state winners with the final flight competition located at NASA Langley.

**General Education (Outcome 3):** As part of the 2011-2012 season, the Grand Theatre in Frankfort, Kentucky included a performance of "Forged in the Stars" by storyteller Jay O'Callahan. The oral cultural tradition of Storytelling is celebrated in Kentucky with popular annual competitions that draw international attendees and participants. Jay O'Callahan is a premiere storyteller in the United States and was commissioned by NASA to develop a storytelling performance in honor of NASA's 50<sup>th</sup> anniversary. Including his performance as part of the 2011-2012 season of the Grand Theatre in Kentucky's capitol city was a synergistic general education opportunity. An audience of 286 attended the performance and viewed an installation of Apollo Program images on loan from NASA Kentucky for the event.

## PROGRAM ACCOMPLISHMENTS

SMART Objectives (5-year goals)

### **Year 2 Progress**

NASA Kentucky Space Grant Programs were proposed following NASA's Educational Framework. Results are reported herein for each program under the three educational outcomes. SMART Objectives are listed from the proposal in un-bold type, followed by the Year-2 Progress toward each goal in bold. These include 5-year combined targets for normalized measures such as competitiveness, return-on-investment (RoI) and diversity percentages, as well as 1-year totals for award and participant counts. Brief comments on each objective follow the summarized results.

Note that this is the second year that the NASA Kentucky Space Grant was hosted at the University of Kentucky (UK). Therefore, some programs described in the original proposal are still being phased in over the 5-year total period as indicated below.

### Outcome 1 - Higher Education

Diversity in the Higher Education programs is included in Part Measures section below.

Graduate Fellowships (5 LT Fellows, Competitiveness 1:3, Pubs/Presentations 1/Fellow)  
**Year 2 Progress: 5 LT Fellows, Competitiveness 5:6, Pub/Pres 1/Fellow**

Student count target met for Graduate Fellowships. Baseline competitiveness was established in Year 1, but decreased in Year 2; Year-3 efforts will focus on increasing the number of submitted proposals. Poster presentations at the May 2012 Kentucky EPSCoR Conference are required for all SG Fellows.

Undergraduate Scholarships (10 LT Scholars, 3 HE Institutions, Competitiveness 1:2, 3 HBCU applications, 20 participants, 1 team project, 10 travel, 15 contacts with NASA)  
**Year 2 Progress: 10 LT Scholars, 6 HE Inst., Competitiveness 10:34 (Undergraduate Scholarships 3:3, Team Projects 2:2, Spring/Summer Interns 5:29), 0 HBCU, 20 Participants, 10 Travel, 15 contacts with NASA**

All targets met for Undergraduate Scholarships.

Research Initiation Awards (3 LT students, Competitiveness 1:3, 6 awards, Publications/Presentations 2/award, follow-on proposals \$3:\$1)  
**Year 2 Progress: 3 LT Students, Competitiveness 5:10, 5 awards, Pub/Pres 1/award, Follow-on Proposals N/A**

Baseline competitiveness was established in 2010 at 61.5% (8:13), and improved in 2011 to 50% (5:10), but still has not reached goal of 33% (1:3). The number of submitted proposals did not increase in Year 2, however. A reduced number of proposals is

attributed to issuing a combined SG and EPSCoR RFP, so time-limited PIs chose to submit for the larger EPSCoR RIDG opportunity instead of the SG RIA. Year-3 RFPs will be issued separately to confirm this thesis. Baseline Kentucky EPSCoR Reporting System (KERS) results for pub/pres and follow-on funding results (KERS reporting is annually during the summer) will be available in Year 3.

Kentucky Space (6 LT students, 4 HE Institutions, 3 year return on investment \$1:\$1)  
**Year 2 Progress: 11 LT students, 2 HE Inst., 3 yr Return-on-Investment (RoI) N/A**

Student count targets met; institution count target not met. Kentucky EPSCoR Reporting System (KERS) results not available for follow-on funding results (KERS reporting is annually during the summer). Follow-on funding measure will be available in Years 3-5.

NextGen Partnerships (4 industry partnerships established)  
**Year 2 Progress: 1 Industry Partnerships initiated**

Annual target not met for establishing NextGen Industry Partnerships. Theta Tech Solutions visit established a relationship for Kentucky student summer industry internships and for supporting aerospace curriculum development.

Curriculum Development (1 course developed/revised)  
**Year 2 Progress: 0 Courses developed/revised**

Target not met for Course Development in Year 2, but exceeded (3 instead of 1) in Year 1, so overall to-date target is met.

### Outcome 2 - Precollege Education

Outposts (Identify 6 Outposts, sponsor 2 fieldtrips or short PD per outpost)  
**Year 2 Progress: 0 Outposts**

Outposts programs not implemented yet. Year-3 plan to initiate Outpost relationships and conduct Outpost events.

Mini-Grants (4 HE Institutions, 6 awards in addition to 4 diversity awards, 7000 Primary/Secondary participants)  
**Year 2 Progress: 3 Mini-Grants awards, 3 HE Inst., 2192 P/S participants**

Targets not met for number of awards, institutions and participants. Only 5 MG proposals submitted (2 not fundable). Efforts in Year 3 will focus on increasing number of submissions. P/S participants include 1542 Engineering Tours, 425 KIAE network students curriculum and design competition, and 225 Engineering Open House. P/S target not met, but increased over that of Year 1. Participants still not fully accounted for due need for new P/S participant reporting process with new host institution (communication

is one priority of the Program Coordinator defined in Year-2 restaffing plan). Year-3 efforts will include definition of P/S Participant reporting process.

NextGen Partnerships

**Year 2 Progress: Director worked with state government and KIAE network to draft an agreement for Capitol City Airport hangar lease to KIAE.**

### Outcome 3 - Informal Education

Artifacts & Models (Display 3 unique-to-KY artifacts)

**Year 2 Progress: 4 Exhibits**

Target met, including BIG BLUE Mars Airplane with UV-Curing Wings at Engineering Open House (E-Day) Feb 2012, Apollo Images and ILC Dover Spacesuit display at NASA Kentucky Grand Opening Oct 2011, Apollo Images at “Forged in the Stars” performance Mar 2012 and at Jim McCurry Hall of Distinction induction reception April 2012.

Distribute Materials (Distribute NASA/KSGC materials to 30 sites)

**Year 2 Progress: 12-15 sites provided program information**

Target not met. Materials provided to KIAE schools and NASA Kentucky SG affiliates, among others. As outposts are established, widespread materials distribution will be facilitated.

Informal Education Partnerships (Informal Educators attending annual meeting)

**Year 2 Progress: Including informal educators is still pending.**

Year-3 plan to include informal educators attending NASA Kentucky SG meeting.

## PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Student Data and Longitudinal Tracking:** Total awards = 32; Fellowship/Scholarship = 12, Higher Education/Research Infrastructure = 20; 6.25% (2/32) of the total award represent underrepresented minority F/S funding. During the FY11 program year 15 are pursuing advanced degrees in STEM disciplines, 2 accepted STEM positions at NASA contractors, 14 accepted STEM positions in industry, 2 accepted STEM positions in K-12 academia, 5 accepted STEM positions in academia, and 20 went on to positions in non-STEM disciplines. The remaining students have not yet received the degree that they were pursuing while they received their Space Grant award.
- **Diversity:** (Goals:10.8% minority, 50% women; targeted recruiting mini-grants 3 + 1 HBCU)

Diversity percentage targets in the 2010 proposal were based on jurisdictional population statistics (10.8% minority and 50% female). Of 28 proposals received for SG programs, key participants (PI, Co-PI or students, totaling approx 57 people) on 2 proposals were minority (7.1% of proposals) and on 9 proposals were female (32% of proposals). Considering faculty PIs of awards, of 18, 0 are minority and 4 are female (22.2% of PIs). Of 32 LT students, 2 are minority (6.25% of LT students) and 10 are female (31.25% of LT students). Although the 50% female target is not met, Year-2 has shown a significant increase in female participation in all diversity measures. Year-3 efforts will also evaluate the appropriateness of a population-based target for female participation when STEM female population statistics for students and faculty range from 10-15% and 5-10%, respectively. The five-year percentage target for women may be adjusted after Year-3 to represent a “stretch goal” from the STEM populations rather than based on the general population. Minority targets were met in Year 1, but not in Year 2. The numbers overall are small, so Year-3 efforts will focus on increasing the targeted recruiting award counts. Continued efforts with minority-serving institutions in the jurisdiction will also focus on attracting more minority participation in SG programs.

- **Minority-Serving Institutions:** 2 (1 consortium affiliate; 1 Challenger Center located at Shawnee High School, a pending consortium affiliate)

Kentucky State University (KSU) is the HBCU in the jurisdiction. One Summer Intern in 2011 was selected from KSU, with excellent results all around. For the Year-2 RFP, the KSU affiliate representative did participate in proposal selection, but no program submissions were received. Year 3 will continue to build on these Year-2 contacts. Plans are being formulated with engaging African-American PIs at other NASA Kentucky institutions to present seminars, coordinated with targeted recruiting of students and faculty at KSU.

The Academy@Shawnee High School in Louisville, KY is actively involved in KIAE and the NASA Kentucky Wing Design Challenge. They developed a microbiology payload for the first SSEP cycle and opened a new Challenger Learning Center for Space Exploration. Shawnee serves 560 urban students with 63% minority and 86% free or reduced lunch enrollment. In Year-3, all three Challenger Centers in Kentucky will be recruited as NASA Kentucky SG affiliates.

- **NASA Education Priorities:** 20 funded projects address 7 of 8 NASA Emphases

E1.10 projects with authentic, hands-on student experiences in science and engineering including fellow/scholar (GF/US), team projects (TP), Higher Ed KySpace, HE/Pre-College KIAE Wing Design Challenge, IEEE Robotics, and more.  
E2. 3 projects engaging middle and high school teachers in hands-on curriculum enhancement for climate change, LRO lunar and aeronautics involving 97 teachers.  
E3. 1 project providing summer STEM opportunities on campus for secondary students (Robinson Scholars is an established program for Appalachian student

development; Space Science Camp for 18 selected students at Morehead Space Science Center).

E4. 0 projects specifically with community colleges (expected for Year-3 and beyond with new affiliates)

E5. 3 projects involving aeronautics research or NextGen Air Transport including graduate fellowship (GF) in aircraft design optimization, team project (TP) designing and building a sensor aircraft for boundary layer turbulence measurement, and the KIAE wing-design competition.

E6. 1 project focused on Climate Change teacher training with NASA materials (note that an offering was planned for 20 teachers, but more than 60 requested registration in less than 24 hours, so the project was expanded to allow for 60 middle and high school teachers.

E7. 11 projects which include some aspect of diversity (or more than one): 4 GF/US have female students, 4 Research Initiation or GF awards to female PIs, and 6 have institutional diversity being at smaller regional or private affiliate institutions.

E8. 6 projects (5 RIA and 1 TP) enable talented early career faculty to develop research capabilities and NASA collaborations.

## IMPROVEMENTS MADE IN THE PAST YEAR

The host institution moved to the University of Kentucky with this award in June 2010. This past year has seen the completion of the first subaward cycle, so processes were developed for reviewing and approving (if merited) subaward extensions, and for closing out subawards. The NASA Kentucky offices were completed and a Grand Opening event was held on Friday, October 7, 2011.

A new staffing plan was developed after seeing the operations of other Space Grant Consortia and experiencing part-time Director unavailability. A rebudget request accompanies this report detailing the restaffing and programmatic adjustments after two-year review.

The 2010 proposal included a plan to review the programs after two years and to make adjustments if target metrics were not achieved. Although many of the target metrics were met in the first two years, target competitiveness was not, so program funds are being slightly reallocated to evaluate the impact, particularly on larger-award competitiveness (graduate fellowships).

Year 2 included meeting with key academic administrators (e.g., UK VP Research, UK Legislative Affairs Office), the Statewide EPSCoR Committee (which provides state matching for NASA Kentucky Space Grant and EPSCoR programs), and with state government leaders (e.g., shadowing of state representative Susan Westrom) to introduce them to the NASA Space Grant and EPSCoR Programs, along with resulting STEM infrastructure and workforce development. We are seeing continuing or increasing state and institutional support as a result of these contacts and meetings. For example, the

Statewide EPSCoR Committee increased its 5-year commitment to the Space Grant Consortium matching from \$250k to \$375k.

## PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Bellarmino	University Private, Parochial University
Centre College	Private College
Eastern Kentucky University	Public Comprehensive University
Kentucky Science and Technology Corp.	Non-profit Organization
Kentucky State University	Public Comprehensive University, HBCU
Morehead State University	Public Comprehensive University
Murray State University	Public Comprehensive University
Northern Kentucky University	Public Comprehensive University
Thomas More College	Private, Parochial College
Transylvania University	Private University
Tribo Flow Separations, LLC	Industry
University of Kentucky	Public Doctoral Granting University
University of Louisville	Public Doctoral Granting University
Western Kentucky University	Public Comprehensive University

Affiliate Representatives distribute Requests for Proposals, encourage proposal submissions, promote partnerships with NASA, participate in proposal review cycles and develop program policies such as by-laws. Additional affiliates will be added once a by-laws mechanism is in place for applying and approving affiliates and representatives. Requests for affiliation will be considered for the following: Berea College (Private University), Challenger Centers (Hazard and Shawnee), Kentucky Institute for Aerospace Education (Non-Profit Pre-College Aerospace Education Network), Theta Tech Solutions (Industry), Bluegrass Community and Technical College (Community College), among others.