

## **FY15 Year 1 APD**

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

Indiana Space Grant Consortium  
Lead Institution: Purdue University  
Director: Barrett Caldwell  
Telephone Number: 765-494-5092  
Consortium URL: [insgc.org](http://insgc.org)  
Grant Number: NNX15AI07H

LOB: NASA Internships, Fellowships, and Scholarships; STEM Engagement; Institutional Engagement; Educator Professional Development

### A. 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 2015.

### B. PROGRAM GOALS

Indiana Space Grant Consortium (INSGC) goals are as follows:

- *Be a preferred source of information, materials, and opportunities for inspiring, preparing, and supporting individuals for NASA-related Science, Technology, Engineering, and Mathematics (STEM) education / careers.*
- *Be an effective and preferred vehicle for enhancing the engagement of K-20 educators and students in NASA-related STEM activities and opportunities.*
- *Raise awareness of and access to NASA-related activities, events, and opportunities for the government, institutions, and residents of the State of Indiana.*

We have also devised clear SMART Objectives in order to measure the attainment of the INSGC goals and ensure alignment with NASA Education Program Assessment Rating Tool (PART) measures. The construction of SMART objectives assures that there is a clear

connection between INSGC funded activities and Consortium goals in quantifiable, measurable outcomes.

The SMART objectives for 2015-18 include:

- 1) All doctoral fellows who receive INSGC funding will report increased research capacity and competency as a result of their awards.
- 2) Students who participate in INSGC higher education programs will demonstrate an increased: a) interest in STEM study and careers, b) understanding of NASA programs, and c) perception of leadership skills.
- 3) At least 65% of student participants who graduate after participation in INSGC higher-education programs will seek employment with NASA, aerospace contractors, universities, and other educational institutions.
- 4) At least 30% of undergraduate students who graduate after participation in NASA higher-education programs will move on to advanced education in NASA-related fields.
- 5) At least 35 underrepresented and underserved students (minimum 25% of total students participating in funded programs) will participate in INSGC-funded higher education programs in each year of the three-year program.
- 6) At least 3 new or revised STEM courses targeting STEM skills relevant to NASA research areas will be created through INSGC support in 2015-18.

#### C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS

INSGC has awarded funding to projects within the targeted outcomes in alignment with our proposed allocation percentages (Outcome 1: Current 74%, Proposed 74%; Outcome 2: Current 25%, Proposed 25%; Outcome 3: Current 1%, Proposed 1%).

##### *NASA Outcome 1*

**Scholarship/Fellowships/Internships:** The competitive award mechanism for scholarship/fellowship support includes students at institutions across the State. Awardees were 60% female and 65% underrepresented minority (URM). NASA internships are placed and supported based on selections by NASA Centers.

##### **Higher Education Anecdote:**

*Summer Undergraduate Research Fellowship Program (SURF) (Purdue University)*

INSGC sent José R. Rivas-Padilla to the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) conference. SACNAS is a society of scientists dedicated to fostering the success of Chicano/Hispanic and Native American scientists, from college students to professionals, to attain advanced degrees, careers, and positions of leadership in science. The SACNAS conference programming is specifically tailored to support undergraduate and graduate students, postdoctoral researchers, and career professionals at each transition stage of their career. Rivas-Padilla attended seminars including “Entrepreneurship Essentials: From Academia to Creating Your Own Company”, “Building Interdisciplinary Collaboration and Diversity in the STEM Workforce”, and many others. He said, “I spoke with universities and organizations such as: University of California Berkeley, Stanford University, University of Wisconsin, NSF, US Department of

*Energy, CIA, NASA, USDA, National Geospatial Agency, Washington University, Cornell University, Carnegie Mellon University, among others. I learned about new research opportunities and met great professionals with whom I now have correspondence. This was a great experience to expand my network.” The most impressive and inspiring quote from his report was “The second day of the conference I presented my SURF summer research. During the poster presentation, I got great feedback from the judges and was recognized for my impressive research results and solid presentation ability. During the session, a graduate student of Penn State Engineering was interested in my research and later brought the Director of the Multicultural Engineering Program for me to present to. He was very interested in me and my graduate student potential, and strongly advised that I apply to their summer research programs. A graduate student from Stanford University was also interested in my research and strongly suggested that I apply for summer research at Stanford University through the Leadership Alliance. I was very surprised by how the opportunities kept stacking up thanks to my research efforts and support from INSGC.”*

**NASA Outcome 2 - Precollege Anecdote:**

*Using Aquaponics Systems to Build Competency and Confidence in STEM (Saint Joseph’s College)*

The vision of this project was twofold: 1) to provide a sustained professional development experience for pre-service teachers in the STEM disciplines, and 2) to provide STEM education opportunities for elementary children through aquaponics, which is a sustainable food production system that grows fish and vegetables simultaneously. By creating an aquaponics system at the Saint Joseph’s College (SJC) Student Farm, pre-service educators engaged in real-world applications of STEM disciplines and thus built competency and confidence in teaching STEM fields as they taught about aquaponics at St. Augustine Elementary School. SJC has been engaged in sustainable food production since 2010, and the food products are then marketed to the local community.

**NASA Outcome 3: Informal Education Anecdote:**

*Digital Discoveries (Challenger Learning Center of Northwest Indiana)*

Digital Discoveries is a proposed distance-learning program that will excite, entertain, educate and engage primary and intermediate students in the space sciences while providing a local access point for NASA. The Challenger Learning Center developed two programs, one each at the primary and intermediate level that can be delivered via Skype or iChat directly to a classroom of students. The programs are media-centric, but require students to complete standards-based activities before, during and after a 1.5 hour live connection. The programs are designed to be visually stimulating, but content-rich while integrating NASA content and current events, space science, living in space, and engineering.

**D. PROGRAM ACCOMPLISHMENTS**

- NASA Internships, Fellowships, and Scholarships (NIFS):

INSGC takes great pride in our scholarship, fellowship, and internship awardees. This year we have continued to increase participation of female and minority participants, resulting in

60% female and 65% URM participation. We continue to have many applicants from all of our academic affiliates.

- Higher Education projects:

#### *Faculty and Research Support*

INSGC has provided the following NASA competency-building education and research opportunities for faculty, researchers, and post-doctoral fellows: *MURI Discovery* (IUPUI) facilitates faculty and undergraduate research in multidisciplinary areas including core research skills, research “professionalism”, academic success skills, and in-depth work in a multidisciplinary team; *Multi Physics Simulation Training for Multiple STEM Classes* (Purdue Calumet); and the *Fungal Bioremediation Solid Waste* (Valparaiso University) project that investigates fungal bioremediation of solid waste while providing valuable training and research experience for two undergraduate students.

#### *Student Support*

Student support projects included the following: travel funding for a group of students to attend the National Society of Black Engineers (NSBE) Conference (Purdue University); funding for a group of students to attend SpaceVision 2016 (Purdue University SEDS); Matching funds for Undergraduate Research Grant Program (Purdue Calumet); Summer Intensive STEM Transition to 4 year Degree (Anderson University); Bridges Program for Transfer STEM Students (IUPUI).

#### *Student Involvement in Higher Education*

INSGC provided many opportunities for groups of post-secondary students engaged in authentic mission-based activities. *SARA* (Valparaiso and Ball State)- Membership provides access to two research-quality telescopes for faculty and student research and used in general education, outreach, and research programs; *Observational Astronomy for Research and STEM Engagement* (Valparaiso) - research experience for undergraduate STEM majors and engagement experience for non-STEM majors; *Research Experiences in Mathematics* (Anderson University) - provide opportunities to expose undergraduate students to research early in their academic careers in order to increase the likelihood they will pursue a graduate education in a STEM field; *Student Team Solar Car Project* (Anderson University); *Academic Boot Camp Go-Kart Design* (Purdue University Minority Engineering Program) – bridge program for incoming minority students on campus designed to retain participating students in engineering and improve their first-year academic performance; *NASA Robotic Mining Competition* (Purdue University); *MATE ROV* (Purdue University) – underwater robotics student team; Marine Advanced Technology Education (MATE) uses underwater robots (also known as remotely operated vehicles or ROVs) to teach STEM and prepare students for technical careers; *Engaging Undergraduates in hands on STEM Learning to Expand Local Food Production and Aquaponics Systems* (Saint Joseph’s College) - hands-on experience and research opportunities for undergraduate students to promote NASA-related STEM workforce development by creating an aquaponics system at the Saint Joseph’s College (SJC) Student Farm; *NASA Human Exploration Rover Challenge* (Purdue Calumet); *AIAA Design Build Competition* (Trine University) - Student teams will design, fabricate, and demonstrate the flight capabilities of an unmanned, electric powered, radio controlled aircraft which can best meet the specified mission profile.

### *Course Development (Educate)*

INSGC is able to provide course resources for integration into STEM disciplines. Projects included: *Multi Physics Simulation Training for Multiple STEM Classes (Purdue Calumet)* - enhance the skills and proficiency of 130 post-secondary students in Nano/Micro technology field through hands-on simulation; *Electrical and Computer Engineering Senior Design Lab (Trine University)* – provides a separate laboratory for ECE students at Trine to enable them to construct, test, and debug a system gaining hands on experience.

- Research Infrastructure projects:

INSGC provides funding for Targeted Institution Research and Academic Infrastructure at our smaller affiliate campuses.

*Decoding the Photocatalytic Enhancement of Graphene (Valparaiso University)* – enables a new faculty (PI) to initiate a new research direction in graphene-based nanocomposites, which has potential for current and future applications in the NASA mission. It will also provide financial support for two undergraduate students to participate in cutting-edge NASA-related research on campus.); *Exploring Novel Catalytic Properties of Subnanometer Transition Metal Alloy Clusters (Valparaiso University)* – this project’s goal of computationally designing new catalysts is closely aligned with the NASA mission. The project will also provide funding for a rewarding opportunity for a community college (CC) student to participate in NASA-related research while being mentored by a Valparaiso University undergraduate student.

- Precollege projects:

#### *Educator Professional Development – Long Duration*

*Using Aquaponics Systems to Build Competency and Confidence in STEM Teaching (Saint Joseph’s College)* - by creating an aquaponics system at the Saint Joseph’s College (SJC) Student Farm, pre-service teachers will engage in real-world applications of STEM disciplines and thus build competency and confidence in teaching STEM fields as they teach about aquaponics; *Nanotechnology Summer Teachers Program (IUPUI)* - Indianapolis-area high school math/science teachers participated in IUPUI’s “Research Experiences for Teacher Advancement in Nanotechnology (RETAIN)” summer program (<http://indi.iupui.edu/RET.php>). RETAIN’s immersive educational program, formed by a partnership between the Integrated Nanosystems Development Institute (INDI) and the Center For Research and Learning (CRL), will provide educators from high-needs schools with research experiences coupled with professional development activities designed to aid in translating research into classroom teaching modules that will boost high school student interest to pursue higher education and future careers in STEM-fields.

#### *Curricular Support Resources*

*Developing a Set of AP Environmental Science Laboratory Activities for High School Teachers (Indiana State University)* – designed based on science teacher conference experiences to overcome the following obstacles: students passing the AP test in environmental science are not receiving credit because they have not completed laboratory activities, they are not being introduced to the interdisciplinary college/career possibilities

that environmental science offers, and there is a basic unawareness among teachers of how easy and low-cost environmental science lab activities can be with the use of NASA materials.

#### *Student Involvement K-12*

INSGC partnered with the Indianapolis Symphony Orchestra for their Cosmos Festival which brought in a large number of K-12 students. Additional projects included:

*Purdue Space Day (Purdue University)* - educational outreach program which provides students from Grades 3-8 the opportunity to learn about science, technology, engineering, and mathematics by participating in age-appropriate activity sessions throughout the day, along with the chance to meet and listen to an astronaut discuss their experiences;

*Engineering Summer Program (Purdue Calumet)* - hands-on engineering experience to expose college bound junior high and high school students to many facets of the engineering process from design to operation. They will learn about how: airplanes fly, tall structures are designed, traffic patterns are analyzed and roads designed, air conditioning systems are designed and built, water treatment technologies are developed; and how electric circuits, computers, and communications networks are designed; *Foundations in Science and Math (Indiana University)*; *Engineering Experience for Middle and High School Girls (University of Evansville)*; *Nanotechnology High School Scholars Program (IUPUI)* - supports STEM achievement in students from Indianapolis-area underserved high schools by engaging them in hands-on discovery in nanotechnology that will encourage continued education and future careers in STEM fields that coincide with NASA interests.; *FIRST Robotics (Purdue University)* - engages, inspires and mentors K-12 students locally, statewide and across the Midwest to pursue higher education and careers in STEM disciplines through participations in FIRST programs, including FIRST Lego League Competition and FIRST Robotics Competition; *A Summer STEM Experience for Girls and Community College Students (University of Evansville)* - help young women overcome cultural stereotypes and prepare for careers in engineering and computer science. At the same time, this project also promotes collaboration between community colleges (Vincennes University campuses) and a primarily undergraduate institution (University of Evansville).

- Informal Education projects:

Informal education efforts build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission.

#### *Challenger Learning Center of Northwest Indiana – Digital Discoveries*

Digital Discoveries is a distance-learning program providing an access point for elementary-aged student groups to NASA, its programs, and content through video connection either independently or in the classroom. The Digital Discovery sessions are designed to demonstrate that NASA-based projects, topics and information can be accessible to students who do not live near NASA centers.

E. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS

*Include summary data for the bulleted list below:*

- **Diversity:** the diversity of institutions, faculty, and student participants (gender, underrepresented, underserved)  
INSGC proudly continues to exceed targets for ethnic and gender diversity of student participants; 60% of scholarship, fellowship, and internship awardees are female, and over 65% are members of underrepresented minorities, once again exceeding INSGC goals in support of NASA's performance measures.
  
- **Minority-Serving Institution (MSI) Collaborations:** Summarize interactions with MSIs within the consortium, and describe projects/activities.  
No Historically Black Colleges and Universities (HBCUs) or Hispanic-Serving Institutions (HSI) with a focus on STEM degrees exist in the state. However, both Purdue and Indiana University have strong relationships with MSI in other states and there has been continued significant partnering with the Minority Engineering Program at Purdue University.
  
- **Office of Education Annual Performance Indicators:** Provide numerical values for consortium contributions to API's.
  - APIED-15-1            24                            (Number of NIFS to racially or ethnically underrepresented students, women, and persons with disabilities.)
  - APIED-15-2            185                            (Number of educators.)
  - APIED-15-4            34                            (Number of informal education events.)
  - APIED-15-5            5000+                            (Number of K-12 students.)

F. IMPROVEMENTS MADE IN THE PAST YEAR

Relationships with Affiliates:

Over the past year, INSGC has continued to make great strides in strengthening the relationships and involvement of our Affiliates. This year we have focused efforts on broadening the reach of INSGC throughout our Affiliate Institutions, with the result of a much wider variety of funded projects and involved faculty. These efforts have also resulted in increased publicity and involvement of students on all campuses. Several of our Affiliate directors are taking much stronger ownership of activities and the overall mission of INSGC. The involvement of our affiliates with the community college partnership has also led to increased visibility and a wider range of faculty and students involved at our affiliate institutions who are building lasting relationships with our community college partners.

Staff involvement:

INSGC office staff have continued to increase involvement in STEM activities statewide as well as at the host institution. Dr. Dawn Whitaker is currently serving on the Purdue University College of Engineering Engagement Committee, and all staff are involved in many STEM planning and oversight activities around the state involving public/private partnerships, non-governmental organizations, industry, education, and state/local

government partners. As a result of these activities, INSGC is building a reputation state-wide as a resource for STEM and NASA information and activities. These involvements are connecting INSGC with many communities, organizations and events.

**G. CURRENT AND PROJECTED CHALLENGES**

State government involvement:

Although INSGC has quite strong relationships with our federal government officials, as well as with the Indiana Board of Education, one upcoming goal is to build relationships with our state legislature. The INSGC Advisory Board, as well as our affiliate directors, will be helping with planning and execution in building these relationships.

Processes:

Another challenge has been working with our Society of Physics Students offices on accounts and proposal processes, as well as the various offices and procedures at our affiliate institutions. There are many people and offices involved with proposal submission, accounting, and processing of invoices which require a great deal of time and oversight. We have had several meetings recently which have resulted in incremental improvements, and we expect further improvements once the new hires in those departments are ‘educated’ on our processes.

**H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION**

The INSGC office engages the Affiliates to discuss and contribute to the strategies of the consortium. All Affiliates have voting rights and responsibilities approving strategic directions and Consortium program decisions discussed at Affiliate Meetings.

**Academic Affiliates**

Purdue University – <i>Lead Institution</i>	Purdue University Calumet
Purdue University College of Tech at Columbus	Anderson University
Ball State University	Saint Joseph’s College
Indiana State University	Taylor University
Indiana University – Bloomington	Trine University
Indiana University Purdue University Ft, Wayne	University of Evansville
Indiana University Purdue University Indianapolis	University of Southern Indiana
Valparaiso University	

**Outreach Affiliates**

Children’s Museum of Indianapolis	IMAX Theater
Challenger Learning Center of Northwest Indiana	Indiana State Museum
Ethos, Incorporated	Evansville Museum
Science Central	Terre Haute Children’s Museum
Conner Prairie	Near Space Launch

**Corporate Affiliates and Partners**

StratoStar Systems	Near Space Launch
Indiana Afterschool Network	ISTEM-Purdue University
Indianapolis Symphony Orchestra	