Indiana Space Grant Consortium
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## PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The **Indiana Space Grant** Consortium is a Designated Consortium funded at a level of **$575,000** for fiscal year 2011.

## PROGRAM GOALS

INSGC Goals are as follows:

- *INSGC will be a preferred source of information, materials, and opportunities for inspiring, preparing, and supporting individuals for NASA-related STEM education and careers.*
- *INSGC will be an effective and preferred vehicle for enhancing the engagement of K-20 educators and students in full range of NASA-related STEM activities and opportunities.*
- *INSGC will raise awareness of and access to NASA-related activities, events, and opportunities for the government, institutions, and residents of the State of Indiana.*

INSGC SMART Objectives, as proposed in 2010, are based on the INSGC Goals and intended to align with the NASA Education outcomes listed below. During the 2012 Spring Affiliates Meeting, INSGC Academic and Outreach Affiliates engaged in a detailed discussion regarding the design, implementation, and measurement of these SMART Objectives. After a review of both Objectives and NASA program priorities, they expressed recommitment to achieving the INSGC SMART Objectives through improved communication and documentation of assessment instrument questions / tools.

These new assessment questions will be used to support accurate and timely collection of critical program performance data used to document achievement.

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

**Scholarship / Fellowship**

*1.3 Student Involvement Higher Education* - Provide opportunities for groups of post–secondary students to engage in authentic NASA–related mission based R & D activities.

INSGC Scholarship and Fellowship applicants are managed through an open competitive application process to the INSGC–controlled website. For any campus with at least two valid applicants, at least one undergraduate scholarship is guaranteed, ensuring that INSGC awards are provided to all academic affiliates.

**Higher Education**

*1.1 Faculty and Research Support* – Provide NASA competency-building education and research opportunities for faculty, researchers, and post-doctoral fellows.

*1.2 Student Support* – Provide NASA competency–building education and research opportunities to develop qualified undergraduate and graduate students who are prepared for employment in STEM disciplines at NASA, industry, and higher education.

INSGC intends Higher Education award funds to support student participation in authentic hands-on experiences at NASA centers or industry partners, as well as team-based project activities that may occur on academic campuses.

**Research Infrastructure**

*1.5 Targeted Institution Research and Academic Infrastructure* – Improve the ability for targeted institutions to complete for NASA research and development work.

INSGC does not favor Research Infrastructure awards at our research intensive campuses (Purdue-West Lafayette and Indiana University-Bloomington). Instead, RI funds are prioritized toward supporting young faculty and student involvement in STEM research activities at our smaller undergraduate and regional campus academic affiliates.

*INSGC Objective 1-A*: Faculty, researchers, and doctoral fellows who receive INSGC funding will report increased research capacity and competency as a result of their awards. (Objective 1.1)

*INSGC Objective 1-B*: Students who participate in INSGC higher education programs will report an increased: a) interest in STEM study and careers, b) understanding of NASA programs, and c) perception of leadership skills. (Objectives 1.2 and 1.3)

> As of this APD (April 13), most academic year higher education awards are still operating; not all project reports have been received. Highlights and anecdotes received to date do indicate unsolicited qualitative responses that demonstrate achievement of INSGC Objectives 1-A and 1-B.

*INSGC Objective 1-C*: At least 60% of INSGC higher education program student participants will seek employment with NASA, aerospace contractors, universities, and other educational institutions. (Objective 1.2)

*INSGC Objective 1-D*: At least 40% of undergraduate students who participate in NASA higher education programs will move on to advanced education in NASA-related fields. (Objective 1.2)

*INSGC Objective 1-E*: At least 25 underrepresented and underserved students (minimum 30% of total) will participate in INSGC-funded higher education programs.

> As indicated below, 55% of scholarship, fellowship, and internship students funded to date are underrepresented minorities (23 total). This figure does not include students funded in undergraduate research programs or other faculty-led program awards. Preliminary data received to date indicates that INSGC will achieve 2011-12 targets for INSGC Objectives 1-C, 1-D, and 1-E.

*INSGC Objective 1-F*: At least 2 new or revised course targeting STEM skills needed by NASA will be created through INSGC support. (Objective 1.4)

> Delays in funding for 2010-11 required a deferral of one new course development to the 2011-12 academic year. INSGC is now on target to meet INSGC Objective 1-F in 2011-12.

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

**Pre-college/Higher Education/General Public**

*2.1 Educator Professional Development* – Provide short duration professional development and training opportunities to educators, equipping them with the skills and knowledge to attract and retain students in STEM disciplines.

*2.3 Curricular Support Resources* – Provide curricular support resources that use NASA themes and content to a) enhance student skills and proficiency in STEM

disciplines; b) inform students about STEM career opportunities; and c) communicate information about NASA's mission activities.
*2.4 Student Involvement K – 12* - Provide K – 12 students with authentic first hand opportunities to participate in NASA mission activities, thus inspiring interest in STEM disciplines and careers; Provide opportunities for family involvement for K – 12 students learning in STEM areas.

Beginning in 2010 and continuing into 2011, INSGC has more strongly emphasized a focused portfolio of in-service and pre-service teacher training experiences and K-12 activities.

*INSGC Objective 2-A*: At least 75% of elementary and secondary educators who participate in two or more NASA training programs will use NASA resources in their classrooms. (Objective 2.2)

*INSGC Objective 2-B*: At least 60% of elementary and secondary educators who obtain NASA content-based education resources or participate in short-duration NASA education activities will use NASA resources in their classroom instruction. (Objective 2.1)

*INSGC Objective 2-C*: At least 50% of students will express interest in science, technology, engineering, and math (STEM) careers following their involvement in elementary and secondary education programs. (Objective 2.3)

*INSGC Objective 2-D:* At least 500 elementary and secondary students will participate in INSGC instructional and enrichment activities. (Objective 2.4)

The FIRST Robotics Boilermaker Regional competition held in March 2012 hosted over 1500 K-12 students (not including parents and other visitors) to the Purdue Armory; Purdue Fall Space Day hosted over 600 K-12 students in October 2011. These two events more than demonstrate achievement of INSGC Objective 2-D. During the INSGC Affiliates Meeting held on April 11-12, 2012, Outreach Affiliates whose programs contribute to INSGC Objectives 2-A through 2-C indicated that existing activity assessment and exit survey instruments were not yet aligned to collect data to demonstrate achievement of these Objectives. Detailed discussion during the Affiliates Meeting resulted in the generation of new assessment questions that will be used going forward to document achievement of INSGC Objective 2-A and 2-B. Because of recent limits in funding for teacher professional development opportunities for Indiana in-service teachers, INSGC will not require that all training programs occur within a one-year period.

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

**General Public/External Relations**

*3.1 Resources* – Provide informal education support resources that use NASA themes and content to 1) enhance participant skills and proficiency in STEM disciplines; 2) inform participants about STEM career opportunities; and 3) communicate information about NASA's mission activities.

*3.2 Professional Development for Informal Education Providers* – Provide opportunities to improve the competency and qualifications of STEM informal educators, enabling informal educators to effectively and accurately communicate information about NASA activities and access NASA data for programs and exhibits.

INSGC added two additional outreach affiliates, the Evansville Museum and the Children's Museum of Indianapolis, during 2011-12. INSGC continues to promote and open doors of opportunity with the three Challenger Learning Centers, and solicit partnerships with INSGC Outreach Affiliates to provide informal educator opportunities. INSGC highlights the need to provide cost-effective support for these projects within the identified NASA Office of Education priorities for the Space Grant program. High levels of leverage are gained through cost-effective partnerships with NASA and other STEM exhibits and programs at INSGC Outreach Affiliates.

*INSGC Objective 3-A:* At least 4 museums and science centers in Indiana will actively engage the public in major NASA events, with exposure of at least 1000 persons to STEM content and educational opportunities available through INSGC. (Objective 3.1)

*INSGC Objective 3-B:* At least 25 informal educators will report increased efficacy as a result of INSGC supported professional development. (Objective 3.2)

The Outreach to Space exhibit at Science Central has hosted approximately 22,000 visitors as of mid-April 2012; the Celebrate Science activity in Indianapolis in October 2011 (with participation by the Brownsburg Challenger Learning Center and Children's Museum of Indianapolis) hosted 2000 visitors. The Children's Museum Wings over Indiana exhibit (also funded by a separate NASA grant) opened in March 2012. In conjunction with the National Science Teachers' Association conference in Indianapolis in March 2012, the IMAX Theater of Indianapolis supported over 200 free tickets to the "Space Junk" movie distributed at the INSGC booth. Thus, INSGC Objective 3-A has already been documented. At the 2012 INSGC Affiliates Meeting, a detailed discussion among Outreach Affiliates resulted in a plan for more explicit sharing of assessment items to ensure data capture and documentation of INSGC Objective 3-B.

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

One of the major goals for INSGC is to increase our benefit and impact to engage STEM Education across the State of Indiana. Particularly due to the fact that Indiana does not have a NASA center within the state, INSGC can be the voice of NASA and a connector of NASA activity to STEM education priorities within the State, giving Indiana residents the opportunity to learn about NASA's mission and goals, and increasing the appreciation for NASA and its many accomplishments and resources. In taking a more active and visible role within the state, INSGC will increase its exposure and value. This will lead to the development of key relationships with individuals and programs that have similar goals and interests, whereby we can leverage the financial strength of the programs, attain synergy and dramatically improve results while minimizing budgetary impacts.

For the 2011-2012 year, INSGC has awarded funding to projects within the targeted outcomes in alignment with our proposed allocation percentages. The outcomes and current and proposed funding percentages are as follows:

- Outcome 1 (scholarships/fellowships/internships, plus other projects): Current 77%, Proposed 75%
- Outcome 2: Current 20%, Proposed 24%
- Outcome 3: Current 3%, Proposed 1%

**Highlights and Anecdotes**
The following information is not an exhaustive list, but is representative of the significance and benefits of the INSGC programs arranged by outcome.

### *NASA Outcome 1*

**Scholarships/Fellowships/Internships**
The competitive awarding mechanism for INSGC scholarship and fellowship support includes students at affiliate institutions across the state. The overall demographics for the 42 scholarship, internship, and fellowship awardees from the base award show 42% female participants and 55% underrepresented minority (URM) participants. NASA internships are placed and supported based on selections by NASA Centers; corporate internships within Indiana were not placed in 2011-12. Breakdowns per program are as follows:

- 35 Scholarships/Fellowships with 51% Female and 60% URM participants
- 7 Internships with 0% Female and 29% URM participants

**Higher Education**
*MATE ROV (Marine Advanced Technology Education Remotely Operated Vehicle)*: The Purdue IEEE ROV Team is committed to creating an ROV that meets and exceeds the Marine Advanced Technology Education Center International ROV Competition requirements every year. The team creates a new ROV every year to assure a vehicle designed specifically for the task at hand. For the 2011-2012 season, the mission theme is WWII shipwreck assessment. This involves inspecting the ship with simulated sonar,

perform a detailed survey and mapping, relocating endangered coral, detecting whether debris is metal or non-metal, and removing any oil left in the ship's hull. The international competition this year will be held in Orlando, Florida in mid-June.

**Research Infrastructure**
*SARA Telescope*: INSGC support for Valparaiso University for access to the Southeastern Association for Research in Astronomy (SARA) Telescope in Kitt Peak, AZ and the opening of the SARA South telescope in Chile has provided roughly twice the capacity for observations versus the past. The telescopes were not only used for research but to broaden the participation of the general public in science.

## *NASA Outcome 2*

**Pre-College**
*Summer Prep Course in Physics and Mathematics:* Indiana University presented a two-week summer program offering prep courses in science and mathematics for local high school students. The purpose of this program is to provide a foundational basis upon which students will be better able to take full advantage of their high school courses. Students will be taught introductory terminology and topics as well as problem solving methods that are vital to attaining a thorough understanding of the material. We believe that students who complete this program will have an improved ability to understand and participate in their future high school courses.

*ASM Materials Camp*: Purdue University Calumet (PU-C) hosted their 4th annual American Society for Materials (ASM) Materials Camp for teachers from June 20-24, 2011. PU-C recruited teachers from middle and high school in science, math, and technology. They had 12 teachers in attendance for the 2011 camp. The main purpose of the camp was to show teachers, especially those of mathematics, science, and technology, how to use and integrate everyday materials easily into existing lesson plans. Participating teachers learned how to conduct low or no cost simple labs and experiments to engage students in STEM. The participants were expected to design one learning module that addressed academic standards they use to design programs in their subject area. Evaluation of the program is administered by ASM International. Further evaluation of how materials presented in camp have been incorporated will be conducted at the end of the school year.

*Outreach to Space*: The Outreach to Space (OTS) project allows a location to be converted into a home base for astronomy-focused, STEM learning. Ten interactive exhibits, designed and built by San Francisco's famed Exploratorium with original project support from the National Science Foundation, were designed to inspire urban and rural communities as they learn about astronomy, space travel and technology. OTS is comprised of exhibits, a tent, and print materials, and is ideal for fairs, festivals, libraries, and many other community-based events. Science Central has developed and provided the platform of staffing, scheduling, advertising and transportation, and has taken the exhibits and trained staff to 13 different fairs, festivals and school events within a 110

mile radius of Science Central. This project has impacted over 14,000 people in both urban and rural settings. Science Central purchased a portable telescope with a solar filter with some of the funds and is using the telescope with the outdoor venues. The primary objective of this grant was to provide STEM content, allow people to make connections about the content with real work concepts and initiate the "fun factor" where visitors discover that science is fun. This exhibit reaches and teaches across socioeconomic status and across the generations. Upon completion of the grant cycle, it is predicted that OTS will impact approximately 25,000 people.

## *NASA Outcome 3*

**General Public / Informal Education**

*Purdue Space Day:* In its 16th year of being a successful educational outreach program for grade school students, PSD hosted guest speaker, Gary E. Payton. PSD provided students three hands-on STEM activities throughout the day. A total of 570 sixth through eighth grade students along with 193 Purdue student volunteers attended in 2011. Over the past 16 years, PSD has touched 5,994 grade school students and 1,936 Purdue student volunteers. These student volunteers find creative ways to engage the grade students in hands-on, NASA-related learning activities that excite the grade school students to think about future careers in NASA-related research areas.

*Indiana State Museum Foundation and Omniglobe Software and Concept Upgrade*: In the fall of 2011, INSGC provided funding towards an upgrade of the Ominglobe, a multimedia installation developed by ARC Science that currently simulates 600 million years of plate tectonic movement. The new software and content uses data from sources including NASA, NOAA, USDA and others that portray aspects of the solar system. Once the upgrade is completed, visitors will use in interactive touch-screen kiosk to move between visual programs, including still images and animations. The overall goal and expected outcomes will increase both K-12 and public audiences' knowledge of space and earth sciences as well as awareness of NASA activities and goals.

*NASA Ignite! And Central Science Indiana:* October 8th, 2011 Science Central of Indiana hosted their 1st Celebrate Science Festival in Indianapolis, Indiana. Astronaut Stephen K. Robinson, along with Indiana Superintendent of Public Instruction, Tony Bennett were the guest speakers. Over 2,000 were in attendance providing them hands on activities and entertainment and providing many teachers workshops with NASA to help bring space exploration into the classrooms.

## *Personal Statements*

INSGC takes great pride in the positive influence on the lives of the people served. A few of many outstanding comments regarding the role of INSGC funding in supporting their education are shown below.

*Garrison Turner (Ball State University); awarded a fellowship from INSGC*: "Along with these results [on stellar research], there have been several side benefits to working with the INSGC not only with this fellowship, but with grants received by my thesis advisor. From the grants he has received, I've had the privilege of working several years on an exoplanet project as well as the ability to go to Kitt Peak several times. These years doing research and the ability to travel to Kitt Peak have been invaluable observational experience."

*Kevin Bonanne (Purdue University, West Lafayette); awarded a Summer Internship at Jet Propulsion Laboratory:* "My internship over the summer of 2011 at NASA Jet Propulsion Laboratory was a thrill. From the first day on campus to the last day on the job, there was always more and more to learn on site. I showed up and began working on two different projects, but realized that both had commonalities with each other. Later in the summer, I was using lessons learned from one project to improve upon my work on the other, truly learning the subject matter and applying it to real NASA projects. This is a skill that is not often taught in the classrooms and one that will definitely help me in the future. Between the enthralling work and the great networking connections that I was able to make, I could not have asked for a better summer internship."

*Jessica Windschitl (IU-Bloomington); awarded a fellowship from INSGC:* "The analysis of the M104 globular cluster system that I performed during the last year with INSGC funding is one of the core pieces of my Ph.D. dissertation. The data acquired on my recent observing runs and its analysis will also be included. I am currently preparing to meet with my committee again to present an update of my progress and a detailed outline of my dissertation. I am on track to defend my work within a year."

*Chris Davies (Purdue West Lafayette); awarded a fellowship from INSGC:* "I have thoroughly enjoy my year as an INSGC Fellow because of the opportunity to further not only my research in pursing my PhD, but also, I have been exposed to the NASA-related programs that were until now, unknown to me as a student. Educationally, the most important progress that has been made is the ability to discuss and explain my research to those individuals outside of my specific field. When I attended the INSGC Regional Meeting, I was forced to enlighten my colleagues as to why my research is important and impactful. I believe of all my experiences in attending national conferences, this was the most rewarding because of the positive responses I obtained throughout the poster session. I have appreciated this wonderful opportunity to be an INSGC Fellow and I look forward to being involved in NASA-related STEM educational opportunities in the future."

## PROGRAM ACCOMPLISHMENTS

To date, (April 13, 2012) and for the grant year May 17, 2011 through May 16, 2012, this grant has enabled INSGC to fund over $332,000 in program awards with $208,551 in projects, $88,000 in scholarship/fellowship awards and $35,850 in internships.

## *NASA Outcome 1*

**Higher Education**
The funding from INSGC has enabled many of our affiliates to participate in Higher Education Projects. These projects focused on Affiliate strengths in aerospace, engineering, astronomy, environmental studies, mechanical engineering, and physics.

### *1.1 Faculty and Research Support*
INSGC has provided the following NASA competency-building education and research opportunities for faculty, researchers, and post-doctoral fellows.

- Finding the Genetic Component of the Circadian Clock in Saccharomyces Cerevisiae – Valparaiso University; Undergraduate research investigating the effects that length of day has on the biological clock of Saccharomyces Cerevisiae
- Undergraduate Research in High Temperature Materials for Aerospace Applications – Valparaiso University; Undergraduate research opportunity in materials and aerospace engineering
- INSPIRE - Assessment Hub for STEM Literacy - Purdue University; Advocacy effort to increase the U.S. commitment to P-12 engineering education
- MURI Discovery – Indiana University Purdue University Indianapolis; Undergraduate research in multidisciplinary areas

### *1.2 Student Support*
*Scholarships / Fellowships* - INSGC ran its open competition for the 2011-12 award year from December 1, 2010 through February 24, 2011. For the 2011-12 grant year, INSGC has doubled its scholarship applicants. INSGC continues to receive a growing number of requests for scholarships / fellowship awards with an increase level of recognition and prestige associated with the designation of being an INSGC Scholarship/Fellowship winner. The scholarship/fellowship interest continues to expose more underrepresented STEM students throughout the state of Indiana. INSGC supports the summer interns, Virgil "Gus" Grissom Memorial Scholarships, and Diversity Enhancement scholarships that enhance student participation at Purdue West Lafayette.

*Projects* - INSGC provided NASA competency-building education and research opportunities to develop qualified undergraduate and graduate students who are prepared for employment in STEM disciplines at NASA, industry, and higher education.

- Purdue Space Day - Purdue University; undergraduate participation in leading general public / K12 event with a space and aerospace engineering theme
- Discovery Park Undergraduate Research Initiative (DURI) - Purdue University; Undergraduate research in multidisciplinary areas

- Matching funds for Undergraduate Research Grant Program - Purdue Calumet; Funds to help reduce the cost associated with undergraduate research projects
- Diversity Equity and Minority Affairs STEM Initiative - Indiana University; Summer research program for students of Historically Black Colleges and Universities (HBCUs) and IU
- Pathevo - Purdue University; Pathevo 2.0 Engineering software (http://www.pathevo.com/home.asp), which is designed for exploring and planning personalized engineering education and career paths

***1.3 Student Involvement in Higher Education***

INSGC has been able to provide many opportunities for groups of post-secondary students engaged in authentic NASA related mission-based activities.

- Undergraduate Research in Observational Astronomy-Ball State University; Undergraduate research in binary star systems at universities and in Arizona
- Undergraduate Research in Observational Astronomy-Valparaiso University; Undergraduate research in binary star systems at universities and in Arizona
- Application of Metabolomics to Improve Health during Long-Term Space Flights – Indiana Purdue University – Ft. Wayne; Characterizing small organic molecules to counter muscle loss in space
- MATE ROV Competition - Purdue University; Design and build an ROV that can do specified tasks to compete in competition
- Space Launch Initiative-University of Evansville; High powered rocket competition for undergraduates
- Purdue Microgravity Flights - RGSFOP; Undergraduate and NASA partnered research
- A Study of Interacting Spherical Stellar Systems - Purdue Calumet and Ball State University; Study of the dynamical effects of galactic interactions on neighboring elliptical galaxies

**Research Infrastructure**

***1.5 Targeted Institution Research and Academic Infrastructure***

- Undergraduate Research in Observational Astronomy Using the SARA Telescopes in AZ and Chile - Valparaiso University

## *NASA Outcome 2*

**Pre-College**

Pre-college programs emphasized the support of activities for K-12 students to participate in STEM related activities and increase enthusiasm to pursue STEM majors at the university level. Rather than supporting individual teams or schools, INSGC chooses to support the programs as a whole. These programs included:

***2.1 Educator Professional Development - Short Duration***

- ASM Materials Camp for Teachers - Purdue Calumet; Teacher training in the field of Materials Science to develop classroom programs

***2.3 Curricular Support Resources***

- NSTA National Conference Booth - all affiliates; Curriculum distribution and training for K-12 science teachers

***2.4 Student Involvement K-12***

- FIRST activities - Purdue University
- Summer Prep Classes in Physics and Mathematics – Indiana University, Bloomington; Summer prep camp for high school students as an introduction to physics and advanced math

**General Public-Informal Education**

***2.4 Student Involvement K-12***

- Nanotechnology Space Consortium Summer Teacher Fellows Program – Indiana University – Purdue University Indianapolis; Underserved high school teacher training in nanotechnology
- Outreach to Space – Science Central; Funds for 10-12 interactive astronomy exhibits geared for the general public

**Informal Education**

***3.1 General Public Resources***

- Omniglobe Software and Content Upgrade - Indiana State Museum; Updating the software for an multimedia earth science display

## PROGRAM CONTRIBUTIONS TO PART MEASURES

*Student Data and Longitudinal Tracking*: INSGC continues to update and follow current and previous significant awardees with our longitudinal tracking surveys and Facebook connections. We have been successful in tracking >80% of the significant awardees since 2005 and >75% of the significant awardees since 1995.

*Diversity*: INSGC continues to exceed targets for ethnic and gender diversity of student participants; over 40% of scholarship and fellowship awardees are female, and over 50% are members of underrepresented minorities. In 2011-12, INSGC has increased the diversity of institutions and geographic areas represented, with the addition of three new academic institutions across Indiana.

*Matching funds*: Complete accounting of matching funds was not available at the time of report generation (April 13, 2012). However, projected match for base program funds awarded was $483,000, or a ratio of 0.84:1 for NASA funds.

*Minority-Serving Institutions*: INSGC does not have a designated Minority Serving Institution among its academic affiliates; no Historically Black or Hispanic Serving Institution with a focus on STEM degrees exist in the state. However, both Purdue and Indiana University (where the overwhelming majority of underrepresented STEM minorities are enrolled) have strong relationships with minority serving institutions in other states. INSGC does partner with Diversity, Equity and Minority Affairs (DEMA) where we are able to reach several underrepresented students from eight different campuses throughout the U.S. who come to IU for the opportunity to conduct research and receive mentorship from faculty in diverse areas of study. This provides an opportunity for undergraduate underrepresented minority students in STEM fields to experience what it would be like to pursue a graduate degree in their field of research.

*NASA Education Priorities*: The projects funded by INSGC are in strong correlation with NASA Education Priorities and NASA mission efforts and program competitions; examples are provided below.

- The Purdue IEEE ROVE team builds an underwater ROV to the themed competition of surveying and detecting a mock shipwreck. Right now the team is working on modeling and machining the vehicle, giving team members real life design and build experience that is unique to coursework based group projects.

- Student lead reduced gravity research is also an example of student involvement in research. The Purdue team fabricates an experiment based on NASA Mission Priority research and then tests the experiment onboard NASA's Weightless Wonder. Not only will this project educate the students involved, but through this unique academic opportunity, the team has conducted outreach events to share the knowledge gained from the experiment to K-12 schools to create interest in STEM and share NASA opportunities.

- At the University of Evansville, INSGC funds the Student Launch Initiative which provides undergraduate engineering students the challenge of designing, building, and flight testing their own high powered rocket. Their hands-on experience is later validated with a launch at Marshall Space Flight Center.

- The Summer Scholars Institute at Indiana University is an eight-week program summer that enrolls select HBCU and IU college students in a continuous substantive research experience. The majority of the Summer Scholars' time during the Institute is spent in mentored research projects, giving them a unique summer research experience.

- Studying hypersonic vehicle applications for ultra-high temperature materials, Valparaiso University is using its INSGC funded research to teach undergraduate students about aeronautical materials technologies important to NASA. This opportunity serves to inspire students towards aerospace engineering research.

- Finally, INSGC is working with a new faculty member at Valparaiso University to start a research opportunity in the field of Circadian rhythms, the study of the

genetics of the biological clock. Establishing this research program will allow her to carry out research with undergraduate students while generating data for the field of genetics and molecular biology.

## IMPROVEMENTS MADE IN THE PAST YEAR

*Management*: INSGC Central Office Management has achieved a stable and higher level of performance since the start of the current five-year award period in 2010. Additional gains have been achieved by increasing use of student interns to assist in INSGC support functions. Student intern Ben Weiss has completed his BS in Aeronautics & Astronautics, and is now a commissioned officer in the US Marine Corps. Intern Isa Fritz (who was a previous INSGC Graduate Fellowship awardee) is completing her MS in Aeronautics & Astronautics in May 2012, and has accepted a job offer at Loral Space Systems.

As of March 2012, Purdue College of Engineering has revised its business office support functions provided to higher-funded faculty (including INSGC Director Caldwell). The result of this organizational change is that explicit charges for Business Office support (Pam Hartman) are no longer borne by INSGC. This change in staffing costs (as well as continuation of personnel costs for INSGC Program Manager and Operations Coordinator) is a primary reason for the Budget Addendum (submitted with this APD Progress Report) requesting changes in base budget allocations for Years 3-5 of the INSGC Grant. Additional streamlining of paperwork and approval flows between INSGC, Business Office staff, and Purdue Sponsor Program Support offices has been achieved throughout 2011-12 via monthly coordination meetings.

An extensive discussion of INSGC processes and status at the 2012 Affiliate Directors Meeting held on April 11-12 on the Purdue West Lafayette campus included an explicit discussion of INSGC Objectives and Annual Performance Data. Affiliates expressed appreciation and interest in this detailed examination of INSGC priorities and evaluation criteria, and indicated that previous shortcomings in meeting INSGC Objectives were due to a lack of awareness of major evaluation processes, limited recognition of the source of INSGC requests, and limited dissemination of suitable assessment instruments to support appropriate documentation of INSGC Objectives achieved (especially INSGC Objectives 1-A, 2-A, 2-B, and 3-B). Affiliates agreed to create and share new survey questions that can be used when assessing programs and completing reports to more effectively document achievement metrics.

*Industry efforts*: INSGC was a sponsor and supporter of the Celebrate Science Indiana (CSI) event held at the Indiana State Fairgrounds in October 2011. CSI was a result of partnerships between Dow AgroSciences, Eli Lilly, Rolls-Royce, and other Indiana companies with State Government, education, and other organizations. Prof. Caldwell was invited to speak at a regional BISEC STEM workshop (sponsored by AIA/NDIA) to be held on April 3, 2012; results of this interaction has already led to discussions for additional partnerships to continue in 2012-13. For instance, members of a BISEC

working group have identified improved sharing of STEM internship and job opportunities among Indiana aerospace companies. INSGC Affiliates have determined that a focus on STEM employment awareness and opportunities will be a major strategic and event focus for 2012-13, and have already decided to begin work as a coordination entity for this STEM employment effort.

*Projects*:

*Access for STEM Engagement*: INSGC has participated in several additional events throughout the year, which has increased our visibility in the state as a portal for access to STEM engagement activities across Indiana. INSGC representatives have attended Celebrate Science, science fairs, and a job fair for science and engineering students at Purdue. Additionally, INSGC hosted a booth at the National Science Teachers Association National Meeting in Indianapolis on March 29-31, which drew an estimated 9000 registered attendees. (Partnerships with the IMAX Theater provided incentives to visit the INSGC booth in each registrant's program bag.) We have started sending relevant information directly to K-12 STEM teachers throughout the state as well as posting the information to our website. Prof. Caldwell was interviewed for an Indiana Expeditions program, "Wings over Indiana," produced by Indianapolis public television station WFYI, and was featured in the finished production and trailers for the program. This program debuted on March 1, 2012.

*Application numbers*: With an eye to increasing the diversity of institutions and participants represented in our higher education / scholarship and fellowship programs, INSGC has again significantly increased the number of scholarship applications received over last year. We received 36 applications in 2009-2010, 64 in 2011-2012, and 103 for 2012-2013. We also received a significantly larger number of project proposals from our affiliates. In 2011-2012 we received 33 proposals, and 43 for the 2012-2013 funding cycle. We have been working closely with our affiliates to improve the quality of the proposals and to foster communication at the affiliate institutions to broaden the scope of projects and include more fields within STEM. As a result of these increases in scholarship / fellowship and program award applications, as well as desires to effectively assist and support existing affiliate activities, INSGC has ceased soliciting new Academic or Outreach Affiliates.

*"Next Big Thing"*: INSGC Affiliates have made best recent progress when engaged in group discussions focused on specific event initiatives, rather than general process committee efforts. The successful experience of the National Science Teachers Association booth began with a group discussion at the 2011 Spring Affiliates Meeting, which itself coincided with a Yuri's Night celebration that began with a group discussion at the 2010 Spring Affiliates Meeting. Such event-focused initiatives are now known as "Next Big Thing" discussions, and help to focus INSGC energy on activities that coordinate the efforts and skills of multiple Academic and / or Outreach Affiliates. At the 2012 Spring Affiliates Meeting, several new "Next Big Thing" emphases have emerged, including:

- STEM Student Employment and Opportunity Awareness Workshops

- Community-Based Multi-Site Astronomy Programs
- Indiana "Big Data" Student Project Competitions
- Multidisciplinary, Multi-Grade Citizen Science Coordinated Projects

*Website*: The tagline for the INSGC website (http://www.insgc.org) now reads, "Engaging STEM Education for the State of Indiana". In addition to general improvements in content and clarity on our website, we have a new section - "All About STEM – Homepage for Indiana Students". This newly created zone in our website is built to showcase multiple aspects about STEM including fun home and classroom activities, interactive learning websites, and career options. It's geared to lead students on a STEM exploration starting with a "Why STEM?" section that discusses its importance to our everyday life. The career options sections detail common (and uncommon) jobs in each field, paired with cartoon images to maintain user engagement. Finally, the "Fun for Kids" section lists K-12 friendly games, videos and activities, and links to a variety of websites ranging from NASA Kid's Club to Skateboard Science. The All About STEM zone on our website offers a fun and interactive way for students and parents to learn about STEM in a comfortable format for any age.

## PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

A continuing priority for the INSGC office has been the engagement of the Affiliates. In the past year, INSGC has added three additional academic affiliates (Anderson University, Trine University, and Saint Joseph's College) and two additional outreach affiliates (The Children's Museum of Indianapolis and Evansville Museum). INSGC encourages the affiliates to actively work with the office and to discuss and contribute to the strategies of the consortium. We have also begun strategic discussions on the role of partners in project execution, as well as input regarding selection of projects to foster. We have found that soliciting input regarding a major project for each group of affiliates (academic and outreach) that can be worked on as a group is an effective way of achieving large goals and building unity within the consortium.

All Affiliates (Academic, Outreach, Corporate) have voting rights and responsibilities for approving strategic directions and Consortium program decisions discussed at Affiliate Meetings. INSGC generally holds two Affiliate meetings per year. In October 2011, the annual Fall Teleconference took place from Purdue University. One of the key objectives of this conference is building upon new partnerships that have started this year and initiating new ones. The Spring 2012 Affiliates Meeting was held on April 11-12, 2012, and welcomed two new engagement partners (Indiana Afterschool Network and Wisdom Tools) and a local NASA STEM Education Liaison (Julia Muffler, AESP) to more actively engage in INSGC project activities and statewide STEM education engagement and integration.

A list of current Affiliates by type follows:

**Academic Affiliates**
*Purdue University – Lead Institution*
Anderson University (John Millis)
Ball State University (Ronald Kaitchuck)
Indiana State University (Susan Berta)
Indiana University – Bloomington (Paul Edwards)
Indiana University Purdue University Fort Wayne (Jihad Albayyari)
Indiana University Purdue University Indianapolis (David Coats)
Purdue University Calumet (Adam Rengstorf)
Purdue University College of technology at Columbus (Jack Head)
Saint Joseph's College (Jennifer Coy)
Taylor University (Jeff Dailey)
Trine University (Jamie Canino)
University of Evansville (Philip Gerhart)
University of Southern Indiana (Glen Kissel)
Valparaiso University (Bruce Hrivnak)

**Outreach Affiliates**
Brownsburg Challenger Learning Center (Mary Patterson)
Children's Museum of Indianapolis (Michele Schilten)
Challenger Learning Center of Northwest Indiana (Rebecca Manis)
Ethos, Incorporated (Patsy Boehler)
Evansville Museum (Mitch Luman)
IMAX Theater (Craig Mince)
Indiana State Museum (Peggy Fisherkeller)
Indianapolis Challenger Learning Center of Decatur Township (Cyndy Meier)
Science Central (Martin Fisher)
SpacePort Indiana (Brian Tanner)
Terre Haute Children's Museum (Lynn Hughes)

**Corporate Affiliates**
StratoStar Systems (Jason Krueger)