

Iowa Space Grant Consortium
Lead Institution: University of Northern Iowa
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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 2013.

PROGRAM GOALS

The ISGC's 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. In PY24 (FY2013), the ISGC underwent a change of directors while still maintaining our goals and meeting our objectives. The following sections provide details as of March 14, 2014.

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 (SSTFI) 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 (MSI) 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 (SSTFI).

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, & 3)

Goal 1, 4, and 5: In order to support Outcome 1, we focused on the following three programs areas: 1) engagement in interdisciplinary research to develop new scientists necessary for our future; 2) higher education fellowship/scholarship program to provide the opportunity for students to work with researchers focused on NASA-related questions and problems; and 3) base programs on each affiliate campus to provide a strong NASA presence.

Shown below are two anecdotal examples of the direct benefit to Outcomes 1 and 2:

“Under the ISGC Scholarship program, I have been able to research both the use of an infrared sensor for a possible asteroid intercept mission and the Yarkovsky Effect. Over the summer, I composed a report that discussed the feasibility of using a long wave infrared sensor for asteroid detection and target acquisition. This past fall, I continued research of the Yarkovsky Effect on irregularly-shaped asteroids. My current goal is to improve the orbital predictions for near-earth objects, which would help us plan for a possible asteroid impact.

I feel that I have been given a great opportunity to further both my education and personal connections through the ISGC scholarship program. I have been able to collaborate with many graduate students and faculty members, exposing me to new and interesting concepts. This program has encouraged me to academically push myself more than ever before. I am very excited about where my academic career is headed, and I am grateful to the ISGC for assisting me in pursuing my goals.” – Dalton Groath, scholarship recipient, Iowa State University

“This year we have been able to recruit a new cohort of students to learn the program, and continue the development of our original cohort. We are excited to be able to take our original cohort to Wallops Flight Facility this spring (March 17) to meet with NASA scientists and tour the facility. In addition, we had two presentations at conferences demonstrating student work. We are excited to be look at individual projects by our Fellows that include attempting to collect culture bacteria at high altitude, identifying pollen at high altitude, and identifying tree species from photographs taken during the flight based on the various shades of green they reflect. We are planning to train the original cohort to be ham radio operators as they prepare to finish their involvement with the program. We also look forward to a spring launch so that participants may fly their capsules.” – John Ophus, ISGC supported faculty, Base Program, University of Northern Iowa.

Direct benefit to Outcome 3:

The Iowa Academy of Science (IAS) sent three high school students and one chaperone to the American Junior Academy of Science (AmJAS) Annual Meeting in Chicago from February 12 – 16, 2014 held in conjunction with the American Association for the Advancement for Science (AAAS) Annual Meeting. Two of the students were the top award winners at the Iowa Junior Academy of Science research project competition at the IAS Annual Meeting, April 19-20, 2013. To be eligible, the students submitted research grant proposals to the Iowa Junior Academy of Science (IJAS), presented their research at a state or regional science fair in Iowa, and presented at the 125th IAS Annual Meeting. The students made poster presentations about their research to scientists in a non-competitive environment. They also met with scientists one-on-one, met peers from across the U.S., and visited locations of scientific interest. Our students were very excited to attend the meeting and take part in the activities.

PROGRAM ACCOMPLISHMENTS

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.

SMART Objectives

Objective 1a. The original grant identified 10.8% (2007 Department of Education data tables) of awardees will be from underrepresented minority students and 50% of awardees will be female. As of March 2012, the ISGC objective was realigned with the NASA objectives of 40% female. To keep pace with the needs of Iowa’s population, the FY2013 goal for underrepresented minority students was 19.3% per the 2010 data tables located at: http://nces.ed.gov/programs/digest/d11/tables/dt11_239.asp.

Results: In FY2013, Iowa awarded one graduate fellowship and 22 undergraduate scholarships, which included four community college transfer scholarships; 21.7% (5/23, goal 19.3%) of awards went to underrepresented students and 52.2% (12/23, goal 40%) went to female students.

In FY2013, there were 27 direct funded student participants; 18.5% (5/27) of all student participants were underrepresented, and 51.9% (14/27) were women. To reach more students, ISGC sent announcements of opportunities to all of the minority and financial aid offices at our academic affiliates as well as the academic advisors of the STEM departments.

Objective 1b. Ensure all awardees actively participate in base programs or with other ISGC-supported faculty on their respective campus.

Results: 100% of fellowship and scholarship awardees actively participated in research on their campus. Each awardee enrolled in an independent study or research class at their institution. A part of the higher education area of projects within the ISGC are base programs; these base programs form the basis for sustained funding at each campus in a STEM field of interest to the institution, the state, and NASA. The base programs serve as the main NASA activity on each campus, creating a NASA presence for ISGC. The fellowship and scholarship program and higher education programs work together to engage and educate our students in authentic, hands-on research experiences.

- Dr. Marc Busch and Co-I Dr. Heidi Sleister led the Drake University base program. Undergraduate students participated in research titled *Effects of Low Gravity Environments on Host-Pathogen Interactions*.
- Dr. Bong Wie led the Iowa State University base program, which focused on *Space Technology Research for Robotic and Human Exploration of Near-Earth Objects*.
- Dr. Bernd Fritzsich led The University of Iowa base program, which examined *Understanding gravity sensing defects through targeted ear manipulations*. Dr. Fritzsich's interdisciplinary faculty research team included Co-I's Dr. Daniel Weeks, University of Iowa Dept. of Biochemistry, and Dr. James Bucholtz, University of Iowa Dept. of Mechanical Engineering.
- Dr. Ophus and Co-I, Dr. Alex Oberle led the University of Northern Iowa base program titled *High-altitude ballooning for enhancing STEM learning among undergraduate, preservice teachers in science and geography/social science*. Matthew Nelson of Aerodyne Labs collaborated (ISGC industrial affiliate).

Objective 1c. Ensure that awardee retention in STEM exceeds that of the general STEM student population at their institution.

Results: Awardee retention in STEM exceeded STEM retention in their higher education institutions; please see page 12, student data and longitudinal tracking.

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

SMART Objectives

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

Results: The 2014 science fair will be held March 27-28, 2014. Student participation numbers and results will be reported in the final report. The judges at the SSTFI identify the top senior research projects. ISGC staff selects one student researcher for a scholarship to attend college at the ISGC academic affiliates. The scholarship

incentivizes the student involvement through their senior year in science fair research. Eligibility requires academic affiliate enrollment in a STEM discipline.

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

Results: Of the seven students currently being tracked and/or reported, 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. The majority of awards will go to students who participated in SSTFI in prior years.

Results: Current registration indicates 28 seniors are registered for the 2014 fair, a 40% increase over the number of seniors that exhibited at the 2013 fair. Of the 28 registered, 20 are eligible for the ISGC award as sole exhibitors on their project. Fifteen of the 28 students are return exhibitors. Fifteen of the 20 eligible participants are female; five are males.

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

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

SMART Objectives

Objective 4a. Each base program will produce publications, and non-ISGC grant proposals each year.

Results: The four base programs produced six publications and 23 presentations. In FY2013, the base programs sought \$960,950 in non-ISGC grant proposals.

- Drake's participating students had opportunities to present data collected from the base program at conferences: two presentations were made at the national meeting, American Society of Cell Biology; two presentations were made at the statewide Iowa Academy of Science meeting; and three presentations were made at the Drake University Conference for Undergraduate Research. Additionally, students are contributing to the preparation of manuscripts. The project generated four grant proposals; two were funded for a total of \$2,700 and two are pending for a total of \$43,000.
- Iowa State University's base program produced five peer-reviewed publications, 11 presentations that were published as conference proceedings, and one other professional presentation. Dr. Wie submitted one grant proposal to NASA for \$500,000.
- The University of Iowa's base program had three presentations: one at the National Space Grant Directors' fall meeting, one at the State ISGC meeting, and one on campus at The University of Iowa's Fall Research Festival. The project produced one peer-reviewed publication. One grant proposal was recently submitted to NIH for \$415,250.

- University of Northern Iowa's base program produced once conference proceeding and two presentations.

Objective 4b. Each base program will develop a NASA collaboration that did not exist before the base program was established.

Results: Each base program developed a new NASA collaboration.

- Drake University base program faculty collaborated with Johnson Space Center's, Dr. Duane Pierson.
- Dr. Bong Wie, Iowa State University base program manager, collaborated with Brent Barbee, Goddard Space Flight Center.
- The University of Iowa's base program led by Dr. Bernd Fritsch collaborated with Dr. Richard Boyle, Space Biosciences Division, NASA Ames Research Center.
- The University of Northern Iowa's base program led by Dr. John Ophus, collaborated with Joyce Winterton, Senior Advisor for Education and Leadership, Wallops Flight Facility. Additionally, the UNI base program developed an industrial collaboration with Matthew Nelson of Aerodyne Laboratories (Ames, Iowa).

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

Results: Each base program generated non-federal cash or in-kind match equal to or greater than NASA funding.

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

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

Objective 4e. Competitions will be conducted to select new base programs on a three-year cycle.

Results: Two new base program competitions are being conducted in FY2013 at Drake University and Iowa State University. Results of the competitions will be reported in the final report. In FY2014, the base programs at The University of Iowa and University of Northern Iowa are scheduled for new base program competitions.

Goal 5: Continue to develop the previously selected interdisciplinary research projects and new research infrastructure 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.

SMART Objectives

Objective 5a. Research infrastructure programs will produce 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 with projects with high success due to momentum gained in work. From past experience within the ISGC with research infrastructure efforts, we learned that sustained seed

funding of a program over a number of years is necessary to bring a researcher to a competitive level.

The ISGC Research Infrastructure program coordinates with the Iowa NASA Experimental Program to Stimulate Competitive Research program (INE), to focus on building core strengths needed to grow competitive research and technology development capabilities that address scientific and technical problems of importance, as defined by NASA.

In FY2013, ISGC funded two early career investigators in the research infrastructure program. These programs were in their third and final year. Both programs produced publications and non-ISGC grant proposals.

- Dr. Sarah Vigmostad from The University of Iowa worked on the *Development of realistic computational models of the spaceflight effects on human physiology*. Dr. Vigmostad published one manuscript and submitted two. She gave one professional presentation and received two grants for a total of \$50,000. In spring 2013, Dr. Vigmostad was honored with a 2012-2013 Teaching Award in the College of Engineering at The University of Iowa.
- Dr. Nicola Bowler from Iowa State University is in the third and final year of an early career award. Dr. Bowler is working on the *Electromagnetic nondestructive evaluation of degradation and flaws in polymer-matrix composites*. Dr. Bowler gave three presentations, submitted a grant proposal for \$200,000 (pending) and received \$30,000 funding on another proposal.

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

Results: The research infrastructure programs have developed NASA collaborations as well as collaborations with researchers from other national laboratories, academic institutions, and industry.

- Dr. Vigmostad assembled an interdisciplinary team of collaborators. She maintained collaborations with Dr. Steve Platts (JSC), Dr. Robert Hester (Univ. of Mississippi) and Dr. Domenico Calcaterra (Indiana University). She also engaged other UI faculty on the project including Dr. Karl Kreder, Urology Department, and Dr. Nicole Grosland, Department of Biomedical Engineering and Dr. Vincent Magnotta, Department of Radiology.
- Dr. Bowler also had a diverse number of collaborators. She maintained collaboration with Dr. Dan Perey at NASA Langley (Nondestructive Evaluation Sciences Branch), Dr. Richard Bossi at the The Boeing Company, and Dr. Eric Lindgren, Air Force Research Laboratory, Wright-Patterson Air Force Base. She also collaborated with Dr. Roger Jones of the U.S. Department of Energy Ames Laboratory. At Iowa State University, Dr. Bowler collaborated with Dr. Vinay Dayal, Aerospace Engineering and Dr. John McClelland, Mechanical Engineering.

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: *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.

SMART Objectives

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 FY2013 final report.

The ISGC Partner School Program serves goals 6 and 8. The program was restructured for PY24 to leverage Iowa STEM investment provided through the Iowa Governor's STEM Advisory Council and its STEM Hub. The ISGC Partner School Program's professional development is being coordinated with academic affiliates and STEM Hubs. The program this year features ongoing NASA related professional development done in support of multiple programs conducted by affiliates and other STEM programs.

In addition, the ISGC has developed a STEM Summit series to be conducted on a regional basis, beginning in PY24 and continuing into PY25. The summits center on the Next Generation Science Standards (NGSS) and participants will include educators, business partners, and other local groups who have STEM interests. The overarching goal is for participating educational entities to develop and implement a grand STEM plan that includes implementing NGSS with NASA content support to move towards these goals. The Summits will be face-to-face meetings and will be followed by a menu of STEM professional development opportunities, including ISGC supported opportunities. Summit attendees will be selected through an application process and will include teachers across the grade spectrum of one through twelve. Participants from Iowa's North Central, Northwest, and Southeast STEM Hub Regions have agreed to host initial summits. Iowa State University Extension and Outreach, and the Iowa Department of Education, ISGC academic affiliates, and ISGC informal affiliates will be represented at the summits and the follow-up professional development opportunities. Participants will be required to submit STEM plans that will include NASA STEM materials and content for improving learning for Iowa youth.

In addition to the Summits, the Precollege Partner School Program is working with the Waterloo school district. The Waterloo School District has 10,488 students enrolled and of those, 67% are eligible for free or reduced price lunch. The district student population is 44% minority. The ISGC has partnered with the project to link NASA Educational programs to the district to increase underserved youth participation in STEM programming. The project includes STEM programming in district, campus visits, and support for STEM programming in the community and is partnering with local organizations.

Lastly, David Seilstad is an ISU Extension and Outreach K-12 STEM Educator. He participated in last year's *Mars University* program (Partner School). This year, David connected with Brian Banker, a NASA JSC liquid propulsion engineer who has worked at JSC for five years. Brian participated in a conference call with the *Marsville University* middle school program to discuss an engineer's perspective of working at NASA, returning to the Moon, and on to Mars. Mr. Banker is a former ISGC scholarship awardee from 2007.

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

Results: Survey of NASA Explorer Schools indicates that teachers from the program that are still at these schools are still engaging NASA in STEM education.

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: As of the last ISGC teacher survey, respondents reported continuing to provide professional development programs in STEM, linked to the NASA Mission.

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

SMART Objectives

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

Results: All IJAS members in the competition, and their teachers, were exposed to information about ISGC through the IJAS Wiki-Handbook, in the annual meeting program, and at the IJAS award luncheon.

ISGC worked with the Academy to support student's research efforts and sponsor a student research poster competition. Support also included research planning, proposal development, and research guidance. The ISGC provided partial support to students whose research was identified as top quality at the Iowa Academy of Science spring meeting, so they can attend the AAAS/American Junior Academy of Science.

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

Results: The Director of the Iowa Academy of Science confirmed the endowment deposit.

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 April 11-12, 2014. Data is unavailable at the time of this writing, and will be submitted in the final report.

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.

SMART Objectives

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

Results: The Iowa Department of Education, in cooperation with the ISGC, communicates regularly with all school districts to inform them of sponsored professional development opportunities.

- The ISGC precollege program conducted workshops for 410 teachers. Of those, 31 teachers were involved in long-term (multiple day) workshops.
- ISGC supported and participated at the Iowa Academy of Science's Fall Teachers Conference held October 22-23, 2013. Approximately 400 Iowa Science Teachers attended the meeting held at Iowa State University. Of the teachers in attendance, 60 visited the ISGC booth and of the 60, all were aware of NASA educational support for STEM that was available through NASA or ISGC.
- Eight ISGC Partners were identified and included school districts that have high percentages of underserved and minority students as well as a partnership with an Area Education Agency to improve the STEM ability of participants. The Partners participated in the use of Mars learning experiences to improve STEM learning in their classrooms and engaged with STEM professionals from NASA and Space Grants from other states. Partners each conducted two professional development or in-service programs for Iowa educators and developed a NASA based learning project for student use.

Objective 8b. Significant participation from informal organizations such as science museums, clubs, and home school groups will be reached each year.

Results: Three of five of our informal outreach affiliates actively participated in ISGC STEM professional development or NASA based programs as well as 4-H, Scouts, and home-school groups.

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

Results: Due to scheduling conflicts, staff were not able to attend planned professional development trips to the Space Exploration Educators Conference or the National Science Teachers Association (NSTA) National Conference. Plans are to attend the NSTA STEM Conference May 14-17, 2014 to explore the emerging national STEM movement and impacts on Space Grant.

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

SMART Objectives

Objective 9a. Participation in the SSTFI will increase.

Results: The ISGC involvement in supporting students and teachers for doing research for SSTFI included working with PhD Fellows that work with middle school youth in underserved schools. The ISGC precollege program offered training for pedagogy for the Fellows and ongoing support as they mentored students. The 2014 science fair will be held March 27-28, 2014. Results of the student survey and award will be provided in the final report.

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

Results: The 2014 State science fair will be held March 27-28, 2014. Home-school student participation numbers and results will be provided in the final report.

Objective 9c. The SSTFI will establish an endowment, which will grow from earnings and sponsorships.

Results: Because of policy and accounting changes at Iowa State University and Iowa 4-H Foundation, this endowment has been discontinued.

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

Results: ISGC worked with South Tama and Waterloo School Districts to address Goal 10. These Partner School districts have high numbers of underserved and minority students. The South Tama School District offers an after-school STEM club that was started with a focus on underrepresented but was expanded this year to include any student who is interested. The program's sponsor is an ISGC Partner School teacher.

The programming that students engaged in with ISGC during the previous year included aviation through the use of flight simulators, food production (gardening and horticulture), robotics, GPS/GIS, rocketry and more STEM related programs.

The ISGC is also in the development stage for STEM programming for the visually impaired. The program is targeting students that engage with the Iowa School for the Blind and will be a Saturday STEM day. The program is being developed in cooperation with university faculty and staff and is planned for the 2014-15 school year.

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 in FY2011 from original FY2010 proposal): Support STEM informal education programs that enhance public awareness of NASA missions 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.

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

Results: Two proposals were funded by the ISGC in FY2013 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. Two projects selected for funding for this year were: "Exploring Rivers . . . from Space" by the

National Mississippi River Museum and Aquarium; and “Investigation: Climate Change” by the Science Center of Iowa.

At the National Mississippi River Museum and Aquarium, staff educators and volunteers used “The View From Space” wall as a touchstone for conversation about the Mississippi River watershed and ecosystem. The erosion and flood tables and the Wetlab helped educate visitors about the important issues of water quality, flood, drought, and erosion.

This project enabled informal education and school tours to all visitors to the Museum & Aquarium. Many visitors were excited about this new interpretation of the giant View From Space wall map, which is 52 feet wide. Museum educators and volunteers were energized by this effort and saw the View From Space map as an important part of their educational message. In fact, many of the educators and volunteers have researched images on the map on their own to be able to better interpret the space view to visitors.

- Laser pointers were provided to staff educators and volunteers for pointing out features of the Mississippi River watershed as viewed from space, and orienting students and visitors to their location and features within this watershed view. Many visitors were excited to see some of the features of the Mississippi River watershed from views that could not have been seen from the ground or, in many cases, an airplane.
- A spotting scope on a tripod was set up on the museum gallery floor to be able to better see details of satellite image areas. Educators helped visitors view details of the space map not easily viewed from the floor of the Museum & Aquarium. A PowerPoint program was developed for a monitor placed near “The View From Space” to complement the educator led programming.
- Correlations were made to the erosion table and flood table to features and events on “The View From Space.”
- Photographs of Mississippi River features were displayed in the Wetlab, where educators related these views to visitors. Information about earth imaging satellites and NASA programs to image the earth were explained to students and visitors.

This response by one of our educators was a good example of how this project impacts the tens of thousands of people who see “The View From Space” wall map.

“I was quite excited about the View from Space project! It was so easy to just ask guests where they are from and then locate that place on the map. From there, they continued to educate me about their surrounding area. I talked with people from the Upper Peninsula, Michigan, all the way to the Gulf. One couple got on the phone and called their brother in Louisiana to get the proper Cajun pronunciation of places. My favorite was the seed salesman from Dyersville who was visiting with his grandmother. He travels a lot and I was amazed at his knowledge of the country. I asked a group of high school students from Kalona about their area and I was very impressed with their knowledge of the geography of Iowa.”

At the Science Center of Iowa (SCI), despite unforeseen technical problems, progress on “Investigation: Climate Change” moves forward. In Fall 2013, an integral part of the digital “Magic Planet” globe malfunctioned, and a replacement had to be acquired from overseas in a lengthy process. In January 2014, the replacement parts were acquired and

installed, allowing SCI staff access to this essential equipment for continued work on the project.

All content for “Investigation: Climate Change” has been completed, and is now undergoing software conversion for display on the Magic Planet system. Following this, training for SCI staff will take place to familiarize everyone with the new experience. SCI's Director of Education is working to develop a short teacher-workshop experience that will familiarize participating educators with climate science as well as the new “Investigation: Climate Change” experience.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:**

In FY2013, there were 18 “*new significant*” participants. There were five additional students who received fellowship or scholarship awards in previous years (23 minus 18) and were therefore excluded from this “significant” tally. In addition, one higher education student and two research infrastructure students participated at a significant level (\$5,000 or 160 hrs.) in ISGC-funded projects.

- Total new significant awards = 21; Fellowship/Scholarship = 18, Higher Education = 1, Research Infrastructure = 2; 4 of the total awards were to underrepresented minorities (19%); and 10 of the total awards were to women (47.6%).
- All FY2013 students remain enrolled in their current STEM degree programs with ten graduating in the spring 2014 semester.
- Of the FY2006-FY2012 awardees (53) in our tracking system, 77% (41/53) remain in STEM in their current degree program. Twelve of the 53 have reached the next step (10 of the 12 remain in STEM): four are seeking advanced STEM degrees, two are employed at STEM aerospace contractors, two are employed in STEM non-aerospace positions, one is employed in a STEM academic field, one is seeking a non-STEM advanced degree and one is employed in non-STEM.

- **Minority-Serving Institution Collaborations:**

There are no minority-serving institutions in Iowa. However, the effort to promote and provide hands-on, NASA-related activities to minority and underserved students, and schools for the disabled in Iowa was expanded through the ISGC precollege program. As stated under Program Accomplishments, Goal 10: The underserved and minority effort connected with South Tama School District and supported a science club. The club was shifted to the grades 3-5 and has 50 students involved, five high school helpers, one college student mentor and two adult helpers. Iowa State University's Extension and Outreach's E-SET Program and ISGC are partnering with Waterloo School District for year-round STEM programming. Waterloo School District includes George Washington Carver Academy, which the ISGC has supported with aviation simulators supporting STEM in the school. Carver is a STEM Academy for Waterloo middle school students. The school serves underserved audiences and has a student population that is 77% minorities. Additional STEM involvement with K-12 in Waterloo schools includes argument-based inquiry support for teachers and programming in robotics, life sciences, and STEM career linkages. The district has a 44%

minority enrollment for the 2012/13 school year as reported in the district demographics report.

- **NASA Education Priorities:**

- Authentic, hands-on student experiences in science and engineering disciplines: the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities.

As described in program accomplishments above, students engaged in hands-on research with faculty mentors at each of the base programs located at the four academic affiliate campuses and two research infrastructure faculty. Iowa is also supporting:

- The CySLI Rocket Team from Iowa State University will participate in the Great Midwestern Regional rocket launch competition being held in Minnesota on April 25-26, 2014. The team consists of 12 members, 11 males and one female. An update will be provided in the FY2013 final report.
 - The robotics club from Iowa State University will participate in NASA's Fifth Annual NASA Robotic Mining Competition at the Kennedy Space Center Visitor Complex from May 19-23, 2014. The "Cyclone Space Mining" team consists of 30 students including seven women and two underrepresented males.
 - In summer 2014, the ISGC is planning to support six interns. The applications are currently under review by NASA mentors. An update will be provided on Iowa selections in the FY2013 final report.
- Diversity of institutions, faculty, and student participants (gender, underrepresented, underserved).

Prior to March 2012, our underrepresented higher education student participant goal was 10.8% of total awards (2007 data tables). In FY2012, our goal was revised to 17.1% (2009 data tables). For FY2013, again our goal increased to 19.3% per the 2010 data tables located at: http://nces.ed.gov/programs/digest/d11/tables/dt11_239.asp. This year there were 34 funded and unfunded student participants; 20.6% (7/34) were underrepresented, and 50% (17/34) were women. This great success in part is due to ensuring announcements of opportunities are sent to all of the minority and financial aid offices at our academic affiliates as well as the academic advisors of the STEM departments. Though diversity is a challenging task in Iowa, the ISGC is continuously exploring various options to increase public awareness of our opportunities. In the final year of the grant, FY2014, Iowa's goal will be to distribute 22.7% (2011 data tables) of awards to underrepresented minorities and 40% of awards to females.

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above).

"The impact of the ISGC STEM activities and events on Waterloo students has been tremendous! Elementary students who have participated in the STEM Festival, STEM

Clubs, STEM camps, and Girls in Engineering groups have shown increased problem solving skills and a stronger interest in science, engineering, math and technology careers. Many elementary and high school students who visited the ISU campus changed their views about potential careers, and some who were not interested in attending college now see this as an option. I've been most impressed by the growth in confidence when doing STEM activities in the elementary girls who have participated in these programs." – Carol Boyce, Waterloo Community School District

- Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers.
 - The Precollege Partner School Program worked with the Waterloo school district (10,488 students enrolled, 67% are eligible for free or reduced price lunch, and 44% minority). The project includes STEM programming in district and campus visits.

- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with colleges.
 - Four scholarships were awarded to community college students. These awards had great impact on the retention of students in STEM disciplines as these students were paired with our ISGC-funded faculty that could directly assist them with the transition to a university setting and research lab experience.
 - The Higher Education Curriculum Development project engaged community college students, destined to become teachers, to use NASA content in their future classrooms. The objective of this project was to develop the framework and materials for a STEM Education Capstone course at the University of Northern Iowa (UNI). Meeting this objective will bring us closer to our goal of increasing the abilities of UNI's K-6 STEM educators to both improve their students' understanding of STEM concepts and encourage them to consider STEM careers.

- Aeronautics research – research in traditional aeronautics disciplines; research in areas that are appropriate to NASA's unique capabilities; directly address the fundamental research needs of the Next Generation Air Transportation System (NextGen).
 - One former ISGC affiliate base program continues to focus on flight testing, pilot spatial orientation assessment, NextGen integrated intelligent flight deck, simulator fidelity measurement and modeling, characterization of operator performance in flight, Live Virtual Constructive training systems, and human performance in air warfare systems.

- Environmental Science and Global Climate Change – research and activities to better understand Earth's environments.
 - Two former ISGC affiliate base programs continue to focus on environmental and global climate change research.

- Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities.
 - The ISGC feeds projects into the Iowa NASA EPSCoR program, which enables growth to the next level, eventually resulting in sustained funding. PIs begin by affiliating with established ISGC Higher Education Base and Research Infrastructure programs, working with the student scholarship and fellowship awardees. The PI then can add a INE travel grant and/or research fellowship from the INE research infrastructure development (RID) program to provide a means for making the necessary NASA connections and establishing a growth path to competitiveness. Effective utilization of these various ISGC and INE program elements prepare participants to win both the internal Iowa competition, as well as the NASA competition for a NASA EPSCoR research award.
 - Two early career faculty researchers were funded through the research infrastructure program. Two new early career faculty researchers will compete for funding in FY2014.

IMPROVEMENTS MADE IN THE PAST YEAR

- ❖ Promoted and supported applied research activities within ISGC affiliates by engaging students with faculty that led to publications, presentations and research funding.
- ❖ 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. Aerial Services, Inc. (industry) *support through annual membership fee to the ISGC*
2. AeroDyne Laboratories (industry) *support through annual membership fee to the ISGC, collaboration in the UNI base program*
3. Ames Laboratory of the U.S. Department of Energy (federal lab)
4. Cedar Rapids Science Center (science museum) - *Informal education competition participant*
5. Drake University (private four-year university) - *Executive Committee member, base program, scholarships and fellowships, host of ISGC Director (partial year)*
6. Grout Museum District (science museum) - *Informal education competition participant*
7. Iowa Academy of Science (nonprofit organization) - *IJAS poster competition*
8. Iowa Aviation Promotion Group (nonprofit organization) - *Informal education competition participant*

9. Iowa Department of Education (state government) - *Partner Schools program, State Science and Technology Fair of Iowa*
10. Iowa Department of Natural Resources - Iowa Geological & Water Survey (state government)
11. Iowa Department of Transportation, Office of Aviation (state government)
12. 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, host of the State Science and Technology Fair of Iowa, host of precollege programs and ISGC Associate Director for Education*
13. National Lab for Agriculture & the Environment (federal lab)
14. National Mississippi River Museum & Aquarium (science museum) - *Informal education competition winner*
15. Putnam Museum (science museum) - *Informal education competition participant*
16. Iowa Space Science Center (science museum) - *Informal education competition participant*
17. Rockwell Collins (industry) *support through annual membership fee to the ISGC*
18. Science Center of Iowa (science museum) - *Informal education competition winner*
19. Softronics Limited (industry)
20. 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, host of ISGC Director (partial year)*
21. University of Northern Iowa (public master's-granting university) - *Lead institution, Executive Committee member, base program, scholarships and fellowships*

The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD) 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.