

New Mexico Space Grant Consortium

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C. Executive Summary & Consortium Impact

New Mexico Space Grant Consortium (NMSGC) has had a prominent & permanent presence throughout New Mexico's (NM) educational institutions. NMSGC acts 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 and mathematics (STEM).

- NMSGC partners have been extraordinarily successful in creating a permanent presence in NM for New Mexico Space Grant. There is now a building dedicated solely to New Mexico Space Grant Consortium at New Mexico State University (NMSU), the lead institution for NMSGC. The Space Grant building is on the main campus, in the center of the Engineering College & the Agriculture & Home Economics College. We started work on this project in 2000, & the remodeling & opening of the building will be completed in 2004.
- In order to assure scholarship funding for the future, NMSGC created the New Mexico Space Grant Leonard R. Sugerman Math, Science, Engineering, Technology & Education Endowment. The Endowment's first major donation was received in June of 2003, however work on this project started in 2001 during the annual partnership meeting. This Endowment will provide permanent income to fund undergraduate & graduate scholarships for all NMSGC students in NM. All partners have agreed to participate in contributing to this endowment.
- In 1998 the partners agreed the majority of NMSGC programs would focus on higher education, & separate funds would be raised to support K-12 programs. In 1999, NMSGC created a Space Grant Foundation account. Over the past four years approximately \$30,000 has been contributed to support NMSGC's K-12 programs.
- At the request of Johnson Space Center (JSC), NMSGC led the effort to recruit teams to participate in NASA's Reduced Gravity Student Flight Opportunities (KC-135). Within one year, all university partners had applied to fly & within eighteen months all NMSGC applicants had successful flights. University of New Mexico (UNM), New Mexico Institute of Mining & Technology (NMIMT) & NMSU, the three research universities in NM, as well as one community college partner, San Juan College (SJC), & two high schools (Las Cruces High School & Mayfield High School) participated in KC-135 Student Flight Opportunities. All partners agreed to support this statewide effort & dedicate consortium funds to enable the success of the program. The KC-135 program has contributed significantly to statewide recognition of Space Grant among science, technology, engineering, mathematics (STEM) faculty, students, parents, & general public.
- In 2001, NMSU President Jay Gogue asked NMSGC to lead the university-wide effort to create the first Teaching Academy in the state of NM at a major research university. NMSGC Director, Dr. Hynes was asked by President Gogue to lead the effort because of the overwhelming response of faculty to the SETE conference & the GRASP program. Established in 1998, the SETE conference (Science, Engineering, Technology Education Conference) was created to provide a forum for faculty to present their research on teaching success in STEM. GRASP (Gaining Retention & Achievement for Students Program), also created in 1998, provides faculty professional development in teaching strategies proven to increase student retention & achievement in STEM disciplines. NMSU recognizes the broad impact Space Grant can have to significantly improve recruitment & retention of undergraduate STEM students. The President's request for Space Grant to lead the establishment of the Teaching Academy was a result of the university's significant awareness of our mission to improve STEM teaching & our effort to improve retention & achievement of all students statewide.
- Our core partner institutions have remained strong participants in NMSGC. We are proud of

the Space Grant leadership at our research universities & community colleges. All our statewide program directors have been with NMSGC for 8 years or longer. Dr. Mohamed El-Genk at the UNM has been with NMSGC since inception, John Walker of Dona Ana Branch since 1991, Dr. Dave Westphal with NMIMT since 1994. We have added important new partners since 1998 including the State Department of Economic Development, San Juan College (SJC) Las Cruces Museum Natural History, Indian Resource Development (IRD), Black Programs, Chicano Programs, American Indian Programs (AIP), & New Mexico Math, Engineering, & Science Achievement (MESA) Program.

- NMSGC met & exceeded by 6.8% all matching funds requirements for the years 1998-2001. NMSGC met all NASA reporting requirements & deadlines.
- NMSGC contributed significantly to the national Space Grant network through our implementation planning efforts. Significant contributors to these efforts are the superior staff of NMSGC. Our Director, Dr. Patricia Hynes, has been with NMSGC since inception & has served as Director since 1998. Our Associate Director, Dr. Judy McShannon has been with Space Grant since 1990, & our Fiscal Specialist, Joylynn Watkins has been with NMSGC since 1995. Our staff continuity provides the opportunity to build & sustain relationships benefitting NMSGC. Our partners & staff are critical for the success of programs in NM.
- During the past five years, over 200,000 NM citizens participated in NMSGC programs.

Participants include:

University/College Faculty	560
University/College Students	5,388
Pre-College Teachers	5,668
Pre-College Students	63,802
General Public	<u>129,050</u>
Total	204,468

The confluence of these favorable factors & achievements has positioned NMSGC programs to grow significantly in the coming years. Our partners continue to critically examine outcomes & eliminate programs which have either run their course or are considered not as worthy of our resources & time as needs within the state change. We have discovered the importance of strategic partnerships in the K-12 area & have worked to promote collaborations among STEM K-12 efforts, particularly those programs which are NASA funded & or university based. We believe enabling & supporting K-12 programs in this fashion also contributes to improved recruitment efforts at all three research universities.

In the next five years, we will continue to work with excellent partners & collaborate on growth where we believe our resources can best serve NASA & NM's citizens. We will pay attention to the small details, sustain successful relationships, & build new partnerships. The magic is not only in focusing on what is directly in front of us but also in understanding the challenge of working with students, faculty, other partners who look to have a relationship & better understanding of NASA. NMSGC was the office that was contacted when the Columbia accident occurred. While sad, it was comforting for those who were devastated to have a place to gather & mourn. We value that position & cherish it here in NM. We believe NMSGC will contribute to the success of NASA & our nation through our work in the future.

D. Introduction

Strategic Planning is the corner stone of our statewide planning & collaboration efforts. All NMSGC partners are involved in our strategic planning. Additionally, partners are involved in annual assessment of progress on strategic directions. In August of 1998, the partners & affiliates of NMSGC met & created a strategic plan to guide our activities through the year 2004. Below is a short summary of our Vision, Mission, Goals & Objectives.

In consideration of NASA's national objectives, the National Space Grant College & Fellowship Program's guiding legislation, global & market forces impacting our organization, the partners & affiliates developed & have modified the following Vision, Mission, Goals & Objectives to guide NMSGC's work over the last five years.

NMSGC Vision: By the year 2005, NMSGC will have a prominent & permanent presence throughout NM's educational institutions. NMSGC will be an agent for change, coordination, & cooperation in technical education, enhancement of research infrastructure, & promotion & inspiration of lifelong learning in STEM activities & education.

NMSGC Mission: To encourage every citizen of NM to participate in the economic, education, & scientific benefits of space; to encourage & recruit citizens of NM into aerospace-related math, science, engineering, & technology careers; & to establish commonalities among the programs of consortium partners.

NMSGC goals & objectives support its Vision & Mission.

Goal #1 - Research: Continue research with strong student involvement which supports NASA's strategic enterprises.

Goal #1 Objectives include:

- Increase student participation in faculty research
- Continue NMSGC Research Enhancement Program to encourage faculty to develop & sustain space related science & technology research
- Support the dissemination of research benefits to citizens of NM through seminars, colloquia, student presentations & publications
- Provide links to NASA data for high school research projects

Goal #2 - Education: Increase interest & learning, within the education systems, in the areas of science, engineering, technology, & mathematics, using the challenges of NASA's strategic enterprises. NMSGC will increase interest & learning by improving education & by providing professional development, kindergarten through graduate school.

Goal #2 Objectives include:

- Increase interest & learning by improving pre-college education, undergraduate education, graduate education, & by providing professional development for faculty.

Goal #3 - Public Service: Create programs that support STEM literacy for the citizens of NM.

Goal #3 Objectives include:

- Disseminate benefits of Space Grant programs to the general public
- Work with university administrators as first recipients of science literacy program
- Enhance science, engineering, technology, & mathematics programs for the general public throughout NM

Annual assessment of progress on our strategic plan is discussed throughout the document. Assessment occurs during our annual meeting & is done by partners on all funded programs.

Analyses of state's needs:

As reported in the August 15th, 2003, Chronicle of Higher Education, the growing cost of science in higher education requires a greater proportion of funding come from state appropriations, annual giving campaigns & endowment income. NM is fortunate in that education has consistently received excellent support from our legislature; however, faculty & staff salaries have been flat for 3 years which puts recruitment & retention of highly sought after research faculty at risk. In a slow economy, the universities have been able to recruit more students, & enrollment is beginning to rebound in NM. But increased enrollment is not always good news. Tuition covers approximately 20% of the cost of undergraduate education at the 3 research universities in NM. The other 80% must be covered by external funding.

In addition to the increased cost facing universities, particularly in STEM courses, the average indirect cost from the federal government continues to fall, & many government funding agencies require matching funds, as does NASA with Space Grant. Theoretical & experimental STEM researchers rely on sophisticated laboratory facilities which are expensive to build & operate. Research administration requires tracking & significant reporting, all three research universities in NM have integrated financial cost accounting. This enables programs like Space Grant to have parity in accounting & grant monitoring across the state. Yet, it is costly for our universities to provide this service to Space Grant.

Our partners have expressed continued support for Space Grant, yet their universities & stakeholders want to know the value added through the Space Grant programs. Value added comes in many forms through many avenues, & because NASA funding has remained relatively flat, we have to be creative, collaborative & aggressive to assure continued relevance of our programs. There is a unique blend of space related infrastructure in NM. White Sands Missile Range (WSMR) is the home of Launch Complex 33, the focal point for V-2 firings & developmental testing of such missiles as Nike, Viking, Corporal, Lance & Multiple Launch Rocket System. Because of that historic work, the National Park Service designated the complex a national historic landmark in October 1985. We have partnered with WSMR almost from the beginning of NMSGC. We have been given access to the Missile Range for our student launches since 1995, most of this access has been at no cost to NMSGC. The benefit for students, teachers, faculty & WSMR employees is far reaching.

One of the original space pioneers, Lowell Randall, attended an NMSGC student launch in 1999. Mr. Randall worked with Robert Goddard & eventually with Dr. Von Braun. He became interested in working with students as a result of his relationship with Space Grant, & has given a \$200,000 Charitable Gift Annuity to the NASA Science, Engineering, Mathematics & Aerospace Academy (SEMAA) at NMSU. This gift would not have been possible without Space Grant. These funds will be used to continue K-12 NASA related programs for students, & pre-service & in-service teachers. The SEMAA lab, housed in the NMSU Engineering Complex, was built by NASA's Glenn Research Center. The upgrade & expansion of the lab, as well as the staffing & funding of programs, falls to partners like Space Grant. We have been able to add value to this wonderful asset to NM students.



Students in SEMAA Lab

NMSGC has been able to blend K-12 programs with higher education & research because of the many NASA funded university based programs in NM. The Institute of Space Nuclear Power Studies (ISNPS) at UNM is an example of tremendous collaboration & flexibility. NMSGC's partnership with Dr. Mohamed El-Genk, the Director of the Institute has led to many interdisciplinary collaborations, collaborations with NASA centers, K-12 outreach programs & very successful KC-135 flights. The most interesting example of value added by Space Grant may be the course Dr. El-Genk taught for education majors in nuclear physics. He was concerned no one would take his class, but when word got out about how interesting the class

was, enrollment was no longer an issue. Dr. El-Genk eventually expanded the class for graduate students. Prior to teaching the class, he expressed his excitement in the opportunity to teach the basics & fundamentals of nuclear physics to the point where if he got education majors excited about his work, he knew he'd done something truly remarkable. In 2001, Dr. El-Genk was selected as UNM's 46th Annual Research Lecturer, the highest honor UNM bestows on faculty. The title of the lecture, which he presented on April 24th, 2001 was, "Space Exploration: A Journey into the Future". We are fortunate a scholar of this magnitude with a significant space related research program is so involved in expanding the work of our consortium.

The National Science Foundation (NSF) reports in Higher Education in Science & Engineering that less than 50% of those who intend to major in Science & Engineering fields complete a degree within five years & most of the loss is during the first two years of college. NMSGC developed the GRASP Program to address this need. GRASP is 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. NMSGC focuses on working with faculty who teach the freshman & sophomore STEM courses. There is an average increase of 7% in student retention & 4% in student achievement for students whose faculty participate in this program. This includes a 9% increase in the retention of female students & an 8% increase in the retention of minority students retention in their STEM programs. Since inception of the program in 1998, research results presented to the ASEE (American Society of Engineering Education) received "Best Paper Award" in 1999 & 2000.

In the August/September issue of Earth Observing Magazine, an article titled, The Economics of Global Earth Observation, stated an interesting statistic. "Agricultural sector benefits from weather services are about 15 to 1- farmers get about \$15 of value out of every dollar spent forecasting the weather." The lead institution for NMSGC is NMSU, a land grant university. We have been able to partner with the College of Agriculture in developing remote sensing curriculum to integrate into existing classes not only in the College of Agriculture, but also into curriculum in the College of Engineering & the College of Arts & Sciences. The purpose of this approach is to make hundreds of students in classes ranging from Soil Sciences to Criminal Justice aware of NASA data & resources & how to use these data resources to solve problems within their disciplines. The lead for developing the curriculum is the College of Agriculture, supported by Space Grant. They saw the economic benefits of using space based resources to enable better predication of snow melt run off, dust storm monitoring & more efficient hydrology modeling. They experienced the value added by integrating geo-spacial technology including remote sensing curriculum into their existing curriculum & agreed to assist us in expanding the curriculum to include civil engineering, geography, anthropology & criminal justice in our remote sensing projects. Sharing success across the university adds value to all the citizens in NM.

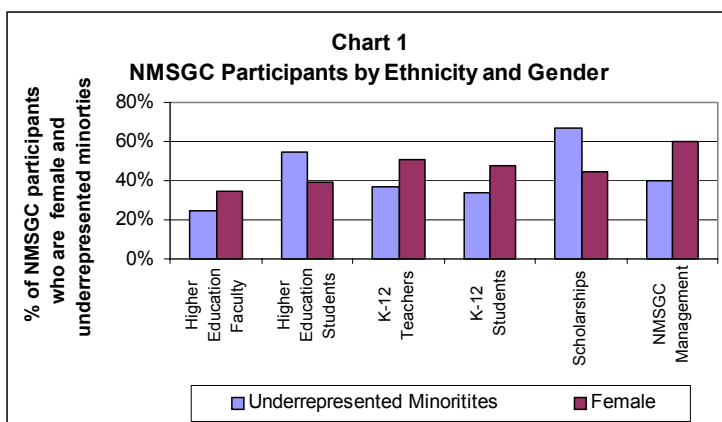
Lightning research is another area where NMSGC is providing better technology & value added to citizens of NM by collaborating with NMIMT's Langmuir Lightning Research Laboratory. Space Grant has provided funding to the lab since 1997. Undergraduate & graduate students have, in partnership with Marshall Space Flight Center (MSFC), developed a lightning detector array. The radio array enables a three dimensional model of lightning. Most lightning strikes are not visible because they are hidden in rain clouds. Better modeling of lightning, enabled by the array, has provided better prediction of intensity & direction of lightning & thunder storms. One of the lightning arrays has been installed at Kennedy Space Center (KSC), another will be installed at WSMR to enable better modeling of thunder storms at both NASA Johnson Space Center- White Sands Test Facility (JSC-WSTF) & the contiguous land on WSMR. The arrays have been spun off into a commercial enterprise & will soon be seen on golf courses, for example. That's value added for some folks, Tiger!



Triggered lightning at Langmuir Lab

E. National Program Emphases

Diversity Participants in NMSGC programs, scholarships, & management are shown in Chart 1: NMSGC Participants by Ethnicity & Gender. The U.S. Census Bureau recently released statistics confirming Hispanics are the largest minority group in the United States. We have discovered students & faculty have no desire to become the minority of preference for government funding, whether Hispanic, American Indian or Black. Students & faculty find using situational resources at any university can make a great difference not only in quality of life, but also in academic achievement. Situational resources can include ethnic & women's studies programs & centers, tutoring programs, & programs like Space Grant. However, it is necessary to make sure students use the situational resources like Space Grant. NMSGC is successful in our statewide efforts to include women & underrepresented minorities in all our programs & partner relationships.



We actively recruit women & minorities into our research & scholarship programs & have been successful in retaining them. NMSGC supports diversity in the following ways:

- All of NMSGC academic partner institutions are minority serving institutions. Academic partners are federally designated as either an Hispanic Serving Institution or a Tribal College. There are no Historically Black Colleges in NM.
- Partnerships include Chicano Programs, Black Programs, AIP, & IRD. The inclusion of these strategic partners has increased NMSGC's ability to include underrepresented minority students, staff, & faculty in NMSGC scholarships, programs & management.
- The NMSGC Director has served on the NSF ADVANCE Grant as research chair. She also serves on the NMSU Commission on the Status of Women & has served on the Women's Studies Steering Committee. NMSGC supports the ADVANCE program's efforts to increase the number of female STEM faculty recruited & retained at NMSU.
- NM's population is made up of 53% underrepresented minorities. NMSGC scholarship recipients are 67% underrepresented minorities.
- NMSGC is led by an female director who encourages the inclusion of women & underrepresented minorities in NMSGC decision making.
- Winners of the 2001 K-12 statewide design competition was a Spanish speaking high school team from Deming, NM. This was a statewide competition on spaceports, judged by university faculty & industry personnel.

Competitiveness

- All NMSGC funds are awarded competitively. Student scholarships are competitively awarded at each partner institution. Students at all institutions must submit an application for scholarship support. Selections are made based on criteria set by scholarship programs at each institution.

- Scholarship students present their research results at an annual colloquium which is attended by their research advisor & is open to the public. Scholarship students also publish their research results at national conferences & in journals.
- All faculty & staff at partner institutions are eligible to apply for funding for a research project, an education program, or an outreach program under the NMSGC Research Enhancement Program. All proposals received are sent out for external evaluation. Selection is made based on criteria published in the RFP.

NASA Ties NMSGC has strong ties with NASA Field Centers & Strategic Enterprises. The contact, ties & relationships are multiple & too numerous to list. However, the list below indicates the diversity of relationships across centers & constituencies.

Johnson Space Center-White Sands Test Facility (JSC-WSTF):

- NMSGC has a close relationship JSC-WSTF, located 20 miles from NMSU. We have placed 4 students at JSC-WSTF. Rosella Sepulveda, a chemistry major, received a permanent position at Honeywell, a contractor at WSTF.
- In March of 2002, NMSGC held a conference for the National Space Grant Aerospace Working group at JSC-WSTF.
- In November of 2001, the NMSGC Director organized a visit by NMSU President, Jay Gogue & NMSU Associate Engineering Dean, Joe Creed, to JSC-WSTF.
- NMSGC coordinates JSC-WSTF educational programs on campuses such as the annual Mars Settlement Design Competition held at NMSU, & the pre-college KC-135 program.

Johnson Space Center (JSC):

- Bonnie Dunbar & Donn Sickorez came to NMSGC requesting we coordinate the first KC-135 program in NM. We had the help of JSC-WSTF in coordinating the first statewide KC-135 program, & they arranged for technical support from JSC-WSTF engineers & JSC. Within one year, three universities, one community college, & two high school teams had participated in this program. This continues to be an outstanding program for annual participation by NMSGC students & their sponsoring faculty.

NASA Headquarters:

- NMSGC Director coordinated the briefing on the National Space Grant College & Fellowship Program with Courtney Stadd, Chief of Staff & White House Liaison.
- NMSGC coordinated the visit of Julius Dasch to New Mexico
- NMSGC coordinates NASA personnel visits to campuses such as Orlando Figueroa's work with NMSGC partner, DABCC.

Marshall Space Flight Center (MSFC):

- NMSGC coordinated a visit to MSFC with NMSU's Vice-President of Research, Director of the Physical Sciences Laboratory (PSL), & the Director of the Engineering Research Center. The purpose of the visit was to highlight NMSU research capabilities, discuss potential research collaborations on SLI, & prepare for a site visit from Garry Lyles & Steve Cook from MSFC.

Kennedy Space Center (KSC):

- NMSGC Director serves on the KSC supported ASTWG (Aerospace Technology Working Group) education & outreach committee & was instrumental in coordinating the NASA Centennial of Flight publicity to include spaceports in the future of Space Flight.

All Field Centers:

- STAIF (Space Technology & Applications International Forum), a very successful annual conference held in Albuquerque, is co-sponsored & attended by NASA Headquarters & all NASA Field Centers.
- NMSGC coordinates NASA funded K-12 activities on campuses such as SEMAA (Glenn Research Center), NASA's PREP Program (Pre-freshman Engineering Program) (Goddard Research Center), NASA's Suborbital Center of Excellence (Wallops Flight Facility), & NASA's Regional Educator Resource Center (RERC).

- NMSGC scholarship recipients have been supported on research projects at NASA fields centers & with NASA contractors. During 1998-2002 scholarship students worked on research with mentors from most field centers including JSC, JSC-WSTF, Jet Propulsion Laboratory (JPL), KSC, Dryden Flight Research Center (DFRC), Ames Research Center (ARC), MSFC, & Goddard Space Flight Center (GSFC).
- NMSGC faculty & staff collaborate on research with NASA personnel at GSFC, ARC, JSC, MSFC, JPL, & the Tracking & Data Relay Satellite System (TDRSS) at JSC-WSTF.
- In order to receive funding from NMSGC, scholarships, research, education, & public outreach programs must specify within their proposals, a relationship to one or more of NASA's strategic enterprises & how their project supports an enterprise goal.

Industry Relations

- Over sixty industry partners support the STAIF conference, serving as sponsors, or on the advisory committee, steering committee, & Technical Program Committees.
- Eight industry partners supported the KC-135 teams through their sharing of resources, equipment, facilities, & personnel expertise.
- 31 industry partners participate with NMSGC in the High Tech Taskforce.
- Over 20 industry partners participated with NMSGC's Director on the Southwest Space Taskforce (SWSTF). NMSGC's Director served on the Board of SWSTF, including 2 years as Board Treasurer.
- NMSGC has facilitated numerous student work & co-op opportunities for its scholars over the reporting period. Many of which are referred to in this document.
- Industry partners, such as The Boeing Company, DV Manufacturing, Conoco, Exxon Mobile, Intel provide financial support for NMSGC programs.

State Government Involvement

- Each year MESA, an NMSGC partner, takes students to the New Mexico State Legislature to keep legislators informed of its activities. MESA student Spaceport Competition boards (like Science Fair boards) were displayed in the Capital Round House in 2002, for all legislators & visitors to view.
- New Mexico Economic Development Department's Office of Space Commercialization is an affiliate member of NMSGC. Its Office of Space Commercialization coordinates the promotion & marketing of NM's space-related resources & businesses. Hansen Scott, the Director, addressed the Space Grant Executive Committee during their meeting in Albuquerque in 2000. NMSGC received \$10,000 in funding through the office of Space Commercialization in 2001-02 to enable closer ties across the state in space-related research & education efforts.
- New Mexico's Economic Development Department provided funding to NMSGC to develop The Center for Aerospace Science, Technology, & Education (CASTE). CASTE members include more than 60 researchers & educators.
- NMSGC is working with EBID (Elephant Butte Irrigation District) on water resource management programs. We have submitted joint proposals with EBID for funding on 2 NASA proposals & one Broad Agency Announcement.

F. Program Elements



Strategic Partnerships

“Our KC-135 flight enabled me to do my best teaching ever. It freed me to focus on discovery learning, science content, & generate new knowledge. Our flights brought a renewal of energy to my teaching that still endures two years later.”
(Dave Westpfhal, NMSGC NMIMT campus director, Physics professor; lead scientist, Magdalena Ridge Observatory; Collaborating Scientist, National Radio Astronomy Observatory & Very Large Array)

1. Consortium Management

Description

NMSGC has a participative organizational structure. Partners participate in significant decision making regarding strategic planning, determination of how funds are allocated & recruitment of new partners. The goals & objectives created by the partners are the guiding principles determining allocation of resources. Day to day management of consortium business, reporting to NASA, proposal submission on behalf of partners, all these & related activities are done by the NMSGC main office personnel at the lead institution, NMSU.

NMSGC’s decision-making & policy-making processes: The policy for the consortium has been developed through partner & affiliate collaboration & through the strategic plan. Our academic partners, NMSU, UNM, NMIMT, DABCC have been members almost since inception in 1989. We are proud of the continuity & quality of partnerships. It is the people at these institutions which make these partnerships work. The NMSGC Advisory Council is comprised of partners, affiliates & external advisors of the consortium. The general purpose of the advisory council is to promote, review, & support NMSGC activities & plans, recommend activities to the director & associate director, & provide assistance in funding NMSGC & its activities.

Approach for 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 & failures. Partners assess performance & support for goals. Self-assessment is not an easy process. Sometimes we take risks & succeed as in the KC-135 project, & sometimes realignment causes projects to end, as in the K-12 Student Launch Project (SLP). Decisions are data driven, regardless of whether the decision is to continue or discontinue a project.

Our university partners have high standards for expenditure of Space Grant resources. In 2000, at the urging of Julius Dasch, we addressed the risk of becoming programmatically stale. Can an organization re-vitalize itself without infusion of new resources? No! Partners agreed, we needed new resources, new projects & new people. This critical approach created the re-evaluation of the SLP, the support for the KC-135 project, the creation of the remote sensing program, increased support for the Langmuir Lightning Research Laboratory at NMIMT, & decreased support for NMHU (New Mexico Highlands University).

NMSGC’s SLP was a success by many measures. Thousands of students & hundreds of teachers participated over the 9 years NMSGC offered the program. Research indicates an important indicator for systemic improvement in STEM within a school is teachers eventually integrate new program materials into their workday. We assessed our teachers annually to determine how many taught enriched or adjusted curriculum as a result of participation in the SLP. In the last 3 years of the SLP, evaluations determined less than 30% of teachers taught our enriched curriculum. Teachers reported the main reason for the decline was the increased demands for alignment to standards & success in standardized testing & AP curriculum. NMSGC changed our support of K-12 program by collaborating with university based NASA funded K-12 programs, like PREP, the Mars Settlement Competition, & MESA.

Dr. El-Genk at UNM, has been an NMSGC advocate within the state, to our Congressional delegation & the scientific community. He advised NMSGC focus to create critical mass in areas related to NASA's strategic enterprises where we can make a difference. He stated, "In short, we should start by continuing successful efforts, & replace others which have not been as successful. Identify a core activity that can make a difference, yet do not conflict, but rather augment the education mission of our institutions, both 2 & 4 years." His vision has been, collaborate, cooperate, be excellent, & don't settle for less. Dr. El-Genk has been a true partner, when he agrees he puts his considerable power & influence behind NMSGC work as demonstrated in his very successful annual international conferences, his outreach & scholarship programs, teaching efforts, & the KC-135 project. When he has a problem or a suggestion for improvement, he calls or emails. Over the fifteen years, we have learned how to listen to each other & the evidence is in our long-term, productive partnership.

Collaborative participation by all consortium members in the development of the Program Performance & Results (PPR) Report: Prior to the August 2003 partnership meeting, all partners received the PPR guidelines document & our first PPR draft. During the meeting, NMSGC partners contributed information to this draft & were asked to continue to submit information as the NMSGC staff received CMIS data & refined the draft of the PPR Report. All NMSGC partners submitted information when asked during the writing of the documents, reviewed the final document & signed their concurrence.

Core Criteria: Strengths & weaknesses & any actions you took to improve them:
Strengths:

- **Consortium Operations:** The greatest strength of the consortium is its partners & their programs. The collaborative organizational culture has permeated 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.
- **Resource Management:** The partners determine resource allocation for the consortium programs. The funds available for programs are allocated based on a fundamental agreement we need to support core programs consistently at member institutions. All partners must submit annual proposals for programs which align with consortium priorities, NASA's education goals, & NASA's Strategic Enterprises to receive funding.
- During annual meetings, partners determine whether programs will be supported, new programs initiated, & where funds can be held to support new programs.
- NMSGC sets aside funds for research enhancement each year. Funds generated by NMSGC staff salary savings are added to the Research Enhancement pool. Partners & non-partners submit proposals under the Research Enhancement Program. The pool funding level averages \$65,000 annually.
- **Consortium Structure/Network:** All NMSGC partners are on equal footing. Whether a partner receives an annual award of \$5,000 or \$50,000, we believe partners must have equal footing & equal stake in the success of the consortium. This commitment to partners enables them to apply for funding annually for programs the consortium has agreed to support. In addition to these partner institutions, NMSGC allows new institutions to apply for funding each year. However, only partners are involved in setting policy & all are accountable for setting & realizing NMSGC's goals & objectives.
- **Collaborations & Partnerships Outside the Consortium:** Partners have a commitment from NMSGC, they are eligible to propose each year for funding. Partners must earn this privilege through timely costing of funds, achievement of proposed program objectives, alignment with consortium & NASA's goals, & participation in consortium activities. New institutions are brought into the work of the consortium based on needs of the members, changing objectives or new programs initiated by NASA, a university or the state. These institutions have only a one year commitment for funding. We initiated a collaboration with the State of New Mexico's Office of Economic Development (OED) in 2001 to recruit the Venture Star

program to NM. OED required numerous services from the universities to respond to the Request for Qualifications from NASA. Although the Venture Star program was cancelled by NASA, our collaboration with OED continues, but is unfunded at this time.

Weaknesses & Actions:

- **Consortium Operations:** Over the past five years, we have experienced a few significant disappointments. In particular, the loss of NMHU as a partner is unfortunate. Partners agreed we will work to re-establish an relationship with them in 2004.
- Partners agree NMSGC needs to expand its partnerships & programs to perpetuate the vitality of the consortium. NMSGC brought in several new partners over the past 5 years, & will recruit new partners in the near future. Partners have agreed we will target Eastern New Mexico University, Dine College, & UNM Valencia Branch Campus.
- **Resource Management:** NMSGC manages resources carefully, always through a proposal process, & pools resources as much as possible to enable a wide number of proposers access to NMSGC personnel & programs. Partners feel strongly some core programs must exist & be sustained within the state. The lead institution has taken the responsibility to increase the pool of funds. NMSGC staff have successfully proposed to multiple funding agencies & salary savings have gone into the Research Enhancement pool to make more funds available across the network for infrastructure improvement in STEM. In addition, partners support the creation of the Space Grant Alumni Association & Endowment to expand financial resources.
- **Consortium Structure/Network:** Stable partnerships are essential to sustaining a statewide network. NMSGC depends on our sustaining partners, UNM, NMIMT, NMSU, DABCC, SJC, to maintain a stable reliable presence in NM. It is difficult to keep museum programs & ethnic programs consistent because of high turnover in personnel. Regardless of turnover in personnel, Space Grant is committed to re-funding these programs when personnel are hired. K-12 partnerships are becoming more stable with the collaboration with NASA funded, university based K-12 programs in the state.
- **Collaborations & Partnerships Outside the Consortium:** Time does not often permit establishment of multiple relationships without direct benefit to consortium projects. We work to keep staff focused on consortium project success & limited human resources must be focused on core program success. NMSGC Director & Associate Director have multiple responsibilities & serve on many boards & committees to enable the expansion of NMSGC collaborations. These partnerships are within the Space Grant national network, with NASA partners, industry & state partners.

Consortium Operations

Office space & facilities: NMSGC main offices are located in Wells Hall, Bays #4 & #1, on the campus of NMSU & are solely dedicated to Space Grant projects & staff. NMSGC has drive up parking for visitors & program participants. The facilities include 6 offices for program & student staff, a small & large conference rooms, a study room with computers for scholarship students, & rooms for project work & storage. NMSGC has raised \$200,000 to remodel a building & move its' offices to a more central location on campus, between the Colleges of Engineering & Agriculture. The building will be renamed the Space Grant building. The move will provide better faculty & student access to NMSGC staff & facilities. NMSGC should move into the facility in 2004. The new building will have equivalent space to our current facility. The Space Grant building will have instructional & lab space, thus increasing interactions with students & faculty. NMSGC has a dedicated phone line with voice mail at the program office. This line is answered as "New Mexico Space Grant Consortium." Our mail code is SG, website is <http://spacegrant.nmsu.edu>.

Staffing levels at the lead institution & support provided to others: NMSGC has a full time director, associate director, & fiscal reporting specialist. Each NMSGC partner institution has a program director responsible for the NMSGC program at their institution. Staff must work only on NMSGC projects for the time supported by NMSGC. In addition to main office personnel, a

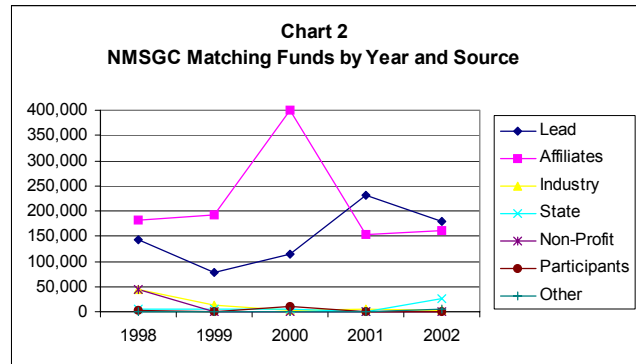
UNM staff member is supported at .09 FTE level by NMSGC.

Composition, role/purpose, & meeting frequency of Advisory Board: NMSGC has one Advisory Board which meets twice a year. The board is made up of individuals from the partner institutions, industry, & government. The general purpose of the Advisory Board summer meeting is to promote, review, & support NMSGC activities & plans. A mid-year meeting is also held in Albuquerque during the STAIF conference, in February.

Resource Management

Matching Funds/Leverage:

Chart 2: NMSGC Matching Funds by Year and Source indicates an upward trend in matching funds from both the lead & affiliate institutions. Matching funds of under \$50K are also received annually from industry, state agencies, & non-profit organizations. NMSGC's required non-federal match for this reporting period is \$375,000 per year, \$1,875,000 for this five year period. NMSGC reported match in CMIS & certified at NMSU, \$2,001,221, 6.8% over the required match.



Allocation of funds among affiliates: Funds are allocated to partners & affiliates through annual subcontracts. NMSGC policy provides a commitment to partners to compete annually for support from our prime award for core programs including scholarship programs which will begin their 15th year across the state. Partners, affiliates, & non-partners may also apply for funding under the Research Enhancement pool to support faculty research programs. Partners may also choose to be included in the Work Force Development programs which include participation in the KC-135 programs, NASA Academies, work at NASA Field Centers during the summer, development of curriculum such as in our remote sensing curriculum program. Partner funds are distributed through subcontracts with negotiated Statements of Work.

In addition to partner institutions, new institutions may apply for one year of funding for their programs. These 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.

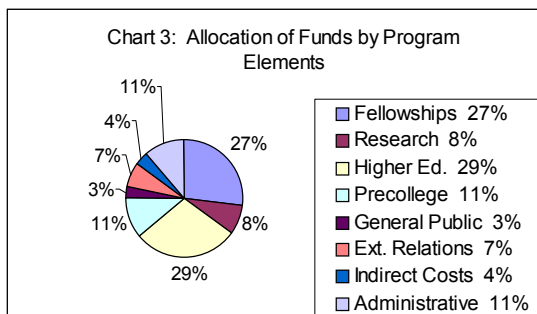
NMSU, UNM, NMIMT receive almost equal amounts of scholarship funds. In order to assure diversity in scholarship recipients, funds are also allocated to ethnic programs. Although partners are not allowed to charge overhead on any NMSGC funds, they strongly support NMSGC. Partners agree scholarships provide additional benefits of maintaining the NMSGC presence in the state, & are necessary to continue university support.

Note: It is advantageous for some affiliates if the lead institution, NMSU, carries the administrative burden for small programs, including K-12 schools. NMSGC administers some K-12 funds at NMSU as a service to our small affiliates. This service may appear to skew the allocation of funds toward the lead institution but the smaller affiliates appreciate this value added service from NMSGC which enables easier distribution of funds to small programs.

Management expenses/administrative costs: Partners agree to allocate the maximum amount of funding to support NMSGC statewide programs, students & faculty. Based on a 5 year average, 11% of Space Grant funds are used for administrative expenses. Our management strategy & strength is to provide service to our partners. To keep administrative expenses low, we use student help & collaborate on projects so we do not assume all the administrative burden on all projects. The weakness of this approach is the NMSGC staff perform multiple tasks on many projects & can get overloaded. It is necessary for staff to consistently coordinate & communication to enable a cohesive team.

Allocation of funds across program elements: Research indicates student retention is critical in the first two years of higher education. Research also suggests involving students in research as undergraduates improves understanding of complex concepts in STEM, improves relationships with faculty, & potentially closes the gap between theory & application. Therefore, partners determined higher education would be the focus for NMSGC, Chart 3: Allocation of Funds by Program Elements, shows the largest program element is 29% for higher education programs.

Eight percent of program funds are used to support research & most of the funds go to involve students in faculty research. Student involvement in the research experience is the value added through NMSGC & essential for student retention & achievement. Therefore, inclusion of students in all NMSGC supported faculty research became a priority for funding across the state.



Eleven percent of NMSGC funds support pre-college programs. The NMSGC policy is to fund strategic partnerships with K-12 programs including university based NASA funded programs, state & local collaborations. The SEMAA lab, RERC, PREP, Mars Settlement Design, Linking Leaders, Promoting Engineering, Technology Education in Science (PETES) are programs supported by NMSGC partners across the state. NASA K-12 programs receive benefit from NMSGC involvement, & vice versa. NMSGC increases the level of complexity & NASA relationship for these programs. The dollar value of these partnerships is not reported in CMIS. These programs have funding that support NMSGC programs but can not be designated as NMSGC matching funds.

Partners determined NMSGC would work to increase scientific literacy in the state & allocate funds to public outreach programs in museums, public & private schools. While only 3% of NMSGC funds directly support general public programs we are able to reach large numbers of the general public because of our strategic partnerships.

Consortium Structure/Network (Internal)

Affiliates: Our partners & affiliates are located across the state of NM. The state is geographically large, culturally & economically diverse. NMSGC has five academic partners, NMSU (lead), NMIMT, UNM, DABCC, SJC; three federal facilities affiliates, WSMR, JSC-WSTF, the Atmospheric Research Laboratory (ARL); two state affiliates, the OED & MESA; & one museum partner- the Las Cruces Museum of Natural History. These partners enable us to have relationships with literally hundreds of K-12 schools, NASA contractors, & various state & municipal programs.

The mix of research partners in higher education is highly effective for the consortium. The three research universities in the state have been partners with essentially the same campus directors since inception. We engaged world class researchers early in their careers & we have grown together as an organization. While each university has a unique research area, all share a common interest in supporting NASA’s Strategic Enterprises. Many faculty know each other, & are able to collaborate across universities by project or discipline. Space Grant students across the state have met many times over the years, presented to each other, & shared their experiences, particularly NASA field center experiences. As discussed above, partners agree we will bring in Eastern New Mexico University, Dine College in Shiprock, & UNM branch campus at Valencia. Partners know which of the community colleges fit well with our work, have value to add, & may assist in providing bridge programs for community colleges to enable students to move to the 4 year universities. Our partners created NMSGC & are the reason we are an effective higher education program in NM.

Relationships with JSC-WSTF have grown significantly. Our partners in northern NM now

have a much stronger relationship with JSC-WSTF which is in southern NM. Our NMIMT & UNM partners facilitate meetings or collaborations with Los Alamos & Sandia for our faculty at NMSU. Los Alamos & Sandia were partners in Linking Leaders, & have supported our students during the summer, & KC-135. Our affiliates in the OED in Santa Fe, facilitated meetings with Holloman Air Force Base, & Kirtland Air Force Base.

Our K-12 partnerships are long standing, & many of our original K-12 collaborators are now in upper administration in school districts across the state. Our partnership with MESA has been invaluable in maintaining support for our K-12 partner programs & relationships. MESA advisors are in the schools every day, we need that presence in the schools to enable consistent & predictable STEM programs of high quality.

Campus/organization representatives: Each partner is responsible for communication of Space Grant at their institution. NMSU has a strong Space Grant presence on partner campuses & superior support from Administrators. Through the GRASP program NMSGC has daily contact with faculty in their classrooms. UNM's Dr. El-Genk's research institute is a premier program. His Research Advisory Board (RAB) meets twice a year to select Space Grant scholars. The RAB board is comprised of faculty & industry partners who travel across the state & promote NMSGC projects & students tirelessly. NMIMT is a small technical university. Students & faculty are close, & there is rarely a student from NMIMT that is not familiar with Space Grant, & Drs. Westpfahl & Winn. We could not ask for better exposure for programs, courses, & facilities available for Space Grant students.

Diversity: As stated on page 8, NMSU, UNM, NMIMT & DABCC are Hispanic serving institutions. SJC is a tribal serving institution. All are full partners & participate in strategic decision making of NMSGC. The NMSGC Director, Associate Director & fiscal specialist, & SJC Director are all female. NMSGC Education Administrator who has recently retired, is female & Hispanic. NMSGC management is 60% female & 40% underrepresented minorities.

Communication: All NMSGC partners communicate between & among themselves regularly. We meet annually, collaborate consistently & share project information & communication at least monthly. Partners agreed to start a Space Grant Alumni Association in 2003 & we will begin to publish an alumni newsletter in 2004. The website is updated regularly with student presentations & announcements of opportunity. The Director informs partners immediately regarding changes effecting their status, deadlines for proposals, allocation of funding, additions or changes to subcontracts. Because of the tremendous amount of work we share on student colloquia, the SETE conference, KC-135 projects, research collaborations, & just day-to-day reporting on fiscal management, we communicate no less than monthly. The NMSGC website is a communication tools which underwent a complete re-design to enable better search capability & easier navigation for students & faculty across the state.

Policy for adding & dropping affiliates/consortium members: Recruiting & dropping affiliates is done by the Director, under the direction of the Advisory Board. The strategy to recruit an affiliate includes individual meetings with researchers or potential affiliates, in areas of interest to the consortium. 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, including WSMR, JSC-WSTF, Physical Science Laboratory (PSL), Los Alamos National Lab, Particle Astrophysics Lab, OED, ARL, SWSTF & High Tech Consortium.

If it is necessary to temporarily 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.

Coordination between & cooperation amongst affiliates: Coordination & cooperation among partners is constant & a valued part of our organization. We help each other succeed. We share student project information during our annual meeting, visit each other's research facilities &

when possible, support each other's projects. All partners participate in consortium planning through the annual partner meetings & telephone/email communications. All academic partners participate in the workforce development program.

Meetings: NMSGC partners meet twice a year. The annual two-day partnership meeting is used for program evaluation & strategic planning. Each year partners discuss what they have done for Space Grant, where they want to go in the future, & action plans to keep NMSGC moving forward. NMSGC partners also meet as part of the STAIF conference in Albuquerque each year.

Collaborations & Partnerships Outside the Consortium

Collaborations & Partnerships - NMSGC collaborated with NASA Headquarters, most of the Field Centers, & all 52 Space Grant Consortia during the 2 year process of creating the Space Grant Implementation Plan. To avoid redundancy, we ask the reader to refer to page 10 of this document under "Industry Relation" & "State Government Involvement" to see the list of most of our industry & state collaborations. At the request of NASA, NMSGC participated in the Linking Leaders program, the Courtney Stadd briefing, the KC-135 program, & other projects listed throughout this document. NMSGC has received funding from the NSF for research on faculty teaching. We have received funding & have collaborated with Departments of Energy & Defense on remote sensing. Cities across the state have participated in the SLP & provided transportation to launch sites, police & fire protection.

Impact/Results

- Retention of founding academic partners & the addition of new partners has led to a stable & diverse organization. Funding from NSF, the OED, & endowment sources has enabled the expansion & perpetuation of benefits to constituents within the state. All funds are costed in a timely fashion, all NASA reporting deadlines have been met, matching funds requirements have been exceeded.
- NASA funded, university based K-12 programs, PREP, RERC, SEMAA, PACE, have agreed to collaborate, share common calendars, recruit & retain students & teachers to enable a pipeline of programs from middle/high school, community college/4 year university.
- Student diversity across the consortium has improved by inclusion of ethnic & women's studies programs in the state. 53% of the population of NM is underrepresented minorities, NMSGC awarded 67% of its scholarship funds to underrepresented minority students.
- All funds have been raised for remodeling of the Space Grant building on the campus of NMSU. An endowment for Space Grant scholars has been established.
- NASA field centers are more aware of & use NMSGC more effectively as evidenced in the KC-135 project, Linking Leaders, NASA Academies, USRP programs.

2. Fellowship/Scholarship Program



Omar Mireles & KC-135 experiment

“Working for NASA is not just an aspiration of mine, it is a life-long dream, a passion. As an undergraduate I made every effort to ensure that my work, research, & extracurricular activities related to space science or technology. New Mexico Space Grant Consortium helped me accomplish that goal.” (Omar Mireles, NMSGC scholar, KC-135 team leader, NASA Academy Researcher of the Year 2002, current graduate student at Georgia Institute of Technology)

Description: Describe your Fellowship/Scholarship Program including:

Purpose: The purpose of NMSGC's scholarship program is to recruit, retain & thereby increase the number of students joining the STEM workforce. This purpose directly aligns with the National Space Grant Program Objectives. The value added through the NMSGC scholarship program is our significant ties with NASA & space related research potential. Therefore, our

alignment with NASA's education goals is essential for continued ability to succeed in our scholarship program. Inspiring the next generation of explorer's as only NASA can is evident through all levels of our scholarship program.

Goals & Objectives: All NMSGC scholarship programs support NASA's education goals:

- NASA Education Goal: Support the NASA mission, facilities, human resources, & programs to provide information, experiences, & research opportunities for students at all levels to support the enhancement of knowledge & skills in the areas of science, mathematics, technology, engineering, & geography.
- National Space Grant Program Objective: Recruit & train U.S. citizens, especially women, underrepresented minorities, & persons with disabilities for careers in aerospace science & technology.
- NMSGC Goals: 1) Increase interest & learning, within the education systems, in the areas of science, engineering, technology, & mathematics, using the challenges of NASA's strategic enterprises. 2) Continue research with strong student involvement which supports NASA's strategic enterprises.

Program characteristics: In 1998, NMSGC partners agreed to focus on recruitment of diverse populations. Faculty also agreed to support student research as a comprehensive approach to retain students. NMSGC scholarships offer students opportunities to work on NASA related research with faculty, industry, or at NASA field centers. University faculty & industry partners act as advisors & mentors to students. All NMSGC academic partners can apply for scholarship funds. There are four types of scholarship programs supported by NMSGC; graduate, undergraduate, education, & ethnic program scholarships.

- Graduate Scholarships: Academic institutions with graduate programs offer scholarships to graduate students. Students must be working on research that supports NASA Strategic Enterprises with a faculty, industry, or NASA advisor.
- Undergraduate Scholarships: All academic institutions offer scholarships to undergraduate students. Students must be working on research that supports NASA Strategic Enterprises with a faculty, industry, or NASA advisor.
- Education Scholarships: Offered during the student teaching semester to students who will become STEM teachers. Recipients create a lesson plan using NASA materials & present this lesson during their student teaching experience.
- Ethnic Programs: Scholarships are offered through Black, & Chicano Programs, AIP, & IRD to their STEM students.

Percentage of consortium budget: 27% (5 yr. average) of the NMSGC budget is dedicated to support scholarships.

Assessment & evaluation: Prior to award, each application is evaluated based on a current transcript, one page project description & it's relationship to a NASA strategic enterprise, 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. Through the Research Enhancement Program, students are funded to present at national conferences.

Core Criteria: Demonstrate how your program:

Met diversity objectives: Chart 4: NMSGC Scholarships Diversity lists the percentage of underrepresented minorities & women in NM per the U.S. Census, NM's colleges & universities enrollment statistics per the New Mexico Commission on Higher Education, & NMSGC scholarship recipients. In 1998, NMSGC partners agreed to a proactive approach to diversity & recommended NMSGC offer scholarships through campus ethnic programs. These programs recruit STEM students & offer them direct student support through NMSGC.

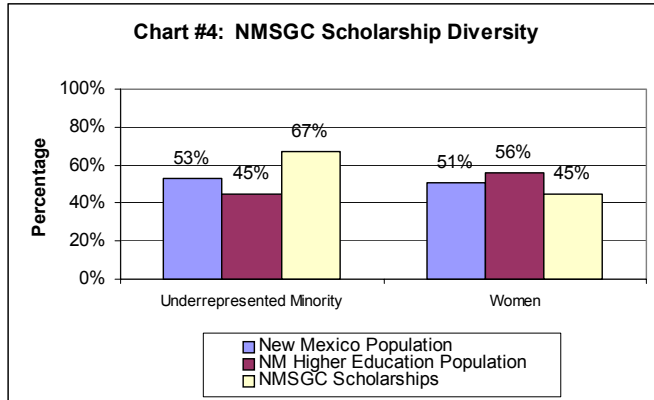


Chart #4: NMSGC Scholarship Diversity: Percentage of underrepresented minorities & women in:

New Mexico's population from the U.S. Census Bureau (<http://quickfacts.census.gov/qfd/states/35000.html>)

New Mexico higher education population from the New Mexico Commission on Higher Education (<http://www.nmche.org/reports/RPTCVRboth2001.pdf>)

New Mexico Space Grant Consortium scholarship recipients from CMIS Table IV-A. Fellowships & Scholarships Report 1998-2002.

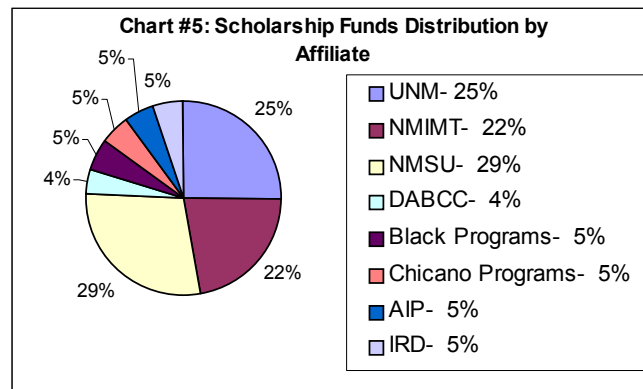
Competitively awarded fellowships & scholarships:

Recruitment of applicants: Scholarship flyers are posted throughout the 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 (such as SHPE, AISES, MAES, etc.) requesting they forward scholarship information to members & announce at meetings. Presentations by NMSGC staff are made at Department Head meetings & in STEM courses. 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. Award amounts differ at each university. NMSU, NMIMT & UNM all require annual student presentations of research results & progress.

Distribution of awards among the affiliates: Chart 5: Scholarship Funds Distribution by Affiliate differs from CMIS Table IV-B because CMIS

the table contains Space Grant funds & matching funds & Chart 5 contains NMSGC funds only. Each academic institution is eligible to apply for scholarship funding depending on the size of the institution. DABCC receives \$5,000 each year. Ethnic Programs (Chicano Programs, AIP, IRD, & Black Programs) receive \$6,000 each. UNM receives \$30,000, NMIMT receives \$26,000, & NMSU receives \$34,000. In addition, students from all academic institutions are eligible to apply for the Workforce Development Scholarships.



Research & mentoring components for undergraduate students: NMSGC scholarship recipients work with a faculty member/mentor on research. NMSGC campus directors at each university also work to help connect students with NASA field centers or NASA researchers, & when possible help students see a relationships between their work & NASA research.

Supported both graduate & undergraduate students: NMSGC partner institutions offer scholarships to both undergraduate & graduate students. The five year average for scholarship awards to undergraduates is 84%, & 16% to graduate students.

Research & mentoring components with NASA field centers & industry: University faculty & industry partners act as advisors & mentors for scholarship recipients & their research. NMSGC scholarship recipients do research at NASA fields centers & industry. During 1998-

2002 scholarship students worked on research with mentors from NASA Field Centers including JSC, JSC-WSTF, JPL, ARC, MSFC, & GSFC. Students also worked at The Boeing Company, Ford Motor Company, Altech, & Los Alamos National Laboratory.

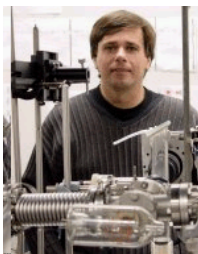
Impact/Results: Evidence of impact of Fellowship/Scholarship Program within NM:

- 191 scholarship students received STEM degrees
- 118 scholarship students are still enrolled in their STEM programs
- 73 publications
- 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 five years. 93% of NMSGC scholarship recipients received degrees or are still enrolled.

Strengths & weaknesses of program & actions taken to improve it:

Strengths: The strength of the scholarship program is the research component & involvement with faculty. Undergraduate research is a retention strategy for students. Students are at greatest risk for dropping or switching out of STEM academic careers as freshmen & sophomores. All NMSGC students are required to work with their campus Space Grant Director during their first two years as undergraduates to ensure their success. This is one reason 93% of Space Grant students receive degrees. Undergraduate & graduate students work with faculty, NASA personnel, or industry partners on research that supports NASA’s strategic enterprises. This creates a strong tie between students & NASA.

Weaknesses & Actions: During the 1998 partnership meeting it was determined it was difficult to recruit students from underrepresented minorities for NMSGC scholarships. Many excellent students were already fully funded & were not eligible for additional financial aide. Therefore, NMSGC created relationships with the ethnic programs on campus (Chicano Programs, Black Programs, AIP, & IRD). These programs have close relationships with their students & are able to find many excellent STEM students in need of additional funding. NMSGC designates scholarship funding for these programs each year to recruit & award scholarships to students who are underrepresented minorities.



3. Research Infrastructure Program

“The experience acquired during the work with NMSGC helped me to start a new research program. The major direction of my new research is laser propulsion. Our newly built lab has four research lasers & a lot of supporting equipment, a net worth of \$250,000. The lab facilities also include a unique 60 ft high vertical shaft, where we are planning to launch our lightcrafts. All these exciting new developments would be hardly possible without initial research help from NMSGC.” (Andrew Pakhomov, Physics Professor, NMHU)

Description: Describe your Research Infrastructure Program:

Purpose: The purpose of NMSGC Research Enhancement Program, is to develop the research capability & infrastructure of NM’s universities in the areas related to space science, engineering, & technology. Partners, affiliates, & non-partners may apply for funding under the Research Enhancement Program. This mechanism was created for all faculty across the state to support the development of research infrastructure & enable faculty research, travel for students & faculty, & outreach programs.

Goals & Objectives:

- NASA Education Goals: To involve the education community, particularly higher education in NASA programs that contribute to the development of new knowledge in support of the NASA mission, & to utilize the talent & resources of the higher education community.
- National Space Grant Program Objectives: 1) Encourage interdisciplinary training, research, & public service programs related to aerospace. 2) Recruit & train U.S. citizens, especially women, underrepresented minorities, & persons with disabilities, for careers in aerospace science & technology.
- NMSGC Goal: Continue research with strong student involvement which supports NASA's

strategic enterprises.

Program characteristics: NMSGC provides access to NASA information, facilities, human resources, & programs to faculty & students to develop new knowledge in support of NASA's mission. NMSGC funds only faculty who do research with significant student involvement. All NMSGC research must support NASA's Strategic Enterprises. The following is a summary of research programs support by NMSGC & their **alignment with NASA's Strategic Enterprises.**

Aerospace Technology Enterprise:

- Broadening NM Space Communication Horizons: addressed the challenge of how to transmit satellite data to personnel on the ground as machines become more powerful at collecting data & as spectrum available is continually restricted.
- Experimental Investigation of Life Performance of Segmented Thermoelectric (STE) for Use with Radioisotope: conducted performance life tests & vacuum tests of the STE.
- Inflatable Membrane Telescope: provided rational design methods for high precision membrane structures to offer improved resolution & lower cost to orbit.
- Self Consuming Spacecraft: investigated the structural material behavior of Teflon reinforced with Kevlar whiskers.
- Study of the structure, kinetics & electronic properties of epitaxial silicon-based systems on an atomic scale provided new insight into the heteroepitaxial nanostructures on a fundamental level, which is critical for the development & application of nanoscale devices using the well-established silicon processing technologies.

Biological & Physical Research Enterprise:

- Xenopus Vestibular Research: studied the structure & function of the developing Xenopus inner ear as a model system for vestibular research to test hypotheses about the effects of altered gravity on the development of the vestibular system.

Earth Science Enterprise:

- Students designed, constructed, calibrated, & deployed instruments for use on balloons, rockets, or the ground, to study thunderstorms & lightning. Students worked on NMIMT's lightning mapping array, solar panel research, NASA's lightning imaging sensor, field mill design, & made real-time electric field data available using a web browser.
- Satellite imagery was used to evaluate the rate of land development in the El Paso, Texas/Juarez, Mexico area.

Space Science Enterprise:

- Ultrafast Dynamic Study of Pre Self Regulated Regimes in Laser Induced Breakdowns for Space Surveillance: is the study of dynamic effects occurring during the breakdown discharge formed by incident laser pulses on the surface of a solid target that simulates the surface of a planetary body.
- Catastrophic Disruption Process: investigated the characterization of the collisional process for non-spherical asteroid-body analogs under various impact conditions creating a better model to interpret asteroid collisional dynamics, ring particle interactions, regolith formation, & formation process of asteroidal satellites.
- Primary & Secondary Stars in Interacting Binaries: developed an understanding the various components of a number of different types of cataclysmic variable.
- Using the Sloan Digital Sky Survey & the Apache Point Observatory faculty studied spiral galaxies to understand their structural parameters & origin.

Education Enterprise: All research must have a strong student component. Faculty must work with graduate or undergraduate students in order to receive research funding from NMSGC.

- An Archaeological Survey of the First U.S. Lunar Landing Site nominated the Apollo 11 Lunar Site (Tranquility Base) as a National Historic Landmark under 36 CFR Part 65 of the National Historic Preservation Act of 1966.

Percentage of consortium budget: 8% (5 yr. average) of the NMSGC budget is dedicated to support research.

Assessment & evaluation: NMSGC obligates approximately \$65,000 annually in the Research Enhancement pool. Faculty at NMSGC institutions submit proposals based on a Request for Proposal (RFP). All proposals are reviewed by external reviewers.

Supports Space Grant Research Priorities in the 1996-2000 Space Grant Strategic Plan:

- Opportunities for not-yet-established faculty: Research Enhancement funds support young faculty, or faculty developing a new research field. All must indicate how their project aligns with at least one NASA strategic enterprise. Three professors, four associate professors, & six assistant professors served as principle investigators in NMSGC Research Enhancement program from 1998-2002.
- Coordination with other NASA programs: NMSGC faculty conducted research with NASA's Sloan Digital Sky Survey, Langmuir Laboratories, the Very Large Array (VLA), GSFC, ARC for Gravitational Biology, JSC, MSFC, JPL, the Tracking & Data Relay Satellite System (TDRSS) at JSC-WSTF, & the NASA Archives.
- Enhanced collaborations for faculty partnerships with NASA personnel: NMSGC collaborated with NASA personnel at GSFC, ARC for Gravitational Biology, JSC, MSFC, JPL, & the Tracking & Data Relay Satellite System (TDRSS) at JSC-WSTF.
- Topical consortia: NMSGC faculty have developed topical consortia in nanotechnology, remote sensing, & environmental students (with emphasis on dust studies).

Strategy for recruitment &/or participation of women, underrepresented minorities, & persons with disabilities: NMSGC encourages women & minorities to apply for these grants. NMSGC requires student involvement for faculty funding. Participants in NMSGC research programs during 1998-2002 included 20 faculty who were underrepresented minority, 10 female faculty, 7 underrepresented minority students, & 10 female students.

Core Criteria: NMSGC research often requires the collaboration of two or more disciplines. 1998-2002 NMSGC research programs involved collaboration in the following disciplines: Neuroscience & Molecular/Cell Biology; Astrophysics, Atmospheric Physics, & Electrical Engineering; Archeology & History; Aeronautical Engineering & Bioengineering; Electrical Engineering & Computer Science. Every proposal has an education component, whether it involves integration into curriculum, development of K-12 lesson plan, outreach, all proposal are tied into teaching.

Impact & Results: Evidence of impact within NM:

- Space communication research has lead to improvement in the nonlinear translations to higher performance data communications systems for NASA's TDRSS system located here in southern NM. As an added benefit, the research results will find "dual use" implementations in the computer industries magnetic recording area.
- Dr. Elba Serrano received a \$12,000 Research Enhancement award early in her career. She then competed & won a NASA Administrator's Fellowship Award in 1998. She specifically thanked Space Grant in her press release.
- 23 papers were published &/or presented.
- Follow-up funding for research initially supported by NMSGC totaled more than \$600,000 (not reported in CMIS due to follow-up funding received after report is complete).
- Five faculty receiving NMSGC research support transferred their research to the Magdalena Ridge Observatory, the U.S. Department of Energy, the University of Alabama at Huntsville, & the Lulea University of Technology.
- 10 undergraduate students & 23 graduate students were given an opportunity to work on NASA related research with their faculty.
- Research collaborations are more diverse across disciplines. Remote Sensing collaborations have spanned disciplines, colleges & universities. We have faculty at NMIMT & NMSU, working with the ARL, EBID, & the state to improve water resource management.
- The Research Enhancement Program received 27 requests totaling \$414,369. We funded 13 for a total of \$187,156. We have uncovered a large unmet need to support small faculty startup for NASA related research in the state.

Strengths & weaknesses & actions you have taken to improve it:

- **Strengths:** NMSGC is able to fund a wide variety of research topics & support all of NASA's Strategic Enterprises. All partners agreed that NMSGC will only support faculty research with a strong student involvement. Therefore, many undergraduate & graduate students become significantly involved with NASA related faculty research.
- **Weaknesses & Actions:** NMSGC previously sent proposals for review to only one reviewer. Feedback suggested use of an external review panel with representatives from government agencies, national laboratories, industry, & other Space Grant programs.
- **Contribution to the development & maintenance of the research capability of organization(s) within NMSGC:** 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 the faculty's or their institution's capability to support NASA research.

4. Higher Education Program



GRASP Faculty & Students

"I was skeptical about the radical changes proposed on my recalcitrant teaching methods. After all, I figured they had already produced good results. I went ahead & made the changes suggested by Dr. McShannon & used GRASP methods & to my great surprise the learning experience was more motivating to the students while making my teaching experience far more enjoyable. Both passing rate & final grades improved considerably. The students made very positive remarks in the course evaluations, confirming my belief the course was more enjoyable & conducive to learning. GRASP is the most beneficial teaching program I have participated in." (Fernando Cadena, Civil Engineering Professor)

Description: Describe your Higher Education Program:

Purpose: The purpose of NMSGC Higher Education Programs is to increase the number of students joining the STEM workforce by retaining students currently enrolled in STEM fields at NM universities & community colleges.

Goals & objectives: All NMSGC higher education programs support:

- **NASA Education Goals:** 1) Faculty Development: To use the NASA mission, facilities, human resources, & programs to provide exposure to teachers & faculty, to support the enhancement of knowledge & skills, & to provide access to NASA information in science, mathematics, technology, engineering, & geography. 2) Curriculum Support: To develop, utilize, & disseminate science, mathematics, technology, engineering, & geography instructional materials based on NASA's unique mission & results, & to support the development of higher education curricula. 3) Student Support: To use the NASA mission, facilities, human resources, & programs to provide information, experiences, & research opportunities for students at all levels to support the enhancement of knowledge & skills in the areas of science, mathematics, technology, engineering, & geography.
- **National Space Grant Program Objectives:** 1) To recruit & train U.S. citizens, especially women, under-represented minorities, & persons with disabilities, for careers in aerospace science & technology. 2) To encourage interdisciplinary training, research, & public service programs related to aerospace.
- **NMSGC Goal:** Increase interest & learning, within the education systems, in STEM using the challenges of NASA's strategic enterprises. NMSGC will increase interest & learning by improving education, by providing professional development, K- graduate school.

Program characteristics: NMSGC provides access to NASA information, facilities, human resources, & programs to faculty & students. NMSGC has three focus areas in Higher Education programs, faculty development, curriculum support, & student programs. A sample

of these programs is discussed here.

Faculty Development: Faculty are in the best position to increase their students' academic achievement & retention because faculty are the single, most influential factor in student learning. NMSGC offers several faculty development programs to help STEM professors change teaching behaviors. These changes in teaching increase student achievement & retention.

- GRASP faculty development program, created by NMSGC, includes integration of teaching strategies proven to increase student achievement & retention.
- SETE is 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.
- NMSGC director, at the request of the President Gogue, led the effort to establish the NMSU Teaching Academy. The Teaching Academy provides workshops, guest lectures, & support services for faculty teaching. This effort created systemic improvement of teaching at NMSGC & was led by Space Grant.
- 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.

Curriculum Support: Faculty at all NMSGC universities designed engineering & science courses.

- Teaching modules on remote sensing were incorporated into existing courses in the Colleges of Engineering, Agriculture, & Arts & Sciences. The purpose of this program was to increase the use of NASA remote sensing data & tools in the classroom. The multi-disciplinary focus of the program is to help faculty use remote sensing by showing them how the application of remote sensing technology, including the use of NASA data, can be used in their discipline. Students may now enroll in a geospatial technologies option for their degrees in the College of Agriculture or College of Arts & Sciences.
- Interdisciplinary space based curriculum was developed for hydrology courses in civil, mechanical & engineering technology. These courses are offered every semester.
- An introductory Astronomy textbook & workbook was written with NMSGC support for an honors course. This honors course is offered each semester to undergraduate students as part of their general education requirements.
- A space technology course for education majors was offered as an elective for education majors' undergraduate degree programs.
- Courses in Nuclear Systems & Nuclear Engineering Design were offered at UNM.

Student Programs: All academic partners offered programs for students at their institutions.

These programs allowed students to integrate a NASA focus into their undergraduate education.

- All academic partners participate in the KC-135 Program. Students work with NASA personnel at a JSC who assist them to qualify & fly an experiment, & analyze data.
- NMSGC funded students publish their research results & present at academic conferences including the annual NMSGC Student Research Colloquium.
- Students from all academic partners were given opportunities for internships at NASA facilities including JSC, JSC-WSTF, KSC, MSFC, DFRC, & JPL. Students also participate in NASA's student programs including the NASA Academy, KC-135, & the Undergraduate Student Research Program.



Students building flight payload

Percentage of consortium budget: The Higher Education Program is NMSGC's largest program area. 29% (5 yr average) of the NMSGC budget is dedicated to support these programs.

Assessment & evaluation: Several higher education programs were evaluated.

- GRASP program evaluation compared pre- & post-GRASP results of student grades & student retention results. Since 1999 there has been a 5% increase in the number of students receiving grades of A, B, or C, & a 7% increase in the number of student remaining in their STEM majors when faculty participate in GRASP.

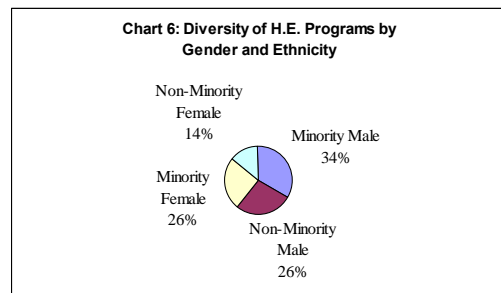
- After each SETE Conference, participating faculty evaluated the conference & made suggestions for improvement. “Best Paper Award” is given annually from peer reviews.
- Participants evaluate each workshop provided at the Teaching Academy.
- An outside evaluation team performs an evaluation for the NSF ADVANCE program.
- Each course created by NMSGC was evaluated by students at the end of the semester.
- In the interdisciplinary hydrology courses, student evaluations were used at the end of new sections & at the end-of-semester.
- The modules on remote sensing were evaluated by students at the end of each module.

Supports Space Grant Education Priorities in the 1996-2000 SG Strategic Plan: NMSGC programs support the following priorities:

- Interdisciplinary Courses & Curriculum: NMSGC developed interdisciplinary curriculum for fluids courses in civil engineering, mechanical engineering, & engineering technology departments. NMSGC developed teaching modules on remote sensing for courses in the Colleges of Agriculture, Engineering, & Arts & Sciences.
- Introductory Courses: NMSGC developed introductory courses in Astronomy as part of the general education requirements for undergraduates.
- Community College Initiative: NMSGC Community Colleges participated in the KC-135 program & created three curriculum modules of physics courses.
- Pre-College Education Enhancement: NMSGC offers a space technology course for education majors & offers workshops & institutes for practicing teachers.

Strategy for recruitment &/or participation of women, underrepresented minorities, & persons with disabilities: All NMSGC academic institutions are minority serving institutions with high enrollments of Hispanic students.

- Partners are supported to involve underrepresented minorities, women, & persons with disabilities in their programs. Chart 6: Diversity of Higher Education Programs by Gender & Ethnicity, shows participants in NMSGC programs were 60% underrepresented minority & 40% women.
- NMSGC worked with the ADVANCE program to increase the number of female faculty in STEM fields at NMSU. NMSGC supported female STEM faculty research efforts. 21 female faculty & 5 underrepresented female faculty participated in this program.



Core Criteria: Demonstrate how your Higher Education Program:

Places an emphasis on undergraduate education:

All NMSGC Higher Education programs support undergraduate education.

- Faculty Development: Faculty development programs are designed for faculty teaching undergraduate courses. GRASP targets faculty teaching undergraduate courses, especially those teaching freshman & sophomore courses because these students are at high risk for STEM drop out. The SETE conference focuses on undergraduate teaching.
- Curriculum Support: All curriculum modules funded by NMSGC were offered in undergraduate courses. NMSGC supported 79 curriculum-instructional development programs, 104 student development activities, & 108 faculty development activities.
- Student Programs: Undergraduate students are eligible to participate in all student programs.

Incorporates collaboration or cooperation of two or more disciplines or fields of study:

Many of NMSGC’s Higher Education programs are interdisciplinary.

- Faculty Development: All faculty development programs support faculty from all STEM disciplines. Faculty have participated from all the departments in the College of Engineering; all the science, mathematics, & technology departments in the College of Arts & Sciences; & all the science departments in the College of Agriculture.
- Curriculum Support: Interdisciplinary teams were involved in creating new curriculum for

hydrology. Teams included faculty from Mechanical, Civil, & Engineering Technology departments. Interdisciplinary teams were involved in creating curriculum for the remote sensing teaching modules. The modules have been integrated into existing courses in the Colleges of Engineering, Arts & Sciences, & Agriculture.

- **Student Programs:** Interdisciplinary student teams were created to participate in student programs. KC-135 teams typically are made up of students from electrical, mechanical, chemical & engineering technology, & physics.

Impact/Results:

- Students may now take an option in geospatial technologies as part of the environmental sciences degree in the College of Agriculture because of the NMSGC program.
- New curriculum is used in hydrology courses in Civil, Mechanical, & Engineering Technology. This curriculum is a permanent part of undergraduate engineering.
- 5 professional development conferences were offered
- 36 proposals were submitted, 11 were funded, bringing in over \$600,000 in funding
- 115 publications were published
- 11 new courses were offered at academic institutions
- 501 university professors participated in higher education programs
- 2,589 undergraduate students participated in NMSGC higher education programs
- 107 graduate students participated NMSGC higher education programs
- 8 undergraduate student teams from all NMSGC higher education partners flew experiments as part of the KC-135 flight opportunities

Strengths & weaknesses & actions taken to improve programs:

Strengths:

- Departments pay NMSGC \$800/semester/faculty to participate in GRASP. Since 1998, 42 faculty have participated in GRASP.
- The SETE Conference continues to grow, 71 papers have been presented & published. President Gogue, Provost Flores, & Deans, and faculty annually attend the conference.
- Once new courses are developed by NMSGC, most become part of the regular academic curriculum, are offered at least once a year, & are funded by academic departments.
- The greatest strength of the student programs is the connection to NASA. Students are given the opportunity to interact with NASA personnel & use NASA facilities while conducting research. This creates a strong tie between students & NASA.

Weaknesses & Actions:

- Few students apply for NASA's national opportunities such as NASA Academy. NMSGC discussed this problem at partnership meetings. Partners agreed to email all relevant department heads at their institutions. Opportunities are also emailed to student groups such as AISES, SHPE, etc. Department heads & organizational leaders are requested forward email to students. More proactive recruiting will be done by faculty.



Summer Institute Participant

5. Precollege Education Program

“When I came to college I wasn't sure what I wanted to major in. I remembered I built a rocket & payload during a summer institute when I was in high school. Since I liked that, I thought I would try engineering. Now I am a senior in Industrial Engineering & am working on a virtual reality research project with the space shuttle mechanical arm. I am glad I attended the summer institute in high school because it got me interested enough to give engineering a try.” (Zitlaly Gutierrez, summer institute participant)

Description: Describe your Precollege Education Program:

Purpose: The purpose of NMSGC Precollege Education Programs is to increase the number of students joining the STEM workforce by preparing precollege students to enroll in STEM fields at NM universities & community colleges.

Goals & Objectives: All NMSGC Precollege Education Programs support:

- NASA Education Goal: To use the NASA mission, facilities, human resources, & programs to provide exposure to teachers & faculty, to support the enhancement of knowledge & skills, & to provide access to NASA information in science, mathematics, technology, engineering, & geography.
- National Space Grant Program Objective: Promote a strong science, mathematics, & technology education base from elementary through secondary levels.
- NMSGC Goal: Increase interest & learning within the education systems, in the areas of science, engineering, technology, & mathematics, using the challenges of NASA's strategic enterprises. NMSGC will increase interest & learning by improving education & by providing professional development, kindergarten through graduate school.

Program characteristics: NMSGC provides access to NASA information, facilities, human resources, & programs to precollege teachers & students. NMSGC has three focus areas in precollege programs, in-service programs, pre-service professional development, & student programs. A sample of NMSGC's precollege programs is discussed.

Faculty Development: Teachers are in the best position to expose their students' to STEM fields & prepare students to enter STEM programs in college. NMSGC offers faculty development programs to help precollege teachers integrate curriculum that supports NASA education goals.

- The RERC provides educators with current NASA educational materials.
- NMSGC provides in-service training to teachers throughout the state. One of these workshops was on spaceports. These teachers' students participated in a statewide competition about why NM would want a spaceport.
- The SLP trained teachers to build & launch rockets with payloads & analyze payload data. Teachers then taught launch technology during scheduled class.

Student Programs:

- The annual Space Design Competition allows students to design a project in reference to a theme such as "Moon Base for the New Millennium." Students interact with top scientists & engineers in the fields of space technology & science.
- The annual special session of the STAIF conference helps middle & high school students capture an interest in Space Science.
- The PREP program brings middle school students on campus for seven weeks during the summer to increase mathematics & science skills so they are prepared to enter college & enroll in STEM majors. These students design, built & launch their balloon & payload.
- The Aerospace Scholars Program provides leadership training at aerospace sites throughout the state to familiarize students with education needed to work in these fields.



Spanish Speaking Spaceport Competition Winners

Pre-service Teacher Education:

- A space technology course for education majors was offered as an elective for education majors' undergraduate degree programs.
- The RERC provides educators with current NASA educational material. As part of the NMSGC education scholarship, recipients are required to develop NASA lessons for use in students teaching.

Percentage of consortium budget: 11% (5 year average) of the NMSGC budget is dedicated to support pre-college programs.

Assessment & evaluation: Several precollege programs are evaluated, including:

- The summer institutes were evaluated by participants at the completion of the institute.
- Spaceport presentations were evaluated by judges from industry at the five regional & the statewide competition.
- Students enrolled in the space technology course for educators completed course evaluations at the end of the semester.
- Scholarship recipients present developed materials to students & to NMSGC.

Supports Space Grant Education Priorities in the 1996- 2000 Space Grant Strategic Plan:
NMSGC programs support the following priorities.

Precollege teacher education: NMSGC offered a space technology course for education majors. The RERC is used by education majors as part of their coursework.

Cooperative partnerships with informal education organizations:

- The Science Advisors Program is a partnership between school districts, personnel at WSMR, JSC-WSTF, & the PSL.
- Linking Leaders is a NASA supported partnership between the state's corporate, education, policymaking, & community leaders.

Strategy for recruitment &/or participation of women, underrepresented minorities, & persons with disabilities:

- NMSGC invites Indian schools in NM to participation in outreach programs. American Indian teachers & students participate in most of NMSGC's programs including the summer institutes, teacher resource center, & SLP. Three Indian schools offered launch technology in their curriculum.
- All partners have involved underrepresented minorities, women, & persons with disabilities in their programs. From 1998-2002 reported participants in precollege programs were 36% underrepresented minority & 48% female.



Launch at Laguna-Acama Pueblo

Core Criteria NMSGC precollege programs align with NM's education standards including the NM Science Standards & Benchmarks, NM Mathematics Content Standards & Benchmarks, NM Standards for Science Teachers, & the NM Technology Plan.

Existing state systemic reform efforts: NMSGC has been working on systemic reform initiatives since 1990. We worked on two systemic reform programs.

- NASA funded Linking Leaders: brought a team of state leaders together to support NM's efforts to improve STEM education. Comprised of representatives of the state's corporate, education, policymaking, & community leadership sectors. The Linking Leader team reviewed the status of STEM, proposed a long-term strategy to advance the state's agenda for improving STEM, & identified specific actions related to implementing that strategy.
- The Science Advisors Program placed scientists from JSC-WSTF, WSMR, & the PSL in every school in southern NM monthly to help teachers teach science.

Places an emphasis on teacher preparation & development: NMSGC precollege programs focus on teacher preparation with the space technology course for education majors, the RERC, & the curriculum development requirement of the education scholarship. NMSGC precollege programs also focus on teacher development with the summer institute program, workshops, spaceport program, & the RERC.

Impact/Results: NMSGC Precollege programs have had an impact throughout the state.

- 63,802 students participated in precollege programs. Students participate in NMSGC programs after their teachers attend workshops or institutes. These programs help teachers implement the new NASA material. No programs are offered for students only.
- 5,668 teachers participated in precollege programs
- 16,535 collaborators participated on Precollege program (parents, administrators, etc.)
- 3 summer institutes given
- 11 teacher workshops given
- 26 schools throughout NM offered launch technology as part of their regular academic curriculum. This includes three Indian schools.

Strengths & weaknesses & actions to improve:

Strengths:

- Aerospace Scholars Program, a collaboration between NMSGC & the MESA Program, is well integrated into the school systems throughout the state. MESA has a state office, five

regional offices, & teachers paid at each of the 91 middle & high schools to the teach the curriculum to more than 4,500 students. This collaboration allows NMSGC to integrate NASA curriculum into the local schools at a small cost to NMSGC.

- The annual Space Design Competition & the high school special session of the STAIF conference allows students from throughout the state to meet NASA personnel working in the aerospace industry.

Weaknesses & Actions:

- The RERC is a tremendous asset to both practicing teachers & students in teacher education programs. NMSGC moved the RERC from the NMSGC offices (in the College of Engineering) to the College of Education. This location provides better access to education students & practicing educators.
- The SLP was a great success for 9 years. Teacher evaluations were high & participating teachers were committed to the academic year follow-up program. NMSGC discontinued this costly summer program in 2000 partially because of scarce resources, partially because it was not reaching our education goals as mentioned on page 11.

Discuss your role in the promotion of a strong science, mathematics, & technology education base within your state: NMSGC works with organizations throughout the state to promote a strong STEM education base. NMSGC staff have served on the boards for Linking Leaders, Science Advisors, New Mexico Partnership for Math & Science Education, Character Counts, & the Las Cruces Museum of Natural History, PREP & SEMAA. NMSGC works with MESA whose mission is to promote educational enrichment for precollege students from historically underrepresented ethnic groups, serving over 4,500 students in 91 schools, & 30 school districts.

6. Public Service Program: General Public & External Relations



“If you look real closely you’ll see the moon is always full, but sometimes not all of it is shining.” (Sam Horst, eight year old)

Description: Describe your Public Service Program; General Public & External Relations:

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

Goals & Objectives: All NMSGC General Public & External Relations support:

- National Space Grant Program Objectives: Encourage interdisciplinary training, research, & public service programs related to aerospace.
- NM Space Grant Consortium Goal: Create programs that support literacy in science, engineering, technology, & mathematics for the citizens of NM.

Program characteristics: NMSGC provides access to NASA information & programs to the general public. A sample of these programs is discussed here.

General Public:

- NMSGC Homepage & Fellows Page: NMSGC partners felt there was a need for an electronic communications center. 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.
- NMSGC brought NASA's Technology Transfer Trailer for "Benefits of Space on Tour."
- The Annual Las Cruces Air Show attracts up to 3,000 people. NMSGC distributed flyers & educational handouts. Students launched rockets with electronic payloads at the Air Show.

- NMSGC museum activities include Sky Safari, a monthly viewing of the sky; Astronomy Mentoring for gifted children trained in astronomy & telescopes; & Astronomy exhibits.

External Relations: NMSGC External Relations program include:

- NMSGC Director served on the Executive Board for National Space Grant Directors, appointed by Julius Dasch to chair the committee to develop the National Space Grant Implementation Plan, served as Treasurer for the Southwest Regional Space Taskforce to support building an inland spaceport in NM, served on the NASA supported Advanced Spaceport Technology Working Group (ASTWG) which provides a forum for federal & state government agencies, industry, & academia to work together to develop a national vision for spaceport development, briefed Courtney Stadd, NASA Chief of Staff on Space Grant.

Percentage of consortium budget: 10% of the NMSGC budget is dedicated to support general public programs & external relation programs.

Assessment & evaluation: External Relations programs are not evaluated. Museum programs are evaluated by participants.

Supports Space Grant Public Service Priorities in the 1996-2000 SG Strategic Plan:

- Topical Consortia: ASTWG is a topical consortia in research & research infrastructure.
- Informal Education Partners: Cooperative partnerships with informal education partners are created with Museums.
- Public appreciation of NASA sponsored research: NMSGC funded research, both student & faculty, are publicized on the webpage. The NASA Technology Trailer shows spinoffs of NASA technology to the general public.

Participation &/or inclusion of women, underrepresented minorities, & persons with disabilities. General Public & External Relations are open to the public, NMSGC is not able to influence who attends these activities. We are not able to collect data on ethnicity or gender.

Core Criteria: Demonstrate how your Public Service Program:

Promoted an understanding of STEM disciplines & the NASA mission: NMSGC disseminated information through 10 posters, 9 exhibits, 6 TV programs. 7,716 brochures, 1,201 newsletters, & 5,070 flyers were distributed.

Stimulated an interest in STEM disciplines & the NASA mission through programs:

NMSGC stimulated interest in NASA & STEM disciplines through 3 museum programs, 5 science fairs, 3 airshows, 1 NASA Technology Trailer, & 1 topical consortia.

Impact/Results:

Strengths & weaknesses & actions to improve:

Strengths: A strength of NMSGC general public programs is successful partnerships with informal education organizations such as museums.

Weaknesses & Actions: New Mexico museums have high staff turnover. When a director leaves a museum, NMSGC does not renew the subcontract until a new director is hired. NMSGC may reestablish a partnership after one year of successful contract administration.

Public Service programs impact includes:

- Museum programs will continue to be offered & funded by the museum foundation after NMSGC funding ends.
- Public Service programs include 3 museum programs, 5 science fairs, 3 air shows
- 129,050 participants