

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.

New Mexico Space Grant Consortium
Lead Institution: New Mexico State University
Director: Patricia Hynes
Telephone Number: 575-646-6414
Consortium URL: nmspacegrant.com
Grant Number: NNX10AM48H

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 New Mexico Space Grant Consortium (NMSGC) is a Designated Consortium funded at a level of \$575,000 for fiscal year 2014.

PROGRAM GOALS

Goal 1: Education: Optimize our unique geographic proximity to Spaceport America to provide a link to commercial launch opportunities for students faculty experiments.

Objective: Use NMSGC programs to build bridges to foster increased participation by student and faculty in NASA's research and science, technology, engineering, and mathematics (STEM) education opportunities and programs.

Goal 2: Marketing: Communicate unique NMSGC programs to local, state, national leaders in STEM education and research.

Objective: Present to local and national audiences at conferences and meetings. Increase followers for NMSGC programs on social media platforms.

Goal 3: Business: Enable commercial space industry development by highlighting NASA and NMSGC programs and capabilities.

Objective: Continue student launch program partnership with UP Aerospace. Convene the International Symposium for Personal Spaceflight (ISPCS).

Goal 4: NMSGC will be a clearing house for statewide space related expertise, information, facilities, and education.

Objective: Increase capstone projects, which will include applying to NASA Announcements of Opportunity.

Goal 5: Collaboration: Increase our collaboration with STEM education partners.

Objective: Create ongoing relationships with industry and community organizations.

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

Outcome 1: “The research I am doing in Virology examining previous NASA experiments related to cultures that can survive on Mars...the research is providing the experience of working in a laboratory which is important for my future goals. I am learning about the research experience and continuing to expand on my knowledge. This experience continues to help me pursue a career in Virology.” Krystal Charley, UNM

Outcome 2: Dr. Hynes provided the Keynote Address at the Annual Southeastern Regional Public School Administrators meeting. Administrators then met and two are now involved in our Student Launch Program.

Outcome 3: In October during ISPCS, Mr. Gerstenmaier met with leaders in the commercial space industry and NMSU’s Provost to determine whether partnering with the ISS national lab would be beneficial to NASA; and whether using the spaceport would add value to this relationship and Space Grant. It was recommended we hold a workshop; invite stakeholders from across the country and assess interest and capability.

PROGRAM ACCOMPLISHMENTS

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

Fellowship/Scholarship

SMART OBJECTIVES:

- Retain and graduate 90% of NMSGC scholars of whom 54.9% will be minority students; 40% will be females
- Require all scholars to perform NASA related research with faculty, present their research annually during the Student Colloquium/other conference and perform 10 hours community service
- Increase the number of students who apply for scholarships/fellowships
- Retain and graduate 90% of NASA Internships of whom 54.9% will be minority students; 40% will be females

ACCOMPLISHMENTS:

- Retain or Graduate NMSGC Scholars
 - 100% of NMSGC scholars were retained or graduated
- Require all NMSGC scholars to perform NASA related research with faculty; present their research annually during the NMSU Student Colloquium or at other conference and perform 10 hours community service
 - 100% of students performed NASA related research with faculty
 - 100% of students presented their research during the NMSU Student Colloquium or at other conferences
 - 100% of students performed 10 hours of community service

- Retain and Graduate NASA Internships
 - 2 New Mexico students applied for internships

Higher Education

SMART OBJECTIVE:

- Recruit NMSGC students to design, build and/or fly experiments into space
- Involve faculty and students in curriculum development that supports NASA's 4 Mission Directorates and OCT
- Partner with colleges at research universities to influence curriculum to contain space themes
- Partner with NMSU and New Mexico Institute of Mining and Technology to create two Freshman Experience classes with space content

ACCOMPLISHMENTS:

Recruit NMSGC students to design, build and fly experiments into space

Dr. Ou Ma: The Inertial Property Algorithm Validation (IPAV) project was selected by NASA Flight Opportunities to fly to space in June of 2015.

2 students participated

Description: Ongoing project: The objective is to validate an on-orbit inertial identification algorithm. This flight will refine tune the C code.

Involve faculty and students in curriculum development that supports NASA's 4 Mission Directorates and OCT

Dr. Thomas Jenkins: Design the Extension Education Provided Curriculum in Sustainable Energy Technologies, Phase III

78 students participated

Description: Completed project: The class designed and built a one square meter solar still; de-icing for stock tanks and a window box solar air siphon.

Partner with colleges at research universities to influence curriculum to contain space themes

Dr. Gabe Garcia: Magellan – Senior Capstone.

16 students participated

Description: Ongoing project: during the Spring 2014 and Fall 2014 semesters students completed the actuating system and animation for the Dragon head, and refined the remote control and telemetry system. The dragon is a test bed for students to work in a floating environment to simulate some microgravity conditions.

Dr. Chunpei Cai: Senior Course AE419 Propulsion Redevelopment

58 students participated

Description: Ongoing project: Purchased several new textbooks, and decided to adopt the AIAA education series, "Elements of Propulsion: Gas Turbines and Rockets" By J. Mattingly, as the new textbook for the Fall 2015 teaching. Currently Dr. Cai is developing new PowerPoint slides, homework and quizzes. Dr. Cai is also collecting other related teaching materials, including pictures and videos from NASA's past work, which may increase students' interests on this subject.

Partner with NMSU and New Mexico Institute of Mining and Technology to create two Freshman Experience classes with space content

Dr. Warren J. Ostergren: Freshman Experience at New Mexico Tech-Enhancing the Living.

8 students participated

Description: Ongoing project: Aerospace LLC research is designed to introduce freshman Mechanical Engineering majors to the basics of aerodynamics, engineering principles, research, design, and experimental testing. The final project for the year will be to launch a rocket with the student-designed nose cone and instrumentation package and compare the flight data to predictions from the student-written MATLAB code. The Aerospace LLC research opportunity introduces these first-year students to the variety of rocket and aerospace opportunities at NM Tech, including the Aerospace Engineering minor.

Additional Supported Projects included:

Dr. Young Lee: Student Competition - Design, Build, Fly AIAA Rocket competition

36 students participated

Description: Completed project: Student team has participated in the Cessna Aircraft Company/Raytheon Missile Systems -Student Design/Build/Fly Competition. The contest provided a real-world aircraft design experience for engineering students by giving them the opportunity to validate their analytic studies. Throughout the year students also documented all engineering decisions in an all-encompassing report that is a heavy part of the scoring system at the competition.

Dr. Patricia Sullivan: BEST Program

38 students participated

Description: Ongoing project: NMSU engineering students serve as mentors to the middle school and high school students who are designing and building functional robots.

Dr. Ricardo B. Jacquez: New Mexico AMP Student Research Conference

128 students participated

Description: Completed project: AMP hosted its annual statewide student research conference in Las Cruces. The conference brought together students and faculty from the state's colleges and universities as well as students and teachers from the New Mexico Math, Engineering, Science Achievement, Inc. (New Mexico MESA) program. NMSGC set up a table in their exhibit area to educate students about the opportunities that NMSGC offers.

Dr. Patricia Hynes: International Symposium for Personal and Commercial Spaceflight (ISPCS)

6 students participated

Description: Ongoing project: ISPCS is to grow the commercial space industry. Showcase new technologies driving the commercial space industry including: new launch facilities, commercially developed launch vehicles, and support/showcase NASA Flight Opportunities Program, and CASIS Programs. ISPCS and, NMSGC are partners in this event.

Dr. Patricia Hynes: Annual NMSU Student Colloquium

9 students participated

Description: Ongoing project: A requirement of the NMSU scholarship recipients is to present their research results at the annual colloquium

Dr. Nadir Yilmaz: Student Competition Intercollegiate Rocket Engineering Competition
8 students participated

Description: Ongoing project: Student team has been heavily engaged in the construction of its competition rocket, SCEPTER (Scientific Cargo and Experimental Payload Transportation and Exploration Rocket). Much of the construction is finished and the team looks forward to completing the rocket by mid-March. In addition to a test flight of SCEPTER in April, the team will continue testing to verify components, simulations, and continue to prepare for the competition.

Research Infrastructure

SMART OBJECTIVE:

- Engage faculty and students in research related to NASA's 4 Mission Directorates and OCT
- All funded research will answer big questions posed by the directorates and/or align with strategies to strengthen NASA's ability to meet the challenges of the Agency

ACCOMPLISHMENTS:

- Engage faculty and students in research related to NASA's 4 Mission Directorates and OCT
- 100% of funded faculty and students were involved in research related to NASA's 4 Mission Directorates and OCT
- 100% of funded research was focused on answering a big question posed by the directorates and/or align with strategies to strengthen NASA's ability to meet the challenges of the Agency

Supported Projects included

Dr. Chris Churchill: Direct Confrontations with Galaxy Evolution Theory
2 student participants

Description: Ongoing project: Ms. Mercedes Maldonado (undergrad, Aerospace major) is working with Dr. Churchill and Dr. Amanda Brady-Ford (Max Planck-Institute, Germany) and Dr. Natalia Batalha (San Jose State, Project Scientists for NASA Kepler) to measure the gas properties of galaxies in simulations. She has made excellent progress and is currently generating the science ready data. We anticipate the analysis will begin mid March 2015 and we will have a published result by summer 2015. Ms. Amber Medina (undergrad, Physics) is working on measuring the kinematics (gas dispersion properties in a sample of 400 galaxies, also in collaboration with Dr. Natalia Batalha.

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

SMART OBJECTIVE:

- Partner with the Las Cruces Public School district's 7 middle schools to integrate a space project into their new science curriculum.
- Create 1 experiment and launch it either on a balloon or rocket.
- Partner with Galactic Unite organization
- Partner with Summer programs to enrich science curriculum

ACCOMPLISHMENTS:

Partner with the Las Cruces Public School District

Description: Ongoing project: Las Cruces Public School District has not been responsive to the many discussions and meetings we have had with them regarding the integration of a space project into the new science curriculum. We are setting up a meeting with the Superintendent, Virgin Galactic, and Dr. Hynes to further discuss the future of this program.

Create 1 experiment and launch it either on a balloon or rocket

Description: Ongoing project: We are developing a relationship with 12 different public schools (Tatum, Lovington, Eunice, Jal, Carlsbad, Hagerman, Dexter, Artesia, Hobbs, Loving, Lake Arthur, Roswell) in the Eastern part of New Mexico in hopes of involving them in the Student Launch Program.

Partner with Galactic Unite Philanthropy

Description: Ongoing project: Dr. Hynes is an active member of Galactic Unite Philanthropy Education Board. They are involved in the Student Launch Program.

Partner with Summer Programs

Description: Ongoing project: Continue and grow the middle school partnerships in the Student Launch Program.

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)*

SMART OBJECTIVE:

- Use existing programs in museums and science centers in NM to engage Americans in NASA's mission.
- Initiate a relationship with the Challenger Learning Center in NM
- Increase faculty and student participation at the ISPCS and its related community and education
- Become the statewide and national resource for education outreach that supports the emerging commercial space industry
- Recruit federal government leadership supporting and facilitating the evolution of commercial space transportation to speak at ISPCS

ACCOMPLISHMENTS:

Increase faculty/student participation at ISPCS and its related community and education

Supported 10 faculty and students to participate in the ISPCS and its related community and education events.

Become the statewide and national resource for education outreach that supports the emerging commercial space industry

Developed an extensive database of all STEM department heads and faculty all institution in New Mexico that allow our office to forward announcements of opportunity to the entire state that supports the commercial space industry. Updating every semester.

Recruited federal government leadership supporting and facilitating the evolution of commercial space transportation to speak at ISPCS

Bill Gerstenmaier, Associate Administrator, Human Exploration and Operations, NASA
Jason Crusan, Director, Advanced Exploration Systems Division, NASA

Reynaldo Garcia, Senior Engineer, Office of National Security and Technology Transfer Controls.

Jess Sponable, Program Manager XS-1, Tactical Office DARPA

LK Kubendran, Flight Opportunities Program Executive, NASA

George Nield, Associate Administrator Commercial Space Transportation, FAA

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity:**

34% female and 69% minority

80% Minority Serving Institutions

20% Tribal Serving Institutions

- **Minority-Serving Institution Collaborations:**

New Mexico State University (HSI) is the lead institution for NMSGC. NMSU participates in our scholarship program, internship program, Research Enhancement Program, Education Enhancement Program, and Higher Education Programs

University of New Mexico (HSI) participates in NMSGC scholarship program, internship program, and Research Enhancement Program

New Mexico Institute of Mining and Technology (HSI) participates in our scholarship program, internship program, Research Enhancement Program, Education Enhancement Program, and Higher Education Program

Southwest Indian Polytechnic Institute (Tribal College) participates in our scholarship program

- **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. Activities include: NMSGC Fellowship/Scholarship Program; NASA Internship Program; Student Launch Program; Capstone Design Courses; Research Enhancement; and Education Enhancement
- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above). This was accomplished in conjunction with Summer of Innovation.
- Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers. Conducted a summer workshop for teachers to learn how to design, build, test, and fly payloads. This was done in conjunction with Summer of Innovation and the Community College STEM Program.
- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges. Conducted a summer workshop for teachers to learn how to design, build, test,

and fly payloads. This was done in conjunction with Summer of Innovation and the Community College STEM Program.

- Aeronautics research – research in traditional aeronautics disciplines; research in areas that are appropriate to NASA's unique capabilities; directly address the fundamental research needs of the Next Generation Air Transportation System (NextGen).
- Environmental Science and Global Climate Change – research and activities to better understand Earth's environments. NMSGC does not currently have any projects.
- Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities.
- Faculty are encouraged to apply for Research Enhancement and Education Enhancements grants to help focus their research on NASA priorities.

IMPROVEMENTS MADE IN THE PAST YEAR

- Attended statewide Annual Alliance for Minority Participation (AMP) Conference; distributed scholarship information and had an information table during the conference
- Developed an extensive database of faculty advisors of student groups. This database is used to distribute scholarship announcements on a weekly basis when opportunity is open.
- Embarked on a collaboration with the NMSU College of Engineering and the College of Engineering at NM Tech to participate in their pilot program for recruitment and retention in freshman and sophomore engineering classes

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Research Universities: HSI- New Mexico State University; University of New Mexico; and New Mexico Institute of Mining and Technology

Comprehensive University: HSI- Eastern New Mexico; New Mexico Highlands University; Northern New Mexico College; Western New Mexico College and Tribal Colleges -Southwest Indian Polytechnic Institute; Navajo Technical College

Role in consortium activities/operations: Partners publicize student opportunities, teach courses for the Student Launch Program Capstone program and offer higher education programs/workshops and offer educational programs through the Education Enhancement Program. Faculty also provide research programs and serve as reviewers on the Research Enhancement Program.