

Iowa Space Grant Consortium
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 2012.

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 this 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 PY23 (FY2012), the ISGC is making measurable progress. The following sections provide details as of February 28, 2013.

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 to 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, OR 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 some anecdotal examples of the direct benefit to Outcomes 1 and 2:

“Graduate students are by definition poor, so receiving the NASA Space Grant Fellowship was a much welcome relief of some of the financial obligations to which we are held. However, the fellowship went far beyond covering class registration and book fees. Having this funding lifted the financial burden I would have otherwise experienced this past fall when I made the trip to the Hispanic Engineering National Achievement Awards Conference (HENAAC) in Orlando, Fl. There I met representatives from NASA and Lockheed Martin who reviewed my résumé, offered professional advice and pointed me toward employment opportunities with both NASA and the Sandia National Laboratory in Albuquerque, New Mexico. In the summer of 2013, I hope to make use of the fellowship to offset some of the cost to travel to the IEEE Pulse Power & Plasma Science conference in San Francisco, CA, where I would like to participate and possibly share some of my findings in pulse power structural capacitors. Looking beyond graduations, I would like to use this fellowship experience as a spring board to the NASA Postdoctoral Program so that I might be able to continue the capacitive research we are presently pursuing”. -- Eliseo De León, fellowship recipient, Iowa State University

“The College of Social and Behavioral Sciences and the College of Humanities, Arts and Sciences have been linked directly through this grant. Two groups of preservice teachers with few connections have been grouped together (STEM and Social Sciences) to design, build, launch and recover high-altitude balloons. This project will not only give them the skills and materials to directly conduct a similar project in their own classes, but also gets the two groups of students communicating and preparing them for cross-curricular experiences in their future schools.” – John Ophus, ISGC supported faculty, Base Program, University of Northern Iowa.

“For all of our projects we have made tremendous progress. In the establishment of any new lab or projects there are a lot of fundamentals that need to be determined before the true experiments can begin. We have optimized lot of conditions and reactions to begin making all the components required for the true experiments to begin. Our lab is now reaching the stage of getting passed the development of the materials and protocols required to execute the research to the research itself. And with the resources being generated and techniques optimized we can begin to make experimental changes to determine mechanisms and factors in influenza A replication in low gravity environments.” – Marc Busch, ISGC supported faculty, Base Program, Drake University.

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

Precollege Education

The ISGC Partner School Program serves goals 6 and 8. The program was restructured for PY23 based on reduced funding. The ISGC reduced the travel expenses related to the Partner School Program with professional development previously conducted at NASA Centers. The program this year featured *Mars University* a hybrid learning experience that included face-to-face meetings as well as virtual classes held online. The *Mars University* participants were selected through an application process and included teachers across the grade spectrum of grade one through twelve. Participants from five school districts, Iowa State University Extension and Outreach, and the Iowa Department of Education were represented in the class. Participants will be required to submit projects that use NASA STEM materials and content for improving learning for Iowa youth. *Mars University* has nine participants, eight females, and one male. The class featured John Weis, AESP Educator from MSFC who worked with the teachers to familiarize them with NASA Education and how to approach STEM from a NASA perspective. Dr. William Garrard, Minnesota Space Grant Consortium Director presented a session on the engineering challenges of landing on Mars from his work with the Curiosity rover. Andrew Chaikin was a course instructor and his book, *A Passion for Mars*, served as the class text. Chaikin provided Mars information from a STEM perspective for improving literacy.

In addition to the *Mars University*, the Precollege Partner School Program is working with 48 additional school districts that are part of a study funded by the U. S. Department of Education’s Institute for Education Studies that targets grades three through five focusing on argument-based inquiry. The ISGC has partnered with the project to link NASA Educational programs to the classrooms.

The ISGC Partner School Program supported the Real World Design Challenge (RWDC) in Iowa. The program is in the second year of support by ISGC. The Challenge is supported by a wide team that includes GEAR UP Iowa. Following the state competition, the GEAR UP Iowa Project Coordinator stated:

Given GEAR UP Iowa's charge – significantly increasing the number of low income and minority students who are prepared to enter and succeed in postsecondary education – the value of our partnership with RWDC has never been clearer than it was this Saturday when each competing student remarked on their postsecondary aspirations. Five of the seven competing teams included team members who are GEAR UP Iowa cohort students and the other two teams' members attend high schools that include Iowa cohort students among their student body.

The success of GEAR UP Iowa relies on a partnered network of community and government organizations, businesses, high schools, colleges, universities, individual community members, and families who believe that with the right approach, postsecondary education is possible for all Iowans. Thanks to all of you for contributing resources – not the least of which being large amounts of your time – to this partnership.

The Challenge is also supported by ISGC affiliates including Rockwell Collins. A Rockwell Collins employee shared the following impression from the state competition day:

Why I am glad I put all these hours into promoting STEM programs:

Judge - why did you join this project?

Kid - my parents said I couldn't do it and I would never amount to anything.

He's now on his way to DC for nationals for the 2nd year in a row.

Goal 7 is being addressed by ISGC in cooperation with the Iowa Junior Academy of Science working with students to increase their ability to do research. ISGC works with the Academy to support student's research efforts. For students whose research is identified as top quality at the Iowa Academy of Science spring meeting ISGC also supports them for attending the AAAS/American Junior Academy of Science.

Goal 9 is addressed by supporting the State Science and Technology Fair of Iowa (SSTFI). 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 efforts to support the fair to increase STEM involvement show up in results for the fair participants in PY23 that included 71% being female. The ISGC scholarship for seniors had an impact in the number of senior participants increasing by 38%.

ISGC is working with South Tama, Waterloo, and Des Moines 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. She reports the following for PY23:

I just wanted to let you know that we have had a steady attendance at our 3-5 grade science club. Our attendance has been averaging 50-55 students, 10-12 high school helpers, and 2-5 adult helpers.

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: Informal Education

Informal education efforts to enhance public awareness and improve scientific literacy for Iowans through the support of STEM programming that serves the NASA Mission is supported by ISGC. Two informal projects were selected for funding for this year and include: The Science Center of Iowa's (SCI) "*Train Like an Astronaut: A New Pilot Outreach Program*" a unique Outreach experience for Iowa's K-5 students. *Train Like an Astronaut* will be designed to be presented in an elementary school's gymnasium and engage students with exercises and activities that reinforce NASA objectives and emphasize Science, Technology, Engineering and Mathematics (STEM) concepts. Additionally, this innovative experience will strengthen 21st Century skills and increase awareness of STEM disciplines while promoting healthy and active lifestyles with Iowa's youth. This highly interactive program utilizes NASA's own *Train Like an Astronaut* resources, including video of NASA astronauts and trainers demonstrating exercises, emphasizing skills needed by astronauts, and reinforcing the importance of healthy and nutritious lifestyles.

The SCI's *Train Like an Astronaut* is currently moving from the planning phase to operational phase of the project. The program will include a take-home fitness journal, which will be distributed to each student participating in the pilot phase. This journal will feature links to NASA resources for kids designed to inspire further investigation, with additional activities that can be completed at home, and ways to set goals and record progress to encourage future fitness. Schools from across the state will participate in pilot testing. Des Moines Public School District's Downtown School has already committed to this program. Several educators from southeast Iowa have expressed their interest in piloting the program at their site, or communicating the opportunity to fellow educators.

The project at the Putnam Museum supported by the ISGC is to create an interactive exhibition on space and the items created for space travel that we enjoy on Earth every day. The exhibition, entitled *Destination: Space* opened on January 25, 2013 and was held in conjunction with the Putnam Museum hosting a call or downlink from the International Space Station. More than 250 area youth in grades 2-10 as well as their teachers and a number of VIP guests attended the opening of the exhibition. ISGC funds helped support the development of the exhibition as well as provide visitor takeaways about STEM career options related to space and NASA that are available in our general region.

By the time it closes in early June, we estimate *Destination: Space* will have been viewed by some 17,000 school-aged youth and more than 35,000 general visitors. Highlights of the space include Career Connections posters and brochure-cards. These cards define NASA careers, including course of study for high school and college, job forecast, regional training program

locations and salary ranges. In addition, this exhibition features some of the pieces that will later be on permanent display on in the Putnam future STEM Learning Center. Students who have visited have recently sent thank you notes relating their experience at the Putnam.

The *Destination: Space* exhibition is an important step forward for the Putnam in presenting career information and an engaging STEM experience outside of our programming and Spark! lab areas. Without support of the funds provided by the ISGC, success in this endeavor would not have been popular.

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; the FY2012 goal was 17.1% (2009 data tables) of awards would be to underrepresented minorities and 40% of awards would be female.

Results: In FY2012, Iowa awarded 19 undergraduate scholarships and three graduate fellowships. Iowa exceeded the FY2012 goal of 17.1% with 22.7% (5/22) of awards going to underrepresented students and exceeded the FY2012 goal of 40% with 54.5% (12/22) of awards going to females.

In FY2012, there were 30 funded and unfunded student participants; 20% (6/30) of all student participants were underrepresented, and 53.3% (16/30) 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. 100% of awardees will actively participate in base programs or 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 or research class at their institutions. In FY2012, ISGC:

- Successfully competed and awarded 19 undergraduate student scholarships and three graduate student fellowships from our four academic affiliates, all higher education institutions.
- Identified and funded two community college scholarships to attract and retain students in STEM fields.
- Two undergraduate interns will be placed at academic affiliates' research labs this summer (2013).
- Also this summer, the ISGC will support one graduate intern at NASA's Jet Propulsion Laboratory, one undergraduate intern at NASA's Langley Research Center

with the Langley Aeronautics Academy, and one undergraduate intern at NASA's Marshall Space Flight Center with the Propulsion Academy.

Objective 1c. Awardee retention in STEM exceeds STEM retention in their higher institutions.

Results: Of the FY2006-FY2011 awardees (50) in our tracking system, 84% (42/50) remain in STEM in their current degree program. Eight of the 50 have reached the next step (seven of the eight remain in STEM): two are seeking advanced STEM degrees, one is seeking STEM employment, one is employed at a STEM aerospace contractor, two are employed in STEM non-aerospace positions, one is employed in a STEM academic field, and one is seeking a non-STEM advanced degree.

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. All senior entrants are aware of ISGC awards.

Results: The top research projects were selected at the SSTFI. Student researchers were offered scholarships to attend college at the ISGC academic affiliates. The scholarships incentivize the student involvement through their senior year in science fair research. Of the 21 senior participants, 17 were females. Ten of the 21 were eligible for the award. Eligibility requires academic affiliate enrollment in a STEM discipline. All seniors responded to our survey, with 14 being aware of our award (66.7%).

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

Results: Of the 11 students currently being tracked and/or reported, eight are still in STEM-related education disciplines, one has transferred to a non-STEM degree track, one is seeking a non-STEM advanced degree, and one is now employed in a STEM (non-aerospace) position.

Objective 2c. Majority of awards will go to students who participated in SSTFI in prior years.

Results: Awardees have participated in the SSTFI for two to seven years.

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, non-ISGC grant proposals.

Results: The base programs produced 7 publications and 35 presentations. The base programs sought \$2.9 million in non-ISGC grant proposals.

Objective 4b. Each base program will develop a NASA collaboration prior to its establishment.

Results: Each base program developed a NASA collaboration that did not exist prior to the establishment of the base program.

- Drake University's base program is in its second year. The program is led by Dr. Marc Busch on *Effects of Low Gravity Environments on Host-Pathogen Interactions*, started collaborating with Johnson Space Center's, Dr. Duane Pierson in the first year. The collaboration continues.
- Iowa State University's base program, also in its second year, is led by Dr. Bong Wie. The project focuses on *Space Technology Research for Robotic and Human Exploration of Near-Earth Objects*. In year one, the program began collaborating with Goddard Space Flight Center; that collaboration continues.
- The University of Iowa's base program began in FY2012. The program, led by Dr. Bernd Fritsch examines *Understanding gravity sensing defects through targeted ear manipulations*. Dr. Fritsch developed a collaboration with Dr. Richard Boyle, Space Biosciences Division, NASA Ames Research Center.
- The University of Northern Iowa's base program began in FY2012. The UNI base program, led by Dr. John Ophus, studies *High-altitude ballooning for enhancing STEM learning among undergraduate, preservice teachers in science and geography/social science*. The UNI base program has developed a collaboration with Joyce Winterton, Senior Advisor for Education and Leadership, Wallops Flight Facility.

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: No new base program competitions were conducted for FY2012. The program rotation schedules are:

Base programs in their second year (FY2011, 2012, 2013)

- Drake University base program led by Dr. Marc Busch.
- Iowa State University base program led by Dr. Bong Wie.

Base programs in their first year (FY2012, 2013, 2014)

- University of Iowa base program led by Dr. Bernd Fritsch.
- University of Northern Iowa base program led by Dr. John Ophus.

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.

SMART Objectives

Objective 5a. Research infrastructure programs will produce publications and non-ISGC grant proposals each year.

Results: In FY2012, there were three research infrastructure programs funded by ISGC. All three projects are early career awards. All of the programs produced publications and non-ISGC grant proposals. More than 21 faculty, post-docs, graduate and undergraduate student members have been involved in research infrastructure activities at different academic affiliates.

- Dr. Zhiyou Wen from Iowa State University is in his third and final year of an early career program award. In FY2012, Dr. Wen published one manuscript and received three grants totaling \$320,000 to advance research in algal culture development for biofuel production. He has another \$750,000 in grants that are still in review.
- Dr. Sarah Vigmostad from the University of Iowa is in the second year of an early career award. Dr. Vigmostad is working on the *Development of realistic computational models of the spaceflight effects on human physiology*. Dr. Vigmostad published one manuscript and submitted a second. She gave six professional presentations and has \$8.5 million in two proposals (pending).
- Dr. Nicola Bowler from Iowa State University is in the second 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 an invited presentation, and submitted a proposal for \$180,000 (pending).

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. Zhiyou Wen from Iowa State University is his final year of an early career program award. In FY2012, Dr. Wen established two new collaborations with Philip Lan, Touchstone Research Laboratory and Matteo del Ninno, Wave Tech LLC.
- Dr. Sarah Vigmostad from the University of Iowa is in the second year of an early career award. Dr. Vigmostad maintained collaborations with Steve Platts (JSC) and Jerry Myers (Glenn); new collaborations in FY2012 were Robert Hester (Univ. of Mississippi) and Domenico Calcaterra (Indiana Univ.).
- Dr. Nicola Bowler from Iowa State University is in the second year of an early career award. Dr. Bowler established two new collaborations with NASA Langley (Nondestructive Evaluation Sciences Branch) and The Boeing Company.

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 Program.

SMART Objectives

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

Results: Survey completed at the school year-end 2012 had a return rate of 32% for a total of 26 teachers who have participated over the past seven years. All teachers responding reported that they are using NASA content and will continue to do so. Responders indicated that they would reach 2,755 students during FY2012 with NASA education.

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

Results: Surveys completed by Explorer School teachers indicated they were still active in using NASA content.

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 survey respondents reported completing professional development programs as required by the Partner School Program.

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) are exposed to information about ISGC through the IJAS Wiki-Handbook, in the annual meeting program, and at the IJAS award luncheon.

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 19-20, 2013. 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 509 teachers. Of those, 235 teachers were involved in long-term (multiple day) workshops.
- ISGC supported and exhibited along with Iowa's AESP Educator from MSFC at Iowa Academy of Science's Fall Teachers Conference held October 15-16, 2012. Approximately 400 Iowa Science Teachers attended the meeting held at Iowa State University. Of the teachers in attendance, 131 responded to the ISGC survey and all but eight knew of NASA Education. There was a strong NASA presence at the meeting: John Weis, Marshall Space Flight Center, and Jay Staker, ISGC Associate Director of Education. NASA content was presented at a Space Grant/NASA booth with multiple hands-on presentations including: NASA and the Engineering Design Process, NASA Solar System Resources, NASA Professional Development Opportunities, Amusement Park Physics with a NASA twist, Human Body in Space, and NASA Geology Resources.
- 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 are participating in *Mars University*. Partners will each conduct two professional development or in-service programs for Iowa educators and develop 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: Five of seven 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: The director of E-SET will attend the NASA sessions at the NSTA National Convention in San Antonio on April 10-14, 2013. The director will also present at the convention and bring NASA content to the teachers that attend the session.

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 2013 science fair will be held April 5th. Student participation numbers and results will be reported in the final report.

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

Results: The 2013 science fair will be held April 5th. Home-school student participation numbers and results will be reported 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.

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 with attendance averaging 50-55 students, 10-12 high school helpers, and 2-5 adult helpers. ISU Extension and Outreach's E-SET Program and ISGC are partnering with George Washington Carver Academy (a STEM Academy) to support Waterloo middle school students. The school serves underserved audiences and has a student population that is 77% minorities. ISGC is supplying support for aviation education at the school.

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 that is identified as sponsored by ISGC is being supported by ISGC for statewide coverage.

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

Results: Two proposals were funded in FY2012 at the Putnam Museum and the Science Center of Iowa (SCI). These two projects target STEM and NASA educational outcomes. The Putnam Museum's *Destination: Space* has had more than 2,500 school-aged youth visit the exhibition while on field trips since it opened. More than 6,000 members of the general public have also been able to interact in this unique exhibition. Since receiving the award in November 2012, the SCI team has continued to test *Train Like an Astronaut* activities with over 200 participants of all ages at their location in Des Moines, Iowa. Individual program activities are currently undergoing evaluation for factors such as age-appropriateness, transportability, accuracy of science content, and participant satisfaction.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- ***Student Data and Longitudinal Tracking:***

In FY2012, there were 17 "new significant" participants. Five students received fellowship or scholarship awards in previous years (22 minus 17) and were excluded. In addition, two

higher education students and two research infrastructure students participated at a significant level (\$5,000 or 160 hrs.) in an ISGC-funded program.

- Total new significant awards = 21; Fellowship/Scholarship = 17, Higher Education = 2, 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 FY2012 students remain enrolled in their current STEM degree programs with eight graduating in the spring 2013 semester.
 - Of the FY2006-FY2011 awardees (50) in our tracking system, 84% (42/50) remain in STEM in their current degree program. Eight of the 50 have reached the next step (seven of the eight remain in STEM): two are seeking advanced STEM degrees, one is seeking STEM employment, one is employed at a STEM aerospace contractor, two are employed in STEM non-aerospace positions, one is employed in a STEM academic field, and one is seeking a non-STEM advanced degree.
- **Diversity:** Prior to March 2012, our underrepresented participants goal was 10.8% of total awards (2007 data tables). In FY2012 our goal was revised to 17.1% (2009 data tables). In FY2012, there were 30 funded and unfunded student participants; 20% (6/30) were underrepresented, and 53.3% (16/30) 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. Iowa's goal for underrepresented participants in FY2013 is 19.1% per the newly available 2010 data tables located at: http://nces.ed.gov/programs/digest/d11/tables/dt11_239.asp.
 - **Minority-Serving Institutions:** 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 with attendance averaging 50-55 students, 10-12 high school helpers, and 2-5 adult helpers. ISU Extension and Outreach's E-SET Program and ISGC are partnering with George Washington Carver Academy to support STEM for the school, a STEM Academy for Waterloo middle school students. The school serves underserved audiences and has a student population that is 77% minorities.
 - **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:
 - There are 30 funded and unfunded students working in science and engineering research rooted in NASA-related questions and issues.
 - Support of the Lunabotics team from Iowa State University to participate in the upcoming 2013 NASA Lunabotics Mining Competition at the Kennedy

Space Center Visitor Complex on May 20-24, 2013. The team consists of 45 students including eight women and one male of Hispanic origin.

- 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:
 - The underserved and minority effort connected with South Tama School District and supported a science club.
 - The ISGC precollege program conducted workshops for 509 teachers. Of those, 235 teachers were involved in long-term (multiple day) workshops.
 - Two projects were selected to support informal education: Science Center of Iowa's *Train Like an Astronaut* and Putnum Museum's exhibition, entitled *Destination: Space*.
- Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers.
 - In the summer of 2013, ISGC is supporting three summer internships at NASA Centers and two interns at academic affiliates to provide hands-on research experience. (See Objective 1b above, pages 6-7.)
- Community Colleges---develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.
 - Two scholarships were awarded to community college students.
- 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:
 - Three early career faculty researchers were funded through the research infrastructure program.

IMPROVEMENTS MADE IN THE PAST YEAR

- Though there are no minority-serving institutions in Iowa, ISGC made several efforts to accomplish our targets in PY23. It is important to note that Iowa exceeded the FY2012 goal of awards going to underrepresented students and exceeded the FY2012 goal of awards going to women. (See the results under Goal 1: Objective 1a, page 6 above.)
- The precollege outreach to underserved students expanded to include a partnership with George Washington Carver Academy, a STEM academy in Waterloo. The partnering provides support through provision of hands-on, NASA-related activities to minority and underserved students. Aviation simulators were loaned to the academy by ISGC to expand their aviation program. Carver Academy's population is 77% minority students.
- Increased hands-on experiences for students by supporting more summer interns, and sponsoring national level competitions such as Lunabotics. (See page 13 above.)
- Initiated a new program to support a semester-long STEM-based Space Exploration series. The goal is to bring scientists and engineers from NASA, academia, and industries involved in space exploration to speak to researchers and students in Iowa. This is an interdisciplinary

event supported by the Departments of Computer Science, Earth Science, Geography, Physics, Technology, Chemistry & Biochemistry, Mathematics, and Biology at the University of Northern Iowa.

- In order to increase Iowa's outreach activities, a new web-portal is under development with geographical information systems (GIS). This web-portal provides interactive detailed location information of students who received scholarship and fellowships from ISGC in the past five years. We are also planning to add additional locational information such as funded research projects, and affiliates.

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) – *Summer 2012 Internship host*
2. AeroDyne Laboratories (industry)
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*
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.*
13. National Lab for Agriculture & the Environment (federal lab)
14. National Mississippi River Museum & Aquarium (science museum) - *Informal education competition participant*
15. Putnam Museum (science museum) - *Informal education competition winner*
16. Rockwell Collins (industry)
17. Science Center of Iowa (science museum) - *Informal education competition winner*
18. Softronics Limited (industry)
19. 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.*
20. University of Northern Iowa (public master's-granting university) - *Lead institution, Executive Committee member, base programs, scholarships and fellowships*

The National Space Grant Office requires two annual reports, this 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.