

Program Title: New Mexico Space Grant Consortium

Lead Institution: New Mexico State University

20 Year Review



A handwritten signature in black ink, which appears to read "Patricia C. Hynes".

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STATEMENT OF CONSORTIUM CONCURRENCE

The concurrence process was completed on-line.

EXECUTIVE SUMMARY AND CONSORTIUM IMPACT

New Mexico Space Grant Consortium (NMSGC) has a prominent & permanent presence throughout New Mexico. NMSGC acts as an agent for change, coordination, & cooperation in technical education, enhancement of research infrastructure, & promotion & inspiration of lifelong learning in the areas of science, technology, engineering & mathematics (STEM). NMSGC acts as a workforce development force to respond to evolving workforce development & emerging industry needs in the state of New Mexico & the Nation. Significant accomplishments & impact on New Mexico include:

- In 2004, NMSGC dedicated its permanent headquarters in the Sugerman Space Grant Building, at 3050 Knox Street on the campus of New Mexico State University (NMSU). It is from this building NMSGC operates our statewide programs. We raised private & public funds to remodel this building which is centrally located on the main NMSU campus, between the College of Engineering & College of Agriculture. NMSU willingness to support NMSGC in obtaining a permanent home shows the contribution NMSGC has made to NMSU over the past 20 years. The building is on all campus maps & directories. This supports our strategic goal: “Create a prominent & permanent presence throughout NM.”
- In order to increase our visibility across the NMSU campus, NMSGC reporting moved from College of Engineering to the Office of the Vice President for Research. Reporting to the College of Engineering made NMSGC appear to be an engineering program. Reporting to the Vice President for Research enables all colleges & universities to perceive NMSGC as a university wide & statewide resource. This move gives NMSGC much more visibility on campus & throughout the state.
- In 2007, NMSGC founded the NMSU Space Development Foundation to support NMSU & NASA activities through programs, educational & promotional opportunities related to the development of Spaceport America & New Mexico’s space commercialization efforts.
- NMSGC expanded its outreach into the commercial aerospace field by establishing the International Symposium for Personal & Commercial Spaceflight in 2005. The symposium allows NMSGC to tell the Space Grant story on a national level, create collaborations between faculty, students & related industry partners from across the national Space Grant network. These collaborations have allowed us to recruit students from across the Space Grant network, & expand our summer internship program to include companies & organizations in the personal & commercial spaceflight industries. This symposium is a highly visible conference, aligned with NASA’s strategic goal to support space commercialization efforts, & provides matching funds & industry partners for our program.
- Proceeds from ISPCS were used to support 8 student internships at 6 organizations. We established 6 new industry partnerships as part of the ISPCS Summer Internship program.
- NMSGC created the Leonard R. Sugerman Public Forum. The purpose of this free public forum is to educate the community members about the commercial space industry developing with Spaceport America. 70 people attended the forum in 2007.
- NMSGC hosted the 2007 National Space Grant fall meeting. All participants were invited to attend ISPCS, the NASA Northrop Grumman Lunar Lander Challenge & the X PRIZE CUP.
- NMSGC disseminated its successful GRASP program to partner DACC with \$150,000 funding from the NSF. 22 faculty & 394 DACC students participated in this program. 78 NMSU faculty & 3,252 NMSU students participated in this program.
- NMSGC brought the NSF Academy for Young Scientists \$600,000 program to NMSU.

- During the past 5 years over 20,000 NM citizens participated in NMSGC programs. Participants include:

University/College Faculty	858
University/College Students	5,350
Pre-College Teachers	182
Pre-College Students	1,373
General Public	<u>13,562</u>
Total	21,325

Strategic Planning is the cornerstone of our statewide planning & collaboration efforts. All NMSGC partners are involved in our strategic planning. Partners are involved in annual assessment of progress on strategic goals. In June of 2006, partners & affiliates of NMSGC met & created a strategic plan to guide our activities through the year 2011. In consideration of NASA’s national objectives, the National Space Grant College & Fellowship Program’s guiding legislation, global & market forces impacting our organization, partners & affiliates developed the following Vision, Mission, & Goals to guide NMSGC's work:

Vision: In the year 2011, New Mexico Space Grant Consortium continues to have a prominent & permanent presence throughout New Mexico. New Mexico Space Grant Consortium is the lead agency of coordination & cooperation in technical education & enhancement of research infrastructure.

Mission: To advance the economic, education, & scientific benefits of space related endeavors. New Mexico Space Grant Consortium promotes & inspires lifelong learning in the areas of science, technology, engineering, & mathematics as it pertains to space related activities.

Goals:

- Develop strong collaborative programs that clearly benefit NMSGC members & clients by leveraging the collective resources of the members.
- Create revenue opportunities by providing professional & educational services to the aerospace industry.
- New Mexico Space Grant Consortium will be a clearinghouse for statewide space related expertise, information, facilities, & education. NMSGC will work with commercial & government organizations to leverage time, capabilities, equipment, & funding.
- New Mexico Space Grant Consortium is part of an existing, larger, broader space related community that can effectively service the interests of academia, industry, education, & the public.
- NMSGC members will bring in diversified funding to support space related activities that meet identified needs.

FOREWORD



“The entire delegation, three republicans & two democrats are HUGE supporters of the Spaceport & the Symposium. This is a life-long dream for our senior senator, Senator Domenici. This work is very near & dear to his heart.” (Steve Traver, Congressman Steve Pearce’s Office)
photo to left: NMSGC Director Pat Hynes & Senator Pete Domenici

Analysis of New Mexico Needs: The State of New Mexico has a long, successful history in space-based research & education. We have multiple observatories including the Very Large Array, Magdalena Research Observatory, Apache Point Observatory, Sloan Digital Observatory, & Sunspot Observatory. The history of modern rocketry started in New Mexico with Robert Goddard’s liquid rocket research in the 1930’s, & continues today as commercial providers work to provide NASA & the world access to space. Spaceport America, the first purpose built inland spaceport, has broken ground. With the passing of the gross receipts tax & recruitment of Virgin Galactic as anchor tenant, Spaceport America is poised to bring a new level of economic development & space related research to New Mexico. NMSGC offers multiple programs to create opportunities for citizens to reap the benefits of space commercialization. NMSGC supports workforce development efforts beginning to take shape to enable economic development in this emerging industry in New Mexico & the Nation. NMSGC programs; research, scholarships, higher education, pre-college, & general public programs support New Mexico workforce development & economic development needs.

NMSGC created the International Symposium for Commercial Spaceflight (ISPCS) to bring together the community involved in all aspects of personal & commercial spaceflight to help grow the industry. New Mexico will invest \$220 million dollars to build Spaceport America. Many opportunities already exist for students & faculty to work with companies coming to New Mexico. Symposium proceeds supported 8 summer interns, 51 students applied for these internship positions. Many students from the national Space Grant network applied. We may have begun to recruit students into New Mexico instead of exporting them to other states.

NMSGC scholarship, internship & research programs, the Reduced Gravity Student Flight Opportunities Program, & the Statewide Spaceport America Student Launch Program were created to develop the technical workforce necessary to meet New Mexico & NASA needs.

New Mexico is a tri-cultural state, with Hispanic, Native American & Anglo cultures merging to create multiple challenges for educators. In particular, the STEM fields have traditionally been difficult to retain students through graduation & New Mexico is no exception. NMSGC programs, described throughout this document, work to address recruitment & retention, gender & ethnicity issues by creating programs where results are measured empirically. The National Science Board reports in “Moving Forward to Improve Engineering Education” (2008) a serious challenge for engineering education is to retain those students who are initially attracted to engineering. Nationally, only 60% of students who enter engineering majors obtain a degree within 6 years. NMSGC programs that address this include:

- Gaining Retention & Achievement for Students Program (GRASP), a semester long faculty development program whose intent is to bring about a change in faculty teaching practices which are proven to increase student retention & achievement. At NMSU we found a 5%

increase in both student achievement & retention. At DACC we found an 8% increase in student achievement & a 4% increase in student retention.

- NMSGC scholarships require students to do research with a faculty member as a retention strategy. As of Fall, 2008, 44% of scholarship recipients are still enrolled & 53% have graduated.
- All students participating in the Reduced Gravity Student Flight Opportunities Program have graduated or are still enrolled in their engineering major.

Response to NASA Priorities: NASA's 2006 Workforce Strategy recognizes that an effective workforce strategy is critical to mission success.

- The purpose of all NMSGC Programs is to increase the number of students joining the STEM workforce in order to respond to evolving workforce development & emerging industry needs in the state of New Mexico, NASA, & the Nation.
- All NMSGC supported faculty research involve students, both undergraduate & graduate, in NASA Mission Directorate research needs.
- All scholarship students participate in NASA related research with faculty.

Demographics:

New Mexico is a minority majority state. (See page 23-24 for details & citations)

Among states, New Mexico has the highest proportion of Hispanics (41%) & ranks second in the proportion of American Indians (9%). With only 43% Non-Hispanic White & 3% African-American, & 2% Asian or Pacific Islander, New Mexico is “the only state in which no single major racial/ethnic group holds a majority of the state’s population.”

- NM Undergraduate population: 53% of NM students are minority, 59% of are female
 - NMSGC minority: 74% of scholarship recipients, 51% of higher education participants & 22% of research participants were minority.
 - NMSGC female: 44% of scholarship recipients were female. 44% of participants in NMSGC higher education programs & 46% of research participants were female.
- National STEM graduate population: 16% minority & 35% female
 - NMSGC minority: 30% of scholarship recipients, 41% of graduate students in higher education programs & 51% in research programs were minority students.
 - NMSGC female: 35% of graduate scholarship recipients, 38% of graduate students in higher education programs & 11% in research programs were female.
- National S&E faculty population: 19% are minority & 28% are female.
 - NMSGC minority: 31% of faculty participating in higher education programs & 17% in research programs are minority faculty.
 - NMSGC female: 49% of faculty participating in higher education program & 13% in research programs are female.
- NM Pre-college population: 69% of pre-college students are minority & 51% are female
 - NMSGC minority: 73% of students participating in pre-college programs are minority.
 - NMSGC female: 53% of students participating in pre-college programs are female

CONSORTIUM MANAGEMENT



Congressman Pearce, Len Sugerman,
NMSU Regent Manatt

“NMSGC provided me with funds to develop a new course in orbital mechanics. NMIM&T & NMSU have a joint program in aerospace engineering. The course is offered via distance education & it is available to students statewide. Without NMSGC support this important course would not be available to our students.” (Dave Westpfahl, Physics professor, New Mexico Institute of Mining and Technology)

Description: Consortium management structure, and operational policies and procedures: NMSGC has a participative organizational structure. Goals & objectives created by partners during our 2006 Strategic Planning guide the allocation of resources through the year 2011. Day-to-day management of consortium business, reporting to NASA, & proposal submission on behalf of partners are done by the NMSGC main office personnel at the lead institution, NMSU.

In 2007 NMSGC reporting moved from the NMSU College of Engineering to the Vice President for Research to enable all colleges to perceive NMSGC as a university wide & state-wide resource. The move gives NMSGC much more visibility on campus & throughout NM.

NMSGC’s decision-making & policy-making processes: Policies are developed in collaboration with NMSGC partners & affiliates & through the strategic plan. We have determined while it is important for the consortium’s long term stability to have ongoing relationships, it is not good for programs to give block grants to partner institutions. All funds are now competitively awarded annually. Proposals are externally reviewed before awards are granted. The strength of this change is reflected in the increase of diversity in program disciplines & diversity of institutions applying for funds from across the state. While there has been a small increase in national funding, we have experienced a proportionally larger increase in the number of academic institutions involved with NMSGC. The weakness is we no longer have funded long term relationships with faculty to act as points of contact at some institutions.

Self-assessment & evaluation: All NMSGC partners participate in the annual evaluation of the consortium’s work. NMSGC goals & objectives are reviewed & re-aligned annually based on successes, finished projects & deficiencies. Project decisions are data driven. Evaluation criteria include costing in a timely manner, capture of matching funds, diversity of participants, project results, & responsiveness. Annual assessment is used for continuous improvement of programs.

Development of the Program Performance and Results Report: Prior to the 2008 annual meeting, all partners received the PPR guidelines & our first PPR. NMSGC partners were asked to submit information as the NMSGC staff refined the draft of the PPR. At the 2008 annual meeting, partners provided input into the PPR. All NMSGC partners submitted information when asked during the writing of the documents, reviewed the final document & signed concurrence.

Analysis of Core Criteria

Management structure, operational policies and procedures: The greatest strength of the consortium is our partners & their programs. The collaborative organizational culture & focus on space programs of high quality have created a high standard for NMSGC programs. Policies have evolved based on discussions, experience & collaboration among partners on what must be

done to ensure vital programs, strong student success, & increasing presence for Space Grant in the state. Over the past five years, we have made several improvements: 1) Block grants to partners were barriers to growth in funding new programs & faculty participation in NMSGC. Instead of block grants to partner institutions we now annually provide a pool of funds for statewide competition. Proposals are submitted online, reviewed by 2 external reviewers, & awarded based on a point system. We receive an average of 6-7 proposals. We continue to work to increase the number & diversity of disciplines of proposals we receive. This is a constant process for improvement & is a significant avenue for partner participation. Our current recruitment strategies include visits to all universities, email announcement to deans & department heads, & flyers to faculty across campuses. These efforts have resulted in a diversity of faculty, disciplines, & NMSGC programs. 2) Since inception NMSGC was administratively housed in the College of Engineering at NMSU. In 2006 NMSGC Director determined the time & climate at the lead institution enabled a move from a college level up to the Office of the Vice President of Research. This gives NMSGC much more visibility on campus & throughout the state.

Strategic Plan: SMART Goal #1: Create a strategic plan that will focus NMSGC programs on NASA Mission Directorates, NASA Educational Outcomes, & New Mexico needs. Outcome: NMSGC has a strategic plan that focuses NMSGC programs on NASA Mission Directorates & Outcomes at all levels of consortium work (see page 4 for details). SMART Goal #2: Create a strategic plan to enable statewide participation of diverse institutions including higher education, industry, & informal education programs. Outcome: NMSGC held a Strategic Planning Conference in June of 2006. 29 partners participated in the creation of our strategic plan which guides our programs. Together participants created plans for the future based on shared ideals that they can work for. Because the resulting vision is created collectively, commitment & enthusiasm for action is very high. In addition to our overall consortium goals we have SMART program metrics such as student retention metrics, diversity metrics, & alignment metrics. Annual assessment of programs & their metrics is used for continuous program improvement.

Consortium Structure/Network (Internal): **Affiliate number, demographics, & char.:** SMART Goal: Increase NMSGC partners to include comprehensive & community colleges, state, federal, & non-profit organizations, & industry. Outcome: In 2002 NMSGC had 11 partners. In 2007 NMSGC is comprised of 37 academic, federal, state, & private organizational affiliates. An additional 32 organizations have provided funding for NMSGC programs. Academic institutions & their characteristics are noted in Table 1. NMSGC partners include all research & comprehensive universities. 7 are Hispanic Service Institutions (HSI), 3 are new partners in the past 5 years. The three research universities have been partners since inception. The mix of partners in higher education is highly effective for our consortium. We engage world class researchers early in their careers & we have grown the organization together. Our academic partners created NMSGC & are the reason we are an effective presence in the state.

Name of Academic Partner	Type of Institution			Hispanic Serving Institution	New Partner in Past 5 Years
	Research University	Comprehensive University	Community College		
NMSU	√			√	
UNM	√			√	

NMIMT	√				
DACC			√	√	
SJC			√	√	
ENMU		√		√	√
WNMU		√		√	√
NMHU		√		√	√

State of New Mexico partners are new in the last 5 years & include the Department of Economic Development, Department of Higher Education, Spaceport America, & NM Farm & Ranch Heritage Museum. All partners collaborate in NMSGC programs.

4 federal institutions are NMSGC partners. All have significant presence in the state & participate in NMSGC programs. NMSGC facilitated development of the student internship program at NASA JSC White Sands Test Facility (WSTF) & a graduate degree through distance education for WSTF employees. WSTF continues to be a major partner, working with NMSGC faculty on NASA related research. All partnerships have expanded & grown in the last 5 years.

14 industry partners collaborate in NMSGC programs. An additional 25 companies provided funding for NMSGC programs. All relationships have developed during the last 5 years.

5 not-for-profit organizations (NFP) collaborated with NMSGC programs including: American Institute of Aeronautics & Astronautics (AIAA), National Public Observatory, Association of Space Explorers, Space Development Foundation, X PRIZE Foundation. 3 NFP placed student internships in their organizations including the National Space Society, Space Foundation, & Personal Spaceflight Federation. 5 NFP provided funding for NMSGC programs including AIAA, Space Foundation, High Tech Consortium, New Mexico Partnership, & X PRIZE Foundation. All these relationships have developed during the last five years.

Our relationship to NASA & its Mission Directorates, our programs, & New Mexico's space related assets make NMSGC unique among programs in the state. NMSGC networks have created collaborations among students & universities, & enabled a structure for NASA programs & access to NASA Academies, field centers, & contractors. We hope to continue to build these relationships & spread our work more deeply into communities throughout NM & the Nation.

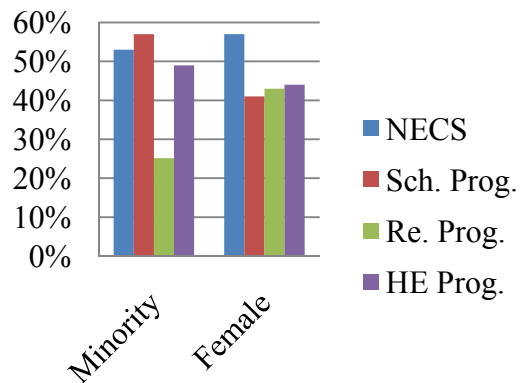
Campus/organization representatives: New Mexico has three research universities who have been the backbone of NMSGC's affiliate network. Faculty participate with NMSGC in research & education programs. Each NMSGC partner institution has an unfunded program director responsible for NMSGC programs at their institution. Their duties revolve around their commitment to informing students & faculty about program opportunities offered by NMSGC. We fund students & faculty to work on projects related to NASA Mission Directorate goals. Each researcher & student must show in writing how their request will support NASA. We encourage alignment with ongoing NASA programs on campuses & encourage building an NMSGC presence on their campuses. At the lead institution, we enjoy superior support from administration. Our participation in campus-wide programs including the Advancing Leaders Program, President's Commission on the Status of Women, & Leadership Academy project have enabled this support. It is important that NMSGC reach deep into the campus community to enable continued support for our growing programs. Through the GRASP Program, NMSGC has daily contact with faculty in their classrooms at NMSU & DACC. NMIM&T is a small technical university & there is rarely a student that is not familiar with NMSGC. Students from all three research institutions participate in the Reduced Gravity Student Flight Opportunity Program, NASA Academy, ESMD, internships, & capstone design courses.

Coordination and/or cooperation among affiliates: Coordination & cooperation among partners is constant & an organizational value. We help each other succeed. We share student project information during our annual meetings, visit each other’s research facilities, & support state legislature requests. An example of coordination & cooperation among affiliates is the Reduced Gravity Student Flight Opportunity Program. When we started this program, it was necessary for all our affiliates to share expertise & willingness to help get this program going. Students & faculty continue to enable this statewide program. All partners participate in consortium planning through the annual partner meetings & telephone/email communications. All academic partners participate in workforce development & the statewide scholarship & internship programs including the ESMD internship program & capstone design courses.

Consortium communication: There is no substitute for face-to-face meetings. Therefore, we have at least one annual meeting for all NMSGC partners. We also have scheduled visits depending on program requirements as distances between institutions is hundreds of miles. We produce a newsletter which we mail & email. Business correspondence is consistent between campus researchers & the program office regarding deadlines for proposals, allocation of funding, additions or changes to subcontracts. Because of the tremendous amount of work we share on NMSGC programs & day-to-day reporting on fiscal management, we communicate regularly. The NMSGC website is a communication tool & is updated regularly with student presentations & announcements of opportunity. We work to create the habit for partners to check the website regularly. We use the website to announce funding opportunities for students & faculty. We use the website to announce scholarship & research awards. We announce NMSGC programs via email including the opening of the proposal process, registration for ISPCS, statewide program opportunities, & scholarship & internship programs.

Diversity: SMART Goal: Participation by diverse populations in NMSGC programs will match the diversity levels of the state. Outcome: Chart 1 indicates by program, the percentage of minority & women who participated in NMSGC programs. NCES-2005 report, indicates 53% of students enrolled in New Mexico’s colleges & universities are minority students defined in this report as Hispanic, African American, Native American & Pacific Islanders. NSF states in “Graduate Students & Postdoctorates in Science & Engineering, Fall 2006” 16% of STEM graduate students are minority & 35% are female. NSF states in “Academic Institutions of Minority

**Chart 1
NMSGC Program Diversity**



Faculty with S&E Doctorates” (June 2006) 19% of S&E faculty are minority. NSF states in “33 Years of Women in S&E Faculty Positions” (2008) 28% of S&E faculty are female. We work with faculty & student programs where minority & female retention is important. In STEM, the largest numbers of women & minority students are in undergraduate entry level classes. By working with faculty teaching these classes through the GRASP program, we have increased retention of diverse populations. NMSGC is committed to diversity in programs, partnerships, & management. Minority-serving institutions are highly involved in consortium management, project coordination, implementation, & evaluation. NMSU, UNM, NMHU, ENMU, WNMU,

SJC, & DACC are HSI. We have actively pursued minority serving institutions, to become new members in the last five years. 80% of NMSGC management is female & 40% are minority.

Consortium Operations

Office space & facilities: SMART Goal: Provide a permanent presence for NMSGC.

Outcome: NMSGC main offices are in the Sugerman Space Grant Building on the campus of NMSU. The office is exclusively dedicated to Space Grant & provides drive up parking for visitors. This 2400' building includes 5 offices for program staff, conference room, room for project work, & storage. NMSGC raised over \$245,000 to remodel this building which is located between the College of Engineering & College of Agriculture. University willingness to support the cost of providing NMSGC a permanent home shows the contribution NMSGC has made to NMSU over the past 20 years. Since the name of the building is the "Sugerman Space Grant Building" NMSGC is mentioned on all campus maps & directories. NMSGC has a dedicated phone line & voice mail, the telephone is answered "New Mexico Space Grant Consortium." Our campus mail code is SG. Our website address is <http://spacegrant.nmsu.edu>.

Staffing levels at the lead institution and support provided by other institutions: NMSGC has a full time director, associate director, fiscal reporting specialist, administrative assistant, & program coordinator. Since 1995 NMSGC has expanded its programs using the same small 3 person staff. In 2008 NMSGC hired an administrative assistant & program coordinator to help with the expanding workload of our programs. Each NMSGC partner institution has a program director responsible for NMSGC programs at their institution. Through our proposal process each institution may apply for multiple awards for research, education, & outreach efforts. Which personnel receive NMSGC FTE support depends on how many apply for & are awarded.

Advisory Board: NMSGC Advisory Board is comprised of NMSGC members, faculty, industry, federal government & affiliate representatives. One meeting is held per year. The Chair is the Director, Pat Hynes. The general purpose of the Advisory Board is to promote, review, & support NMSGC activities & plans. The NMSU Space Development Foundation, founded in 2007 provides broad outreach efforts to enable supplemental funding. This includes the ability to support foreign faculty & students, non-NMSU & New Mexico students, & supplement our summer internship programs with partnerships with industry.

Policy to Add & Remove Members: Adding & removing members is done by the Director under the direction of the Advisory Board. The strategy to recruit an affiliate includes individual meetings with potential affiliates. Once it is determined there is mutual interest in a relationship, faculty are encouraged to submit proposals for funding or collaboration. We also have members which do not receive funding. All industry partners either collaborate in NMSGC programs or provide funding for NMSGC programs. They do not receive funding from NMSGC, they support NMSGC. If it is necessary to suspend or terminate a relationship, the Director contacts the affiliate in writing to describe the status of our relationship, remedies necessary to sustain our relationship, or indicate what must be done to terminate the relationship. Member relationships can be terminated due to lack of fiscal responsibility, non-completion of progress, or inconsistent staffing. At SJC our faculty died, we are still working to replace this very valuable person.

Resource Management: SMART Goal: NMSGC funds must be allocated in a timely manner. Outcome: All NMSGC institutions provide timely & accurate costing & reporting. All partners track & report matching funds through cost-share accounts & each expense report submitted monthly to NMSGC includes the matching funds report.

Distribution of NMSGC funds among affiliates: NMSGC policy provides a commitment to partners to compete annually for support for funding. No funds are set aside in block grants for any affiliate, all funds are competitively awarded. Affiliates may apply for funding under our annual competition for research, education, & outreach programs. Partner funds are distributed through subcontracts with negotiated Statements of Work. New institutions may apply for one year of funding for their programs. New institutions may become partners after demonstrating fiscal responsibility & capability of completing a contract. Some institutions are not interested in a long term relationship & do not seek more than one year of support.

Although partners are not allowed to charge overhead on any NMSGC funds, they strongly support NMSGC. Partners agree scholarships justify maintaining NMSGC presence in the state & are necessary for continued university support. Students apply directly to NASA for NASA Academy, Summer Internships, & ESMD. Stipends & travel funds go directly to students for their participation in these programs. Students apply through our on-line scholarship process facilitated by the National Space Grant Foundation. Scholarships are funded through the financial aid office at the students' home institution. The number of students funded at each institution depends on the number of applications received & awarded from each institution.

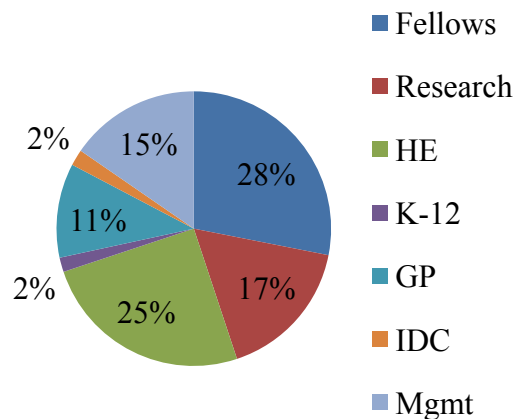
The strength of this method is all programs receiving funding are reviewed before making awards, usually by Space Grant Directors. Student scholarships require research with faculty & are reviewed before awarding. This method supports new faculty, staff, & students each year, expanding our contribution to departments & universities statewide. The weakness in this method is we work with new faculty & staff each year. This does not create long-term working relationships as we had when we offered block grants to the universities. We believe the reviewed proposals are a better method of funding & program development for NMSGC.

Management & Administrative Costs: Partners agreed to allocate the maximum amount of funding to support NMSGC statewide programs. 11% of funds were used for administrative expenses. Our management strategy & strength is to provide service to our partners & distribute as much NMSGC funds as possible to partners. To keep administrative expenses low, we use student help & collaborate on projects so we do not assume administrative burden on all projects.

Allocation of funds across project elements:

Chart 3 shows how funds have been used for NMSGC programs during the past 5 years. Higher education is the focus for NMSGC. 25% of resources are in higher education programs & 28% in scholarships. 17% of resources support faculty research, most of these funds support students in faculty research. Student involvement in the research experience is the value added through NMSGC & essential for student retention & achievement. Inclusion of students in all NMSGC faculty research became a priority for funding across the state in 1998. Only 2% of resources support pre-college programs. General public programs receive 11% of resources.

Chart 3
Summary of Allocation of
Funds by Program Elements
2003-2007



Staff Resource Allocation: NMSGC main office staff are responsible for budgeting, reporting, resource development, program coordination, new program development, matching funds acquisition from the State of New Mexico, industry relations, & new partner relations. Partner institutions are responsible for implementing programs at their institutions, including scholarships, research programs, higher education programs, & public outreach programs.

Collaborations and Partnerships Outside the Consortium: NMSGC collaborates with NASA Headquarters, field centers, & all 52 Space Grant Consortia. In 2007 NMSGC hosted the National Space Grant Directors meeting. NMSGC Director served on the National Space Grant Directors' Council Ex Com, & is Treasurer for the NSGF. NMSGC Director & Associate Director serve as reviewers for faculty research funding for other Space Grant Consortia, Designated Space Grant awards, & NASA Academy applications. NMSGC has worked closely with the State of NM, Economic Development Office & Spaceport America on the developing space related businesses in NM

Impact/Results

- Retention of founding academic partners & addition of new partners has led to a stable & diverse organization.
- Funding from NSF, USGS, State of NM, & NMSU allowed NMSGC to expand programs.
- All NMSGC funds are costed in a timely fashion, all NASA reporting deadlines have been met, all NMSGC programs align with NASA Mission Directorates & NASA education outcomes & objectives, all matching funds requirements have been met.
- NMSGC main offices are located in the Sugerman Space Grant Building.
- NASA field centers are more aware of & use NMSGC more effectively as evidenced in our Reduced Gravity Student Flight Opportunities Program, NASA Academies & Internships.
- NMSGC collaborated with JSC-WSTF on several programs such as their student coop program & WSTF employee aerospace engineering courses.
- NMSGC created endowments with value of \$426,740. The purpose of the endowments is to enable NMSGC to operate in perpetuity should congressional funds discontinue.

NASA EDUCATION OUTCOME 1 - FELLOWSHIPS & SCHOLARSHIPS



Terecita Mayorga
2007 GSFC Intern

“Having these resources has allowed my efforts to continue in applied physics & chaotic dynamics. I not only have success in my academic studies & maintain a 4.0. I plan to pursue an in-depth education leading to an undergraduate, graduate, & Ph.D. I intend to apply my educational & career opportunities to make a difference in our world. I plan to continue my academic perspective & commitment to excellence on campus, & remain an energetic student engaged in campus life & issues. NMSGC support affords this opportunity.” (John Korbin, NMIM&T)

Description

Purpose: NASA's 2006 Workforce Strategy recognizes that an effective workforce strategy is critical to mission success. NASA's strategy is based on objectives that contribute to accomplishing the President's Vision for Space Exploration & carrying out national priorities of scientific discovery & aeronautics research, while also recognizing financial responsibilities & limitations. State of New Mexico Workforce Report 2007 states occupational groups requiring

the highest levels of education are expected to increase more rapidly than the overall average. Workforce growth over the next 6 years is expected to increase 35% in computer & math areas, 21% in architectural & engineering, & 18% in life, physical & social sciences. The purpose of NMSGC's scholarship program is to recruit, retain & thereby increase the number of students joining the STEM workforce in order to respond to the evolving workforce development & emerging industry needs in the state of New Mexico & the Nation.

SMART Goals & Objectives: Contribute to the development of the STEM workforce in disciplines needed to achieve NASA strategic goals by placing students in internships at NASA field centers or industry, & by placing students with faculty to do NASA related research. Our long term goal is to retain & graduate 90% of all NMSGC scholars. Our short term goal is to recruit a diverse pool of students which matches our state's diverse population.

Program Characteristics: NMSGC focuses on building the STEM workforce in the state to respond to emerging workforce needs. We awarded \$2,000 scholarships to undergraduate students & \$5,000 to graduate students. We awarded summer internships of \$5,000-\$7,500 to both undergraduate & graduate students. There is a statewide pool of funds to which students at all NMSGC institutions may apply. Applications are submitted on-line. Students are asked to describe their research program & how it relates to NASA.

Percentage of consortium budget: 28% (5 year average) of NMSGC budget is dedicated to support scholarships, fellowships, & internships.

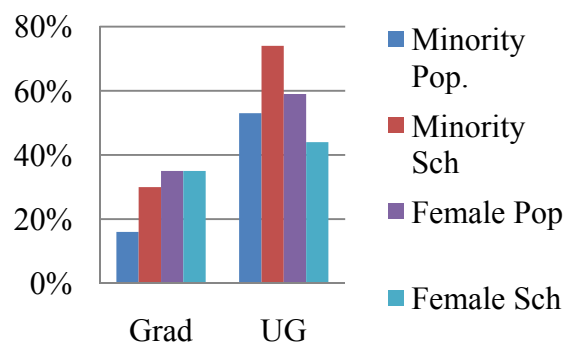
Assessment & Evaluation: Prior to award, each application is evaluated based on a current transcript, one page project description & its relationship to a NASA Mission Directorate, a letter of support & commitment from a faculty member. Awards are made for one academic year. Student research is assessed annually through the Student Research Colloquium & presentations at all 3 research institutions. NMSGC funded scholarship recipients must present results &/or progress at a research colloquium which is open to the public. Faculty advisors also attend. We also assess our program as a whole each year as to the % of female & minority recipients, & retention in their STEM programs (see discussion below).

Support of both graduate and undergraduate students: NMSGC is committed to support both graduate & undergraduate students. 70% of students receiving NMSGC scholarships in the last 5 years are undergraduate students, 30% are graduate students.

Analysis of Core Criteria

Diversity: NCES states 53% of students enrolled in New Mexico's colleges & universities are under-represented minorities. The State of New Mexico "Condition of Higher Education in New Mexico 2005" states 59% of university students are female. NSF states in "Graduate Students & Postdocs in Science & Engineering, Fall 2006" 16% of STEM graduate students are minority & 35% are female. Chart 4 shows NMSGC scholarships to graduate students were 30% minority & 35% female. NMSGC scholarships

NMSGC Scholarship Diversity 2003-2007



to undergraduate students was 74% to minority students & 44% to female students. The Commission on Professionals in Science & Technology (<http://www.cpst.org>) report females

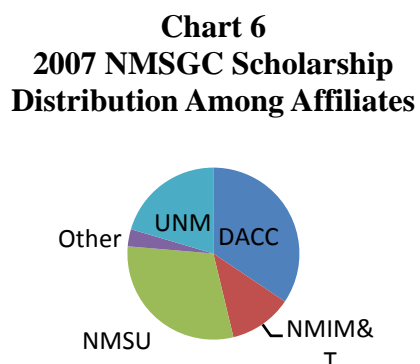
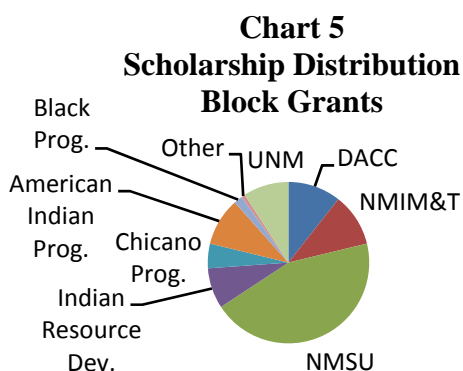
make up 22.6% of the STEM workforce & Hispanics make up 5.3% of the STEM workforce. In an era when U.S. economic prospects hinge on technical skill, the nation must make the best possible use of all sources of talent. NMSGC has consistently worked multiple strategies to increase diversity in STEM. These strategies include developing relationships with female & minority faculty, working with Women’s Studies programs, & service on NSF programs including Advancing Leaders, Alliance for Graduate Education & the Professoriate.

Competitiveness: NMSGC initiated an on-line statewide competition open to students enrolled in STEM. Students upload their application, transcripts, faculty recommendations, & research description through the National Space Grant Foundation on-line scholarship process. This process provides more competitiveness than our previous method of block grants. Before 2006 institutions were given block grants for scholarships. We determined a trend that students who received scholarships tended to be enrolled in the discipline of our NMSGC faculty contact. Since 2006 students from diverse disciplines across campuses, & students from additional institutions received scholarships. NMSGC campus directors facilitate the awards on their campuses. Partners provided guidance on the selection & publicity process for this program. They also work with us to increase gender & ethnicity diversity.

Recruitment of applicants: NMSGC Associate Director meets with department heads & deans to distribute information about scholarship opportunities. Scholarship flyers are posted throughout universities. Emails are sent to department heads requesting they forward scholarship notices to students enrolled in their department. Emails are sent to student STEM organizations requesting they forward scholarship information to members & announce at meetings. NMSGC funded faculty are reminded to recruit students for NMSGC scholarships.

Selection of awardees: Prior to awarding scholarships & fellowships, each application is reviewed & must have a current transcript, one page description of the project & it’s relationship to a NASA strategic enterprise, & a letter of support & commitment from a faculty member. Awards are made for one academic year. Applications are reviewed by NMSGC Director. Since inception, scholarships have been awarded to US citizens only.

Distribution of awards among the affiliates: Charts 5 & 6 show scholarship distribution. In 2003-2005, each academic institution was given block grants & distributed scholarships to students on their choice. In 2006-2007, students applied on-line through the statewide program.



Consortium Specific: SMART Goal #1: Scholarships will integrate students into NASA research priorities. Outcome: All scholarship students must submit a summary of research they will undertake with their scholarship & describe how their research related to NASA priorities. All scholarships funded by NMSGC support NASA Mission Directorates. Scholars presented

research results at the annual NMSGC Research Symposium or in a public forum on their campus. Scholarship research reports were added to the NMSGC homepage, so the general public can have access to NMSGC student research. SMART Goal #2: Scholarship recipients will be retained in their academic program through graduation. Outcome: NMSGC initiated a longitudinal tracking system to track students receiving significant awards of \$5,000 or more. 57 of students receiving significant awards are still enrolled in their programs, 7 have graduated.

Impact/Results

- 7 scholarship recipients received STEM degrees (significant awards)
- 57 scholarship recipients are still enrolled in their STEM degrees (significant awards)
- Students published 5 papers & presented their research results in 72 conferences
- NSF reports in “Higher Education in Science & Engineering” that less than 50% of those who intend to major in Science & Engineering field complete a degree within 5 years. 53% of NMSGC scholarship recipients received their degree & 44% are still enrolled (all awards).

Strengths & weaknesses of program & actions taken to improve it: The research component & involvement with faculty is a strength of this program. Undergraduate research is a retention strategy for students. Research with faculty is one reason 97% of Space Grant students are still enrolled or received their degree. Both undergraduate & graduate students work with faculty, NASA personnel, or industry partners on research that supports NASA Mission Directorates. This creates a strong tie between students & NASA. In 2007, NMSGC initiated a service component to our scholarship program. The purpose is to get students in the habit of giving back & to promote STEM recruitment, retention, & awareness. Students performed 480 hours of service in 2007 to meet their community service requirement of their scholarship.

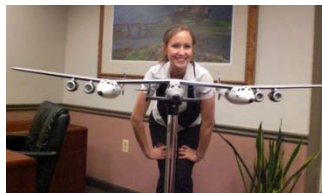
A continuing challenge for our scholarship program is to recruit female & minority students to participate in the scholarship program. We met or exceeded our population for female & minority graduate students & for minority undergraduate students. Undergraduate population is 59% female. 44% of undergraduate recipients were female. We will continue to work on recruitment of female students until we meet or exceed our goal.

External metrics that you have used to determine program success:

Degrees conferred, workforce placement, continuation of formal education: Since longitudinal tracking began in 2005, 7 students receiving significant awards have graduated:

- Jared Goldsmith- BS ME, May 2006, going to grad school at Texas A&M
- Lee Finley, Ph.D. E.E. June 2006, working at L3 Communications
- Jeff King, Ph.D, Professor at University Missouri & Rolla
- Brian Hannafious, PhD Physics, Graduated May 2008
- Kwame Porter Robinson- BS EE, Graduated May 2008
- Jennie Giron, BA Arts & Sciences, Graduated May 2008
- James Stockton, Masters of Science, Graduated August 2008

NASA EDUCATION OUTCOME 1 - RESEARCH INFRASTRUCTURE



“This program enhanced my ability to perform space related research & facilitated my connection to & participation with NASA, & the space technology & propulsion communities.” (Paul Edelmann, University of New Mexico faculty)

Picture Left: Katherine Bailey, Intern, National Space Society

Description

Purpose: The purpose of NMSGC Research Program is to develop the research capabilities & infrastructure in order to respond to evolving workforce development & emerging industry needs in the state of New Mexico.

SMART Goals & Objectives:

SMART Goal #1: Involve diverse faculty in research that supports NASA Mission Directorates. Outcome: All NMSGC research supports NASA Mission Directorates. NSF states in “Academic Institutions of Minority Faculty with S&E Doctorates” (June 2006) 19% of S&E faculty are minority. NSF states in “33 Years of Women in S&E Faculty Positions” (2008) 28% of S&E faculty are female.

17% of faculty participating in NMSGC research were minority & 13% were female. SMART Goal #2: Involve diverse students in faculty research. Outcome: NSF states in “Graduate Students & Postdocs in Science & Engineering, Fall 2006” 16% of STEM graduate students are minority & 35% are female. 51% of NMSGC graduates students were minority & 11% were female. NCES states 53% of undergraduate students are minorities. The State of New Mexico “Condition of Higher Education in New Mexico 2005” states 59% of university students are female. 22% of undergraduate students participating in NSMC research programs were minority & 46% were female.

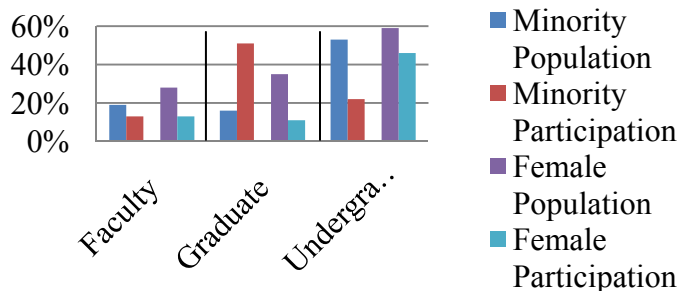
Project Characteristics: NMSGC focuses on building new research capacity in the state to respond to emerging workforce needs. NMSGC research support provides release time for faculty, graduate & undergraduate student support, & seed money. The program assists new faculty to begin their research & supports established faculty to change their research field or update their research procedures to include NASA resources such as satellite data. This investment increases faculty’s or their institution’s capability to support NASA related research. We made 11 research awards from \$15,000-\$25,000. Projects are for 1 year duration. Applications & reviewing is done on-line. Faculty are asked to describe their projects, how it relates to NASA, & their intent for follow-on funding.

Percentage of Consortium Budget: 17% of NMSGC budget supported research programs, most funding supports students to work with faculty on their research.

Assessment & Evaluation: All NMSGC research is reviewed by 2 external reviewers, usually Space Grant Directors from the National Network. We assess monthly for costing, if we don’t see costing over a quarter we contact the researcher.

Strategy for Recruitment of Female & Underrepresented Minorities: NMSGC encourages women & minorities to apply for these grants. The Advancing Leaders Program is an NSF funded program focused on retention of women in the STEM professoriate. NMSGC Director participates on the Steering Committee of this program. Participation in this program & others gives us access to minority faculty to encourage them to participate in NMSGC programs.

Chart 7
Research Diversity 2003-2007



Analysis of Core Criteria

Interdisciplinary: In 2004 NMSU created the 21st Century Space & Aerospace Research Cluster which NMSGC is an active member. The purpose of the research cluster is to encourage collaborations across disciplines in space related research. The research cluster promotes testing & evaluation of UAVs, launching of high altitude balloons that carry a wide variety of payloads, Spaceport America efforts, space weather, space environment, & solar studies. The research cluster brings \$35 million to the researchers each year.

In 2007 NMSGC reporting moved from the NMSU College of Engineering to the Vice President for Research to enable all colleges to perceive NMSGC as a university wide & statewide resource. This move gives NMSGC much more visibility on campus & throughout the state. Reporting to the Vice President for Research lets us have a broader impact throughout the state & helps NMSGC develop interdisciplinary research with faculty.

Alignment with NASA: NMSGC supported 11 research projects with \$163,445 in NMSGC funding & \$214,523 in matching funds for a total of \$377,968 in research infrastructure. All NMSGC research supports NASA Mission Directorates:

Exploration Systems Mission Directorate Projects:

- Revolutionary technology to automatically detect & repair atmospheric leaks caused by micrometeorites in future space crew exploration vehicles & habitats.
- Commandable-cutdown & flight controller for lightning research in the tropospheric & near-space environments

Science Mission Directorate Projects:

- Lightning & thunderstorm studies
- Observational constraints on galaxy evolution
- Survival & growth of desert soil microbes under conditions simulating Mars special regions
- Stringent observational tests of the latest galaxy formation models
- Dynamic & evolution of elliptical galaxies
- Integrating satellite rainfall estimates with weather radar data for NM hydrologic assessments
- Fractal measure of buoyancy-induced turbulence in reduced & increased gravity
- Using Sloan Digital Sky Survey & Apache Point Observatory to develop an observational study of spiral galaxies
- Sequestration of CO₂ by alkalines

Impact/Results

- We are fortunate to be able to fund a wide variety of research topics. Partners agree that NMSGC will only support faculty research with a strong student involvement to enable undergraduate & graduate students to become significantly involved with NASA related research. Unfortunately our program was affected by a delay in funding by NASA, delaying announcement of research opportunities. The disruption resulted in fewer faculty applying.
- 14 under-represented & 11 female faculty; 7 under-represented & 15 female undergraduate students; 18 under-represented & 4 female graduate students participated
- 10 papers were published &/or presented & reported in CMIS. 7 additional publications were published after 2007 & not reported in CMIS.
- In 2005 we instituted a statewide on-line application process which encourages faculty from diverse disciplines & faculty from diverse institutions to apply for research funding from NMSGC. Faculty from 6 disciplines & all research institutions participated in this program.
- Non-federal funding to support research programs = \$402,255

- Research proposal received = \$1,737,144

NASA EDUCATION OUTCOME 1 - HIGHER EDUCATION PROGRAMS



Melendez & Fronczek
NMSU 2006 microgravity team

This experiment was huge, unlike any other experiment that I've done in my past. We had to come up with a unique idea that could compete with the other ideas that other students send in. We weren't just challenged to develop & construct an experiment, but we were at the same time competing with others for that spot in the program. The main thing about this experiment is rising to the challenge. (Aous Manshad, Chemical Engineering, NMSU)

Description

Purpose: The purpose of the NMSGC Higher Education Programs is to increase the number of students joining the STEM workforce in order to respond to evolving workforce development & emerging industry needs in the state of New Mexico.

SMART Goals & Objectives: SMART Goal #1: Involve diverse faculty in educational programs that support NASA Mission Directorates & contribute to the development of the STEM workforce. Outcome: 775 faculty from 43 disciplines participated in NMSGC educational programs, 50% of participating faculty are female & 32% are minority. SMART Goal #2: Involve diverse students in educational programs that support NASA Mission Directorates & contribute to the development of the STEM workforce. Outcome: 4,665 undergraduate students participated in NMSGC educational programs, 46% of participating undergraduate students were female & 47% were minority. 212 graduate students participated in educational programs, 38% of participating graduate students were female & 59% were minority.

Project Characteristics: NMSGC has four focus areas in higher education to develop the STEM workforce. The four areas are:

Research Enhancement: This is meant to support young faculty who are starting their research programs or when older faculty change research areas. Annually NMSGC awarded up to \$15,000 per faculty for one year of support.

Faculty Development: Faculty are in the best position to increase students' academic achievement & retention because faculty are the single, most influential factor in student learning. However, most STEM faculty have no formal teaching training & no leadership training. NMSGC offered five faculty development programs to help STEM professors change teaching behaviors & become empowered faculty.

- GRASP created by NMSGC, includes integration of teaching strategies proven to increase student achievement & retention. NSF provided \$150,000 to disseminate this successful program to partner DACC. At NMSU we found a 5% increase in both student achievement & retention. At DACC we found an 8% increase in achievement & 4% increase in retention.
- NMSGC works with the NSF ADVANCE program to increase the number of women in tenure & tenure-track faculty positions in the STEM fields at NMSU.
- Leadership Academy was created to develop positive individual leadership among faculty & staff for the purpose of empowering & supporting the university community & beyond.
- Advancing Leaders Program supports academic institutional transformation to promote increased retention & advancement of women scientists & engineering in academe.

- SETE was an annual teaching conference created by NMSGC to provide STEM faculty a forum to discuss & exchange ideas about teaching methodologies determined by faculty to increase student learning & retention.

Curriculum Support: Faculty at all NMSGC universities are encouraged to design engineering & science courses that support NASA Mission Directorates. New courses are designed to meet changing workforce requirements to meet the needs of industry developing in the state & nation.

- In response to the development of Spaceport America, NMSGC supported the development of undergraduate Aerospace Engineering programs at NMSU & NMIM&T. 25 aerospace engineering majors are currently enrolled at NMSU & 9 are enrolled at NMIM&T. The first students will graduate in these programs in 2009.
- As part of the Aerospace Engineering Program, NMSGC supported system engineering courses offered through distance education to employees from the NASA Johnson Space Center, White Sands Test Facility. This series of courses evolved because the TDRSS workforce requested system engineering courses to help them better respond to needs that are growing as a request of NASA's ESMD focus on MEMS, ISS, & space ops.
- DACC is developing an Aerospace Associates Degree Program. This program will provide the technician workforce for New Mexico's emerging space industry. As part of this program NMSGC supported the development of computer aided drafting & design courses which focus on aerospace projects. These courses utilize rapid prototyping design technologies to enhance the concurrent engineering design process.
- NMSGC supported renewable energy technology curriculum. The primary objective was to increase the workforce skilled in applied renewable energy technologies including solar, wind, biomass, hydro, geothermal, hydrogen – fuel cell, etc.
- Human journey into space course developed by the Astronomy Department is a distance education astronomy course which highlights Spaceport America & X PRIZE CUP as well as NASA's space commercialization efforts through the COTS & Constellations programs. This course is now a permanent general elective course offered each semester at NMSU.
- Antarctic Search for Meteorites course at UNM supported students participation in weblogs & classroom activities in collaboration with an Antarctic field expedition (Antarctic meteorite searching, meteorite fall statistics, meteorite science, & Antarctic weather).
- Earth Science Course was re-designed to incorporate an earth systems science focus. The previous course was for ES majors only & did not include a laboratory. The course re-design included a earth systems focus with a global view while using NASA imagery, created a lab for the course, & offered the course as a general elective. This course is now a permanent general elective course offered each semester at NMSU.
- Image processing course was developed for junior/senior/beginning graduate level students. The course is an interdisciplinary course between Physics & Electrical Engineering. This is a unique opportunity to integrate student learning with work of the VLA (Very Large Array). This course is now a permanent course at NMIM&T.

Student Programs: These programs, offered at all academic institutions, allow students to integrate a NASA focus into their undergraduate education.

- Students from UNM, NMSU, & NMIM&T participated in the NASA Reduced Gravity Student Flight Opportunity Program.
- Students present their research results at the NMSGC Student Research Colloquium.
- Students from all academic partners participated at NASA facilities or contractors.

Percentage of Consortium Budget: Higher education is NMSGC’s largest program area. 25% (5 year average) of NMSGC budget is dedicated to support these programs.

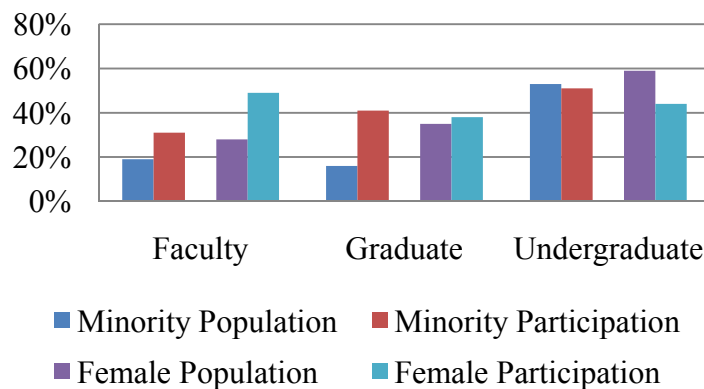
Assessment & Evaluation: Higher education programs are evaluated annually.

- GRASP program evaluation compared pre- & post-GRASP results of student grades & student retention results. At NMSU we found a 5% increase in both student achievement & retention. At DACC we found an 8% increase in student achievement & a 4% increase in student retention. 100 STEM faculty & 3,962 students participated in this program.
- After each SETE Conference, participating faculty evaluated the conference & made suggestions for improvement. “Best Paper Award” was awarded annually. 184 STEM faculty & 20 students participated in this program.
- An external evaluation team analyzes ADVANCE results. 43 faculty participated.
- Each course created by NMSGC is evaluated by students at the end of the semester.

Strategy for Participation of Women & Underrepresented Minorities:

Seven of NMSGC academic institutions are HSI. All institutions are supported to involve minorities & women in their programs. Chart 8 shows we met or exceeded our target population except for undergraduate students. 51% of undergraduate students participating in higher education programs were minority & 44% were female. Many undergraduate students participate by class, & diversity population of STEM students is not as high as the diversity of universities. We continue to work with diverse undergraduate populations because many undergraduate students change their major after coming to the university. There is still an opportunity to bring them into STEM as undergraduates. Strategies include developing relationships with female & minority faculty, working with Women’s Studies programs, Alliance for Graduate Education & the Professoriate, AMP, & working with minority student orgs such as SHPE & SWE. Each year NMSGC reviews diversity results for all programs & creates strategies to address deficiencies. Our goal is for participation in all NMSGC programs reflect the diversity of higher education STEM students in NM.

**Chart 8
Higher Education Diversity 2003-2007**



Analysis of Core Criteria

Interdisciplinary: Many of NMSGC’s Higher Education programs are interdisciplinary.

- Faculty Development: Programs support STEM faculty throughout campus. Faculty have participated from all the departments in the College of Engineering; all the science, mathematics, & technology departments in the College of Arts & Sciences and Agriculture.
- Curriculum Support: System engineering courses included Electrical Engineering, Mechanical Engineering, & Aerospace Engineering curriculum. Earth Systems Science course is interdisciplinary course offer by the College of Agriculture with includes remote sensing, biology, geology, chemistry, & physics.

- Student Programs: Interdisciplinary student teams are created to participate in student programs. Reduced Gravity Student Flight Opportunity Program teams typically are made up of students from electrical, mechanical, chemical & engineering technology, & physics.

Impact/Results:

- 75 Publications and 19 new courses
- 2 new Aerospace Engineering majors at 2 NMSGC institutions
- 11 teams & 74 students in the Reduced Gravity Student Flight Opportunity Program
- 775 faculty from 43 disciplines participated in NMSGC educational programs. 376 of participating faculty were female & 238 were minority.
- 4,665 undergraduate students participated in NMSGC educational programs. 2,029 participating undergraduate students were female & 2,341 were minority.
- 212 graduate students participated in NMSGC educational programs. 42 graduate students are female & 45 are minority, 110 are unknown.
- Non-federal funding for higher education programs = \$389,692
- Proposals funded for higher education programs = \$412,000

Strengths & Weaknesses:

- Strength: university departments pay NMSGC \$900/semester/faculty for GRASP
- Strength: NSF provided \$150,000 to disseminate GRASP to DACC
- Strength: Once new courses are developed by NMSGC, they become part of the regular academic curriculum, are offered at least once a year, & are funded by the university
- A program weakness is few students apply for NASA opportunities such as NASA Academy, ESMD, & internships. Partners agreed to email all relevant department heads at their institutions & student groups such as AISES, SHPE, etc. Department heads & are requested to forward email to students. More proactive recruiting will be done by faculty & staff.

NATIONAL PROGRAM EMPHASIS – DIVERSITY OF PARTICIPANTS

Description

Strategy: The relatively low proportion of women & minorities students & faculty in STEM careers has been the topic of numerous books, reports, & workshops. (NSF 2006, & National Academies 2007). NMSGC works multiple strategies to increase faculty & student diversity in STEM. These strategies include developing relationships with female & minority faculty, working with women's studies programs, service on programs like Advancing Leaders, Alliance for Graduate Education & the Professoriate, Alliance for Minority Participation, & actively recruiting women & under-represented groups into our programs. Each year NMSGC reviews diversity results for all programs & creates strategies to address deficiencies.

Description of your efforts to recruit these targeted groups: NMSGC created several programs targeted to increase diversity. Involvement in these programs expands the pool of faculty & staff working with NMSGC on programs. Once faculty participate in these programs, they are integrated into additional NMSGC programs. Diversity programs include:

- President's Commission on the Status of Women: NMSGC Director served as the chair of the Gender Equity Committee, directed to create gender equity policy for NMSU. The policy took 2 years to create as very few institutions of higher education have a gender equity policy. The policy was adopted by NMSU's Board of Regents in 2007. By adopting this policy, NMSU committed to a pro-active approach to promoting & improving gender equity by adjusting policies & implementing concrete actions designed to improve gender equity throughout the university community.

- ADVANCE-Institutional Transformation Program: Supports increased participation, retention, & advancement of women scientists & engineers in academe. The program is structured to increase the number of women in tenure-track faculty positions in STEM. 10 faculty from this program have participated in GRASP, 2 have received NSMGC research enhancement funding, & 1 faculty received \$660,000 in EPSCoR (CAN) funding.

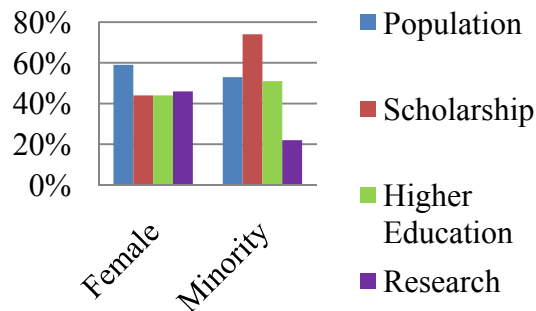
Analysis of Core Criteria

Target: Our goal is for participation in all programs to reflect the diversity of higher education STEM students & faculty in the state of NM. **Progress:** Chart 9 shows participation of undergraduate students. “Condition of Higher Education in NM 2005” states 59% of undergraduate students are female. 44% of NSMGC scholarship recipients, 44% of participants in higher education programs & 46% of research participants were female. NCES 2005 states 53% of students are minority. 74% of NSMGC scholarship recipients, 51% of higher education participants & 22% of research participants were minority.

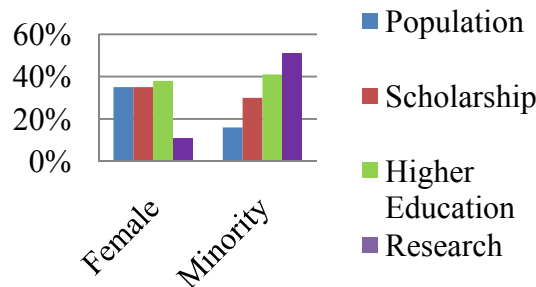
NSF states in “Graduate Students & Postdoctorates in Science & Engineering, Fall 2006” 16% of STEM graduate students are minority & 35% are female. Chart 10 shows 35% of graduate scholarship recipients, 38% of graduate students in higher education programs & 11% in research programs were female. 30% of graduate scholarship recipients, 41% of graduate students in higher education programs & 51% in research programs were minority students.

NSF states in “Academic Institutions of Minority Faculty with S&E Doctorates” (June 2006) 19% of S&E faculty are minority. NSF states in “33 Years of Women in S&E Faculty Positions” (2008) 28% of S&E faculty are female. Chart 11 shows 49% of faculty participating in higher education program & 13% in research programs are female. 31% of faculty participating in higher education programs & 17% in research programs are minority faculty.

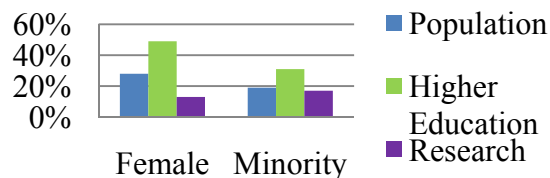
**Chart 9
UG Student Participants
Diversity 2003-2007**



**Chart 10
Graduate Student Participants
Diversity 2003-2007**

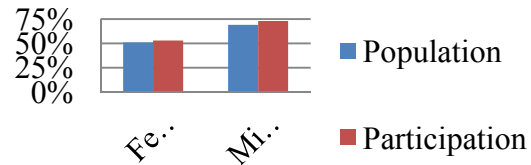


**Chart 11
Faculty Participants
Diversity 2003-2007**



NM Education Department reported in “Making Schools Work: Preparing for New Mexico’s Future” (2007) 69% of pre-college students were minority & 51% are female. Participation in NMSGC pre-college programs was 53% female & 73% minority.

**Chart 12
Pre-College Diversity
2003-2007**



Impact/Results:

- Strength: 7 NMSGC partner institutions are Hispanic Serving Institutions.
- Strength: We look at our diversity participation annually & compare to the external metrics of the NCES, NSF & State of New Mexico. We continuously work to bring increase our diversity participation. Diversity participation 2003-2007 includes:
 - Scholarship participation: 231 minorities received scholarships & 168 were female
 - Research participation:
 - 11 female faculty & 14 minority faculty, 4 female graduate students & 18 minority graduate students and 15 female undergraduate students & 7 minority undergraduate
 - Higher education programs participation:
 - 376 female faculty & 238 minority faculty, 42 female graduate students & 45 minority graduate students and 2,029 female undergraduate students & 2,341 minority undergraduate students
 - Pre-College program participation:
 - 54 female & 77 minority teachers, 636 female students & 920 minority students
- Change: We had given scholarships through minority programs on campuses (Chicano Programs, Black Programs, American Indian Programs) we discontinued this because scholarship given were small & we were unable to make a difference in these students’ education. Now we work with these programs to distribute information about our research scholarships to their students & recruit students to apply for our research scholarships.
- Change: When we initially went to our statewide on-line scholarship application process we had fewer female students apply for the scholarship. We worked with faculty & staff to distribute scholarship information to female students & recruit them for participation.

NATIONAL PROGRAM EMPHASIS – WORKFORCE DEVELOPMENT

Description: NASA's 2006 Workforce Strategy recognizes that an effective workforce strategy is critical to mission success. NASA’s contractor workforce is also vital to success since 80% of NASA’s budget pays for the purchase of contractor goods & services. NASA’s strategy is based on objectives that accomplish the President’s Vision for Space Exploration & carry out national priorities of scientific discovery & aeronautics research, while also recognizing financial responsibilities & limitations. State of New Mexico Workforce Report 2007 states occupational groups requiring the highest levels of education are expected to increase more rapidly than the overall average. Workforce growth over the next 6 years is expected to increase 35% for math & computer areas, 21% for architectural & engineering, & 18% for life, physical & social sciences.

Approach: Workforce development is woven throughout all projects’ design & development. The purpose of all NMSGC programs is to recruit, retain & thereby increase the number of students joining the STEM workforce in order to respond to the evolving workforce needs of the

emerging industry in the state of New Mexico & the Nation. NMSGC offers scholarships, internships, higher education, & research programs to develop the STEM workforce. It is our intent to offer programs that support the improvement of our national technical workforce using NASA's mission challenges. The national investment in NMSGC is an important responsibility that will ensure the availability of a technical workforce needed to strengthen NASA & the Nation's workforce. The development of a highly educated & well-prepared workforce is critical to the success of the NASA's mission & NMSGC is proud to support that effort.

Evidence of Success: Our metric to measure our success is retention in STEM disciplines through graduation so students will be eligible to enter the STEM workforce.

- NMSGC is successful in placing students in internships at NASA centers & industry. 44 students interned at: GSFC = 1, KSC = 2, MSFC = 6, NASA Academy = 8, JPL = 15, JSC = 1, JSC-WSTF = 1, Industry = 3, State (Spaceport America) = 3, Federal (Los Alamos) = 1, & non-profit organizations = 3. 25 of these students are still enrolled, 19 have graduated.
- Proceeds from the International Symposium for Personal & Commercial Spaceflight supported 8 internships, Leonard R. Sugerman Endowment supported 5 scholarships, & NMSGC Alumni supported 1 scholarship.
- Internships change students' lives. "This internship sparked my interest in the aerospace engineering field & further secured my interest in a lifelong career in mechanical engineering. I will be continuing my degree in mechanical engineering, & will seek a Master's degree as well, while also looking at possible aerospace engineering minor. I will also be seeking future internships & career opportunities at NASA, since this internship experience was a completely positive & encouraging one." (Kyle Chavez, NMIM&T)
- 406 students received scholarships from NMSGC 2003-2007. Of those we were able to track, 44% are still enrolled & 53% graduated.
- 4,529 students participated in NMSGC higher education programs 2003-2007
We are not able to determine student participation by name in all NMSGC higher education programs. However, there was a 5% increase in the number of students (3,962) retained in their STEM program when faculty participates in GRASP. 100% of the students (83) participating in the Reduced Gravity Student Flight Opportunities Programs were retained.
- We did not begin to track students through employment until we began our longitudinal tracking program in 2005. We are aware of students joining NASA's workforce: Terecita Mayorga, GSFC employee & Kendall Mauldin, MSFC employee.

NATIONAL PROGRAM EMPHASIS – LONGITUDINAL TRACKING

Description: In 2005 NMSGC began our longitudinal tracking program. We track students who receive \$5,000 or more of support from NMSGC.

Strategy: Once students are awarded a scholarship or internship we input their information into our database using Microsoft Access. All students receiving \$5,000 or more of support are tagged for longitudinal tracking. Every semester we email students asking for an update on their academic progress; confirming enrollment, expected graduation date, & potential employment. During their graduation year we contact students to determine their employment plans before graduation & continue contacting them until they are employed or in graduate school. If we lose track of a student we contact their advisor who usually knows their first employment after graduation. We have been successful tracking 100% of scholarship recipients.

Metric: We measure our success as student retention in their STEM field through graduation & entering the workforce or graduate school.

Evidence of Success: NMSGC awarded 65 students significant awards of \$5,000 or more 2005-2007. 58 students are still enrolled in their programs. 7 students have graduated: 2 graduates are attending graduate school, 1 is a faculty member at a university, 1 is working in industry, & 3 students have not accepted a position yet.

Changes:

- Starting in 2008 we will track all students who receive scholarships.
- Much of the research funding to faculty goes to support students. Students are hired & supervised by faculty. Because students did not apply directly to NMSGC as in the scholarship program we did not have names & demographic information on students participating in research programs. Beginning in 2008, when faculty receive research funding we send them forms to collect information from participating students & to get permission from students to participate in our tracking program.

NATIONAL PROGRAM EMPHASIS – MINORITY SERVING INSTITUTIONS

Description

Goals & Outcomes: SMART Goal: NMSGC membership will increase by one minority institution. Outcome: 7 affiliates are HSI, 3 are new in the last 5 years.

Strategies: NMSGC has three original partner institutions which are federally designated Hispanic Serving Institutions (HSIs). These include: New Mexico State University (37.6% Hispanic enrollment), University of New Mexico (25.7% Hispanic enrollment), & Dona Ana Community College (56.5% Hispanic enrollment). These institutions have been active members of NMSGC for more than 15 years. In an effort to increase participation of minority serving institutions in Space Grant, NMSGC Associate Director met with administrators & faculty from three HSI comprehensive institutions to encourage their participation in NMSGC programs. These institutions include Eastern New Mexico University (39.2% Hispanic enrollment), Western New Mexico University (41.1% Hispanic enrollment), & New Mexico Highlands University (60.8% Hispanic enrollment). These institutions were encouraged to have their students apply for NMSGC scholarships & have their faculty apply for NMSGC research & education funding. We worked hard to find meaningful ways to integrate these institutions. We have not approached institutions unless we have a program they are able to participate in fully.

Evidence of Success

- SIPI (Southwest Indian Polytechnic Institution) student participated in NASA Academy
- SIPI will participate in our rocket program in 2008
- ENMU (Eastern New Mexico University) students have received NMSGC scholarships
- WNMU (Western New Mexico University) students have received NMSGC scholarships & are proposing for AESP.
- NMHU (New Mexico Highlands University) is offering a workshop in remote sensing.

NASA EDUCATION OUTCOME #2 – PRE-COLLEGE PROGRAMS



“My daughter, a high school freshman, cannot get enough science & technology. Her involvement in this program helped her develop the self-esteem & motivation she needs to work hard in these areas. She has a brilliant mind & has spoke about wanting a career in science. We need more women in these fields. With this experience I believe my daughter will be one of them.” (Terisa O'Dowd, BEST)

Description

Purpose: The purpose of NMSGC Precollege Education Programs is to increase the number of students joining the STEM workforce in order to respond to evolving workforce development & emerging industry needs by preparing precollege students to enroll in STEM fields at NM universities & community colleges. All programs included teacher & student participants.

SMART Goals & Objectives: SMART Goal #1: Use NASA Mission Directorates, facilities, human resources, & programs to provide exposure to teachers to support the enhancement of knowledge & skills, & to provide access to NASA. Outcome: All NMSGC programs support NASA Mission Directorates & encourage students to follow the pipeline join the STEM workforce. SMART Goal #2: Female & minority participation in programs will reflect NM population. Outcome: Participation in precollege programs was 53% female & 73% minority.

Characteristics: NMSGC focuses on building the workforce. NMSGC makes awards for up to \$5,000 for pre-college programs. Projects are for 1 year duration. Applications & reviewing is done on-line. Faculty are asked to describe their projects, how it relates to NASA, & how it builds the workforce. Programs include:

- Secondary School Space Technology Special Session in conjunction with STAIF
- Secondary Education Space Design Competition
- Science Saturdays at San Juan College were offered in collaboration with NM Commission on Higher Education & NM State Department of Education
- Southern New Mexico Academies for Young Scientists
- X PRIZE CUP Education Day
- Student Rocket Challenge
- BEST (Boosting Engineering, Science, & Technology)

Percentage of Consortium Budget: 2% (5 year average) of NMSGC budget is dedicated to support pre-college programs.

Assessment & Evaluation: X PRIZE Education Day, BEST, & PREP are evaluated by judges. Academy for Young Scientists is assessed by external evaluators.

Strategy for Participation of Women & Underrepresented Minorities: NMSGC actively recruits female & minorities to participate in our programs. Participants in pre-college programs were 53% female & 73% minorities.

Analysis of Core Criteria - Emphasis on Teacher Preparation/Development: NMSGC gives scholarships to STEM education majors during their student teaching semester to encourage students to use NASA education materials while student teaching. We believe if student teachers become aware of NASA teaching materials they will continue to use them during their teaching career. Students from all universities have participated in this program.

Impact/Results

- 182 teachers participated in NMSGC programs
- 1,373 students participated in NMSGC programs
- Non-NMSGC funding supported NMSGC pre-college programs = \$64,971

NASA EDUCATION OUTCOME #3 - PUBLIC SERVICE PROGRAMS



Astronauts at Symposium

“I’m very caught up in the future. I believe commercial space will be about transportation. It will become a natural extension of our everyday life. The average person will get a chance to do what few people have yet to do. Maintaining the momentum is going to be of critical importance. Symposia like this engage people about commercial space & extend the message.”
(Patricia Grace Smith, Associate Administrator, FAA)

Description

Purpose: The purpose of the General Public & External Programs is to increase science & technology literacy & participation for citizens of New Mexico.

Goals & Objectives: SMART Goal #1: Provide programs that support literacy in STEM for citizens of NM. Outcome: NMSGC created the Leonard R. Sugerman Public Forum to educate NM citizens about the emerging space industry in NM. SMART Goal #2: Grow the personal & commercial spaceflight industry in NM. Outcome: NMSGC created ISPCS to bring together the community involved to grow the industry.

Project Characteristics: NMSGC provides access to NASA information & programs to the general public. NMSGC promotes STEM literacy & an awareness of NASA’s missions through our general public programs.

General Public:

- International Symposium for Personal & Commercial Spaceflight (ISPCS): The purpose of the Symposium is to bring together the community involved in all aspects of personal & commercial spaceflight to help grow the industry.
- Leonard R. Sugerman Public Forum: Held annually to help inform the public about the progress of the business of space.
- NMSGC is the founding member of NMView to promote free & public exchange among its members of data, information & knowledge concerning the Earth & its processes, as observed by remote sensing & GIS technologies, for education & research applications.
- NMSGC Homepage & Fellows Page: All projects, scholarships, administrative information is available over the internet at <http://spacegrant.nmsu.edu/>. The NMSGC fellows page lists all of our statewide scholarship students along with their resume & research results.

External Relations: NMSGC Director serves on the Executive Board for National Space Grant Directors & is the Treasurer of the National Space Grant Foundation.

Percentage of Consortium Budget: 11% of the NMSGC budget is dedicated to general public programs & 5% is dedicated to external relations.

Assessment & Evaluation: Programs are evaluated through participant surveys.

Strategy for Participation of Women & Underrepresented Minorities: NMSGC strives for participation of females & minorities. We do not collect this data for outreach programs.

Analysis of Core Criteria

Alignment with NASA Informal Education Definition: ISPCS is held at the NM Farm & Ranch Heritage Museum. NMSGC director is the Chair. Multiple Space Grant Directors attend ISPCS, which give global visibility for the Space Grant program. ISPCS also enables industry

leaders to see the importance of research universities in driving technical innovation. The Space Grant network is perfectly positioned to drive innovation across the nation & is a national asset. Speakers from NASA who participate in the symposium are highly qualified to educate & inform audience members regarding NASA's role in the emerging commercial spaceflight sector.

Impact/Results

- 1,050 people attended the International Symposium for Personal & Commercial Spaceflight
- 70 people attended the Leonard R. Sugerman Public Forum
- NMSGC disseminated information through 61,823 distributions: campus media = 35, local media = 128, state media = 8, national media = 32, international media = 2, brochures = 16,350, newsletters = 34,300, flyers = 6,240, CDs = 600, videos = 128, & programs = 4,000

Strengths & Weaknesses:

- Strength: High quality speakers at ISPCS. In 2007 there were 67 speakers including: Elon Musk (SpaceX), Clay Mowry (Arianespace), General Robert Dickman (AIAA), Unmeel Metha (NASA Ames), Jess Sponable (AFRL), Anousheh Ansari (Prodea), Lon Levin (t/Space), Olle Norberg (Spaceport Sweden), Patti Grace Smith (FAA), Alex Tai (Virgin Galactic), Valin Thorn (NASA), Michael Lopez Alegria (NASA Shuttle Commander).
- Weaknesses are address by program staff & symposium planning committee. A conference evaluation is done each day.
- External metrics include attendance, number & return of quality of sponsors, & the quality of speakers. Student attendance increases each year.
- Companies participating in ISPCS become involved in our internship programs.