

The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.

Iowa Space Grant Consortium
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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 Iowa Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2014.

PROGRAM GOALS

The Iowa Space Grant Consortium's (ISGC) goal is to promote opportunities in the Science, Technology, Engineering and Math (STEM) disciplines in pursuits aligned with NASA's mission, through stimulating research, education, and outreach programs for all Iowans. Based on NASA's new strategic plan, and Iowa's priorities, the following areas are being given special emphasis for the five-year period from April 2010 through May 2015: 1) Promote and support applied research activities within ISGC affiliates, 2) Enhance connectivity to NASA centers and scientists, 3) Encourage ISGC participation particularly from industry and two-year colleges, and 4) Elevate the impact of the ISGC in Iowa. The following sections provide project progress as of March 13, 2015 according to the following outcomes and goals:

Outcome 1: *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals. (Employ and Educate)*

Goal 1: Continue to implement a competitive fellowship and scholarship program statewide that aligns with the higher education program at each academic affiliate, is effective at retaining students in STEM fields, and meets all of NASA's requirements.

Goal 2: Continue to implement a scholarship program for outstanding precollege seniors at the State Science and Technology Fair of Iowa that has a positive impact on the retention of students in STEM-related fields.

Goal 3: Implement a scholarship program for a Minority Serving Institution that is linked with the base program at one or more academic affiliates. (This goal was revised in FY2011 from our five-year FY2010 proposal. Our MSI initiative has been moved to Precollege, see revision of Goal 10 below.)

Goal 4: Continue the development of competitive, self-sustaining base programs at each academic affiliate campus that combines active research with student involvement.

Goal 5: Continue to develop the previously selected interdisciplinary research projects and new infrastructure research projects amended to include early career faculty to receive sustained ISGC funding and build a sustainable capability in the state with the capability to support NASA's mission.

Outcome 2: *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty. (Educate and Engage)*

Goal 6: Engage more precollege organizations in the statewide Partner Schools program.

Goal 7: To ensure sustained Iowa representation in the National Junior Academy of Science program.

Goal 8: To conduct statewide STEM professional development, preservice and in-service training for formal and non-formal educators working in kindergarten through 12th grades that use NASA content.

Goal 9: Effectively manage the State Science and Technology Fair of Iowa.

Goal 10 (revised in FY2011): Promote and provide hands-on, NASA-related activities to minority and underserved students and schools for the disabled in Iowa.

Outcome 3: *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission. (Engage and Inspire)*

Goal 11 (revised from #10 in FY2010 grant): Support STEM informal education programs that enhance public awareness of NASA missions and general scientific literacy for Iowa.

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

In FY14, ISGC focused on three programs areas: 1) engagement of students in interdisciplinary research to develop talent necessary for NASA's mission through alignment with ISGC and NASA programs; 2) sustained support of productive research programs through campus base and early career faculty research infrastructure programs at institutions of higher learning; and 3) delivery of professional development and hands-on STEM-focused activities to teachers and students of Iowa to attract, promote and retain students in STEM.

Shown below is an anecdotal example of the direct benefit to Outcome 1:

After enrolling in a campus base program research-based course with Dr. Hui Hu, a student identified that "...*this opportunity has enhanced my future career objectives and has motivated me to continue to pursue higher education...*"—Toby John Cruz, scholarship recipient, Iowa State University

PROGRAM ACCOMPLISHMENTS

(The Goals and Objectives listed above are abbreviated and paraphrased below.)

Outcome 1: *Employ and Educate*

Goal 1: Implement a competitive fellowship and scholarship program.

Objective 1a. To keep pace with the needs of Iowa's population, the FY14 goal for underrepresented minority students was raised to 22.7% per the 2011 data tables. For female awardees, Iowa realigned with the NASA goal of 40% female awardees in March 2012.

Results: In FY14-15, ISGC awarded \$150,000 to students for 23 fellowships and scholarships with one fellow and 22 scholars. Eighteen of 23 were awarded to university students. Four of 23 were awarded to community college transfer students. One of 23 was awarded to the precollege senior who won the State Science and Technology Fair of Iowa and matriculated to an academic affiliate in a STEM field. Of all fellowship and scholarships awards, 26.1% went to underrepresented students (6/23, goal 22.7%) and 56.5% went to female students (13/23, goal 40%).

Objective 1b. Awardees will enroll in research-based instruction on their campuses.

Results: All university and community college fellows and scholars (22) enrolled in an independent study or research class at their institution under the mentorship of an ISGC-funded researcher. The fellowship and scholarship program and higher education programs worked together to engage and educate our students in authentic, hands-on research-based experiences. Base programs provided a research-based learning experience and received sustained funding at each campus in a STEM field of interest to the institution, the state, and NASA. The base programs served as the main NASA activity on each campus, creating a NASA presence. Research-based courses provided attractive learning communities valued by students. There were multiple projects, people and opportunities from which to choose, which we believe helped to contribute to attracting a diverse pool of talented applicants.

Objective 1c. Awardee retention will exceed the general STEM population at their institution.

Results: Awardee retention in STEM exceeded STEM retention in their institutions of higher education. Of the 56 FY2006-FY2014 awardees in our tracking system, 94.6% (53/56) remain in STEM in their current degree program.

Goal 2: Implement a scholarship for the winning senior competitor of the State Science and Technology Fair of Iowa to attend an academic affiliate to study in a STEM field.

Objective 2a. Ensure that all senior entrants are aware of the ISGC award.

Results: A positive response for awareness of the award indicates awareness of NASA. Over 700 students from grades 6-12 are registered for the March 26-27, 2015 State Science and Technology Fair of Iowa. Results will be included in the final report.

Objective 2b. Ensure awardee retention in STEM exceeds STEM retention of the general student population in their post-secondary institution.

Results: Of the seven science fair scholars currently being tracked, five are still in STEM-related education disciplines, one has transferred to a non-STEM degree track, and one is employed in non-STEM.

Objective 2c. Awards will go to students who participated in the science fair in prior years.

Results: A positive correlation for participation will indicate students are retained in STEM. The belief is that students who have multiple experiences build skills necessary for future success in pursuit of STEM careers. The number of seniors competing and final retention data will be included in the final report.

Goal 3: This goal has been revised from our five-year FY2010 grant. Our Minority Serving Institution initiative has been moved to Precollege, see revision of Goal 10 below.

Goal 4: Each academic affiliate will have a competitive, self-sustaining base program, which contributes to research important to NASA and engages students in research-based instruction.

Objective 4a. Base programs produce publications and non-ISGC grant proposals each year.

Results: Base programs not only provided instruction to scholars and fellows, but also improved research infrastructure in areas of importance to NASA, Iowa and the institution. This year, the four campus base programs produced eight peer-reviewed publications (six accepted and two submitted), published in three conference proceedings, presented eight papers at professional meetings, and delivered two invited talks. Base programs also sought follow-on funding; two grants were awarded for a total of \$385,000 in non-ISGC grant funding and two proposals valued at \$1,015,020 are pending. Space limited more detailed descriptions of base programs in this report, but will be included in the final report.

Objective 4b. Base programs will develop a new NASA collaboration.

Results: Each base program developed a new NASA collaboration and developed an interdisciplinary team to conduct the research.

Objective 4c. Each base program will generate non-federal cash or in-kind match equal to NASA funding.

Results: All base programs generated non-federal cash or in-kind match equal to or greater than the amount of NASA funding received.

Objective 4d. All students receiving funds will be U.S. citizens.

Results: All students funded were U.S. citizens.

Objective 4e. Conduct competitions to select new base programs on a three-year cycle.

Results: Two new base program competitions at Drake and ISU were conducted in FY13-14. In FY14-15, competitions are underway at UNI and UI.

Goal 5: Support early career faculty to improve research capacity important to NASA's mission.

Objective 5a. Research infrastructure early career faculty will submit publications and non-ISGC grant proposals each year.

Results: The belief is that research infrastructure and capacity to do research is best built-up by successful researchers who win research awards, collaborate with partners to leverage resources, and engage postdoctoral, graduate and undergraduate student research assistants in a long-term sustainable research enterprise. Collaborators in turn, spin off projects with high success due to momentum gained in work. From past ISGC experience with research infrastructure efforts, we learned that sustained funding of a program over a number of years is necessary to bring a researcher to a competitive level.

In FY2014, ISGC funded two early career investigators in the research infrastructure program. One new researcher was selected in FY14; the other was in their fourth and final year of funding. Both programs produced publications and non-ISGC grant proposals. Together, the two researchers produced two patent applications, published three papers in peer-reviewed journals, submitted one paper to a peer-reviewed journal, and presented three papers at professional meetings.

Objective 5b. Research infrastructure programs will develop a NASA collaboration that did not exist before the ISGC research program was established.

Results: One of the research infrastructure programs developed NASA collaborations and other is working to establish NASA collaboration.

Objective 5c. Research infrastructure programs will generate non-federal cash or in-kind match to the NASA funding provided.

Results. All of the research infrastructure programs generated non-federal cash or in-kind match equal to or greater than NASA funding provided.

Outcome 2: *Educate and Engage*

Goal 6: Engage more precollege organizations in the statewide ISGC Partner Schools program.

Objective 6a. Partner Schools will actively use NASA content and ISGC professional development services beyond the first year of participation.

Results: The Partner School survey will be distributed later in the school year. The results will be in the FY2014 final report. Two Partner School professional development workshops engaged 12 school districts and one county Extension and Outreach program. One short-term workshop included 27 teachers. A long-term workshop included 19 teachers.

Objective 6b. Former NASA Explorer Schools will continue to participate as ISGC Partner Schools beyond their term as an Explorer School.

Results: Only one teacher remains from the NASA Explorer Schools program and continues to participate with ISGC through the Partner Schools program.

Objective 6c. The majority of Partner School trained teachers will offer at least two professional development programs in the first year and at least one in subsequent years.

Results: All teachers offered training within their districts. Some teachers also presented at state and national conferences. This year's survey is scheduled for April 2015.

Goal 7: Ensure representation in the National Junior Academy of Science program.

Objective 7a. Senior entrants to the Iowa Junior Academy of Science (IJAS) competition will be aware of ISGC support for the national competition.

Results: Student awareness of the NASA support provides motivation to aspiring scientists. Students will be surveyed at the 83rd Iowa Junior Academy Science annual meeting in April 2015 and results will be included in the final report. The ISGC worked with the Academy to support students' research efforts and sponsor a student research poster competition. Support also included travel to the AAAS/American Junior Academy of Science. Five students, selected at the 2014 IJAS competition, presented their research at the 2015 American Junior Academy of Science conference in San Jose, CA, February 11-15, 2015.

Objective 7b. The IJAS endowment will grow to sustain the national competition participation program.

Results: This objective has been discontinued.

Objective 7c. The majority of IJAS winners will study in STEM fields at academic affiliate institutions or other higher education institutions.

Results: The Iowa Junior Academy of Science meeting will be held in April 2015. Data unavailable at the time of this writing will be submitted in the final report.

Goal 8: Conduct STEM professional development, preservice and in-service training for formal and non-formal educators working in kindergarten through 12th grades that uses NASA content.

Objective 8a. All Iowa schools will be aware of the ISGC STEM professional development services available.

Results: All school districts receive communications from The Iowa Department of Education ISGC affiliate member, which informs them of sponsored professional development

opportunities. The ISGC precollege program conducted workshops for 150 teachers. Of those, 19 teachers were involved in long-term (multiple day) workshops and 131 teachers were involved in one-day workshops.

Objective 8b. Significant participation from informal organizations will be reached each year.

Results: Five of seven of our informal outreach affiliates actively participated in ISGC STEM professional development or NASA based programs.

Objective 8c. The ISU Extension-Science, Engineering and Technology (E-SET) staff will maintain technical proficiency by attending at least one NASA workshop.

Results: The ISGC associate director for education traveled with four teachers to Houston, TX to participate in the 21st Annual Space Exploration Educators Conference at Johnson Space Center in February 2015.

Goal 9: Effectively manage the State Science and Technology Fair of Iowa (SSTFI).

Objective 9a. Participation in the SSTFI will increase.

Results: The ISGC supported training for educators and ongoing support as they mentored students. The 2015 fair will be held March 26-27. Results of the student survey and award will be provided in the final report. Enrollment is anticipated to increase in 2015 from 2014.

Objective 9b. Home-school participation in SSTFI will increase.

Results: The 2015 fair will be held March 26-27. Home-school student participation numbers and results will be provided in the final report.

Objective 9c. The SSTFI will establish an endowment.

Results: This endowment has been discontinued.

Goal 10 (revised in FY2011 from FY2010 proposal): Promote and provide hands-on NASA-related activities to minority and underserved students and to schools for the disabled in Iowa.

Results: In FY2014-15, the ISGC partnered with Iowa State University Extension and Outreach to focus on two large school districts with large numbers of underserved students; the Waterloo School District (10,234, 44% underserved students, 65% eligible for free or reduced price lunch 2012-13 data) and the Des Moines School District (32,396, 49% underserved, 72% eligible for free and reduced lunch, 2014-15 data).

In the Waterloo School District, ISGC worked to establish STEM clubs and camps for students. The program supported 18 teams focused on Junior and FIRST Lego League and FIRST Tech Challenge teams, impacting 100 students and 18 teachers. STEM clubs were added at eleven schools, impacting 150 students and 10 teachers. Support for summer STEM camps for elementary and middle school students during summers of 2013 and 2014 impacted 75 students and five teachers. The District purchased various STEM curriculum materials, which impacted 3230 students and 100 teachers.

Both Waterloo and Des Moines School Districts participated in the FY14 ISGC Partner School program. Participants developed STEM plans that included implementing Next Generation Science Standards using NASA STEM materials and content for improving learning for Iowa youth. Participants also pledged to deliver professional development activities to their districts.

Outcome 3: *Engage and Inspire*

Goal 11 (revised) Support STEM informal education programs that enhances public awareness of NASA mission and general scientific literacy for Iowa.

Objective 11a. Use non-federal funds to support STEM programming on Iowa Public Television that will reach at least 20,000 Iowans and that is consistent with other ISGC education objectives in that it uses NASA content and meets informal education requirements.

Results: NASA related programming is sponsored by ISGC for statewide coverage. The ISGC logo is used after each supported program to identify ISGC sponsorship. IPTV reported programming reached an estimated 23,871 viewers.

Objective 11b. Competitively generate proposals for ISGC affiliates to conduct one or more informal education projects in Iowa.

Results: One proposal was funded by the ISGC in FY2014 through informal education efforts to enhance public awareness and improve scientific literacy for Iowans through the support of STEM programming that serves the NASA mission. The National Mississippi River Museum and Aquarium is conducting a multi-faceted program. Results of the project will be included in the final report.

The ISGC reports there are no changes to the FY14-15 budget.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

Diversity: In FY14, significant support went to 23 fellows and scholars, three NASA interns and three students working on research projects with 48% female (14/29) and 20.7% traditionally underserved students (6/29). In longitudinal tracking, of the 56 FY06-FY14 awardees in our tracking system, 94.6% (53/56) remain in STEM. Three of the 56 have reached the next step (two of the three remain in STEM). One is employed in a STEM non-aerospace position, one is employed in a STEM academic field, and one is classified as “other”.

NASA Education Priorities:

- *Authentic, hands-on student experiences in science and engineering disciplines.* In addition to students engaged with campus base programs, ISGC supported three rocketry teams, a robotics team, and three NASA interns.
- *Diversity.* In FY2014, preliminary data for FY2014-15 shows there were 45 funded and unfunded participants with 49% (22/45) women and 20% (9/45) underrepresented students.
- *Engage middle school teachers in hands-on curriculum enhancement.* ISGC provided professional development to 150 teachers.
- *Summer opportunities for secondary students.* ISGC provided support for STEM programming in district and campus visits for the Waterloo school district.
- *Community Colleges.* Four scholarships were awarded to community college students.
- *Aeronautics research.* The ISU base program focuses on deicing technology and early career project on aircraft noise reduction.
- *Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities.* Two early career faculty researchers were funded through the research infrastructure program.

IMPROVEMENTS MADE IN THE PAST YEAR

- ❖ Promoted and supported applied research activities within ISGC affiliates by engaging students with faculty mentors that led to publications, presentations and research funding.
- ❖ Hosted a regional space grant conference focused on strategies that contribute to attracting, retaining, and promoting underserved talent in areas of importance to NASA.
- ❖ Enhanced connectivity to NASA centers and scientists through collaborations between ISGC faculty researchers and NASA scientists.
- ❖ Encouraged ISGC participation, particularly from two-year colleges, through the successful implementation of community college transfer scholarships that mentored students in their transition to their new universities and research experiences.
- ❖ Elevated the impact of the ISGC in Iowa by working with the Iowa Governor's STEM Advisory Council to deliver NASA relevant content to large numbers of students.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The participation of partners varies as research topics and themes vary from year-to-year. Specific involvement in the current program year is listed in italics below.

1. Aerodyne Laboratories (industry) *support through annual membership fee to the ISGC, collaboration in the UNI base program*
2. Ames Laboratory of the U.S. Department of Energy (federal lab) *advisor for DOE alignment*
3. Cedar Rapids Science Center (science museum) - *Informal education competition participant*
4. Drake University (private four-year university) - *Executive Committee member, base program, scholarships and fellowships*
5. Grout Museum District (science museum) - *Informal education competition participant*
6. Iowa Academy of Science (nonprofit organization) - *IJAS poster competition*
7. Iowa Aviation Promotion Group (nonprofit organization) - *Informal education competition participant*
8. Iowa Department of Education (state government) - *Partner Schools program, State Science and Technology Fair of Iowa*
9. Iowa Department of Natural Resources - Iowa Geological & Water Survey (state government) *advisor for alignment to jurisdiction*
10. Iowa Department of Transportation, Office of Aviation (state government) *advisor for alignment to jurisdiction*
11. Iowa State University (public Ph.D.-granting university) - *Executive Committee member, base program, scholarships and fellowships, research infrastructure project continuation, early career investigator research program, host of ISGC main office, State Science and Technology Fair of Iowa, precollege program and associate director for education*
12. United States Department of Agriculture (USDA) National Lab for Agriculture & the Environment (federal lab) *advisor for USDA alignment*
13. National Mississippi River Museum & Aquarium (science museum) - *Informal education competition winner*
14. Putnam Museum (science museum) - *Informal education competition participant*
15. Rockwell Collins (industry) *support through annual membership fee to the ISGC, aerospace industry advisor*
16. Science Center of Iowa (science museum) - *Informal education competition participant*
17. Softronics Limited (industry) *annual membership fee to the ISGC, aerospace industry advisor*

18. University of Iowa (public Ph.D.-granting university) - *Executive Committee member, base program, scholarships and fellowships, research infrastructure project continuation, early career investigator research program,*
19. University of Northern Iowa (public comprehensive university) - *Lead institution, host of ISGC director, Executive Committee member, base program, scholarships and fellowships*