

# THE NASA / OHIO SPACE GRANT CONSORTIUM



## FINAL REPORT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

TRAINING GRANT SUPPLEMENT

OHIO SPACE GRANT CONSORTIUM

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## EXECUTIVE SUMMARY

The following section summarizes the impact of the Ohio Space Grant Consortium (OSGC) in Ohio and to NASA over the last four-year period (February 1, 2001 to April 30, 2005) and highlights the important accomplishments of the consortium.

The strength of the OSGC network of universities, community colleges, government agencies, industry, and outreach affiliates is well-established and is growing. The OSGC *Consortium Management Structure* was designed and remains committed to using the talents and diversity of everyone within this collaborative network, and operational policies and procedures are such that all consortium members are active contributors resulting in quality OSGC programs in research, education and service, while receiving a relatively small amount of NASA funds. The number of quality activities, both on- and off-campus, and collaborations/partnerships that OSGC has established with NASA and government agencies, state and local government, educational institutions, and private industry, has been impressive. Further desired university affiliate expansion requires additional funds. Diversity is shown in the OSGC 12-member Executive Committee by the presence of three campus representatives from Central State University, Wilberforce University, and The Ohio State University (two underrepresented minority, one female). One additional female campus representative (Cleveland State University) is currently on sabbatical leave and a valuable alternate member attends. Other additional female and underrepresented minority members are on the larger OSGC Advisory committee. All committee members participate fully in all consortium management and policy decisions. The OSGC Executive Committee strives to achieve and communicate a culture of trust, respect, teamwork, open communication, creativity, and empowerment. ***These programs have shown results and impact by their visibility and importance to Ohio and to NASA, resulting in strategic alliances created throughout Ohio. These alliances have improved over the last 4 years.***

The OSGC *Fellowship and Scholarship Program* represents the major effort and commitment of funding by OSGC and its affiliate and participating members. The OSGC has met its objective to encourage U. S. citizens (especially women and underrepresented minorities) to pursue studies in science, engineering, mathematics and technology (STEM) for both undergraduate and graduate education. The OSGC has also provided an aerospace research experience for every undergraduate scholar and graduate fellow, and requires the graduate research to be in collaboration with government center scientists/engineers and to reflect the NASA Enterprises. This research component has resulted in the students gaining insights into the methodologies, pressures, rewards and uncertainties of real-world, goal-oriented research; insights which will help them in their professional careers. Additionally, over the last 4 years, a new Student Bridge Program for undergraduate scholars has been established in collaboration with the NASA GRC Educational Programs Office (EPO) as well as a pre-service teacher scholarship program for undergraduate students pursuing certification in STEM disciplines at a Space Grant member institution. The OSGC Fellowship and Scholarship Program represents a high priority in our mix of program elements and constitutes a major commitment of funding by the OSGC and its affiliate and participating members averaging \$464.95K per year for 2001-2005. This high priority to this area is justified by the average yearly number of students (85,293) studying engineering and science in Ohio's universities. Through this program, the OSGC has met its objective to encourage U. S. citizens (especially women and underrepresented minorities) to pursue studies in science and engineering for both their undergraduate and

graduate education. The OSGC has also provided a unique aerospace research experience for every undergraduate scholar and graduate fellow, and requires the graduate research to be in collaboration with government center scientists/engineers and to reflect the NASA Enterprises. This research component has resulted in the students gaining insights into the methodologies, pressures, rewards and uncertainties of real-world, goal-oriented research; insights which will help them in their professional careers. Through this very successful program, OSGC is building the technical workforce of the future using NASA guidance. OSGC believes this program has had a very positive impact in Ohio and to NASA. Females have received 14 of the 49 graduate fellowship awards (29%) and 82 of the 211 undergraduate scholarships (39%) over the past 4 years. Underrepresented minority students have received 2 of the 49 fellowships (2.0%), but 47 of the 213 scholarships (22%). OSGC universities have identified this low number of underrepresented minority fellowship awards as a concern to be addressed, and each school is committed to an aggressive recruitment effort to increase the number of underrepresented minority graduate students. A minor difficulty exists due to the relatively small number of underrepresented students in Ohio obtaining graduate degrees in engineering such that many of the well-qualified students often have more lucrative aid than what OSGC can provide. However, OSGC is committed to increasing the number of fellowship awards to underrepresented minority students.

In 2004, the first year of the OSGC Pre-Service Teacher Scholarship program, 18 awards were made to undergraduate students. Females received 12 of the 18 awards (67%) and underrepresented minority students received 3 of the 18 awards (17%). ***Through these very successful scholarship/fellowship programs, OSGC is building the technical workforce of the future using NASA guidance, and these programs have had a very positive impact in Ohio and to NASA.***

OSGC has been successful in developing *Research Infrastructure* to promote activities supporting the NASA Space Grant Strategic Plan and the NASA Strategic Enterprises. This has been accomplished through the awarding of seed grants to “not yet established” faculty to develop in the areas of aerospace technical expertise, to seek a co-PI (required) at NASA GRC or AFRL to collaborate with on research of government interest, and to obtain additional research funding. Help on obtaining suitable contacts is provided by OSGC and the Office of University Affairs. OSGC has begun new initiatives in university-industry seed grants and faculty-student-industry intern programs. OSGC programs have led to new research and academic courses in remote sensing, geospatial technology, and in teaching the physics of satellites to students. OSGC has begun new initiatives in university/industry seed grants and faculty/student/industry intern programs and with NASA Centers and AFRL. During the period 2001-2005, the OSGC leveraged university and industry contributions and utilized an average of \$48.76K (3.4%) of total funds and \$28.41K (9.6%) of Space Grant funds in the Research Infrastructure area. The OSGC has successfully increased the number of females, underrepresented minorities, and persons with a disability in our research infrastructure and seed grant programs. Geospatial, remote sensing and cricket satellite university programs have begun at 4 OSGC affiliate universities (two HBCUs), and diversity in participating students is stressed. ***Research and education connections have been strengthened within the university community, NASA GRC, and AFRL by leveraged funding, which has increased the program impact.***

A NASA presence is increasing on Ohio campuses through the OSGC Seed Grant program for *Higher Education*. Grants are awarded to university faculty for quality curricula and technical programs which use NASA educational materials and relate to the SG Strategic

Plan. New interdisciplinary courses for students have been developed by faculty at collaborating universities involving student satellites, geospatial extension, remote sensing, GLOBE and aerospace materials for preservice teachers. Campus representatives are the initiators of these higher education activities, and on one campus an OSGC scholar is a preservice science teacher. Additional interdisciplinary courses in the preservice teacher area which stress the need for teacher science capability will result with OSGC aid and the leadership of education college representatives on the Advisory Committee. This Seed Grant program will continue and the resulting interdisciplinary course and program additions, in both science and education, will prove beneficial to increasing the awareness of students to aerospace technical subjects and NASA contributions. The OSGC program in Higher Education is the third largest OSGC activity, again due to the need in Ohio to contribute to workforce development. A NASA presence is increasing on Ohio campuses through this OSGC Seed Grant program. These grants are awarded to faculty for quality curricula and technical programs which use NASA educational materials and relate to the SG Strategic Plan. Over the past 4 years, OSGC utilized an average of \$47.0K per year of National Space Grant Funds (15.9%) and a total funding of \$128.9K per year (9.1%) for its efforts in Higher Education. To sustain students in the NASA pipeline, information is provided to students in the following NASA GRC Programs: SHARP, L.E.R.C.I.P., the Bridge Program, and the College Intern Program. Joint seed grant proposals between engineering and education faculty for improved preservice science teacher courses have been very successful. ***The OSGC strength in this program is the willingness of very capable university faculty from different disciplines to collaborate, and the impact is shown by the increasing scientific awareness of students, faculty, and the general public to NASA.***

The *Precollege Education* program is OSGC's second largest program with respect to funding by the consortium and its affiliates. The OSGC has furthered NASA's Precollege Education agenda by having the separate areas of Precollege Outreach (seed grants for in-service teacher training) and K-12 (minigrants for K-12 student programs). These programs have been established by building strategic alliances with university faculty and K-12 teachers and administrators. Precollege Outreach programs stress STEM applications (classes for teachers on best methods to teach subjects to students, especially at inner-city schools; how teachers can introduce astronomy and space science; etc.). K-12 grants then provide teachers with NASA resources to make their classrooms more conducive to learning through incorporation of STEM materials and field trip activities (e.g., B-WISER, GLOBE). The OSGC has participated in NASA's new initiatives, e.g., Ohio NASA Explorer School (NES). The Precollege Education program is OSGC's second largest activity due to the large number of K-12 students and teachers in Ohio cities and the effect of this program. Both areas stress the use of NASA STEM materials. Over the past four years, OSGC utilized a yearly average of \$29.0K (9.8%) of Space Grant funds and total average yearly funds of \$178.31K (12.6%) due to significant matching funds (cash and in-kind) from affiliates, universities, schools, and participants. The OSGC encourages university faculty and in-service K-12 teachers to apply for its seed and minigrants. Efforts have been successful in making these awards where diversity is affected. OSGC will coordinate efforts with NASA GRC and the newly named Ohio NASA Explorer School, Lorain Middle School, Lorain, Ohio, and any future schools in an effort to increase the percentages of participation for women, underrepresented minority students, and persons with a disability. ***From both university and K-12 teacher and administrator reviews of the quality OSGC activities, the impact of this Precollege Education program in Ohio has been substantial.***

The OSGC *Public Service* program in Ohio has been strong as evidenced by the amount of matching funds from the affiliates, state government, industry and workshop participants. The quality of the joint programs between OSGC and informal education partners has been excellent and OSGC and NASA have received recognition in newspapers, radio and TV, and on websites (B-WISER, African American Exhibit, GLOBE, Challenger Center, etc.). A goal to increase public awareness of aerospace science and to promote STEM disciplines was met. A second goal to make OSGC a very visible NASA representative in Ohio where teachers, students and the general public can seek aerospace and STEM information was also achieved. The strengths of the program are in the success OSGC has achieved in contacting and collaborating with other organizations on quality activities. Improvement in the number of network affiliates, including active industry participation, in all areas of the state, should make possible the vision of an Ohio Public Service Program where activities can be shared and funds leveraged to produce quality activities and programs. The OSGC Public Service program (General Public and External Relations) in Ohio is the smallest in the use of space grant funds of \$7.6K per year of Space Grant funds (1.6%) but the total funding was \$71.56K (3.3%). The program has been strong and has had a major impact as evidenced by the large amount of matching funds from the affiliates, state government, industry and workshop participants. The OSGC's internal and external partnerships are crucial to the success of this program. Already, close relationships are in place with our partners to insure high percentages of women, underrepresented minorities, and persons with a disability in our programs. OSGC's "African Americans in Space Science" exhibit has been very successful as have other programs such as the establishment of a Challenger center.

***The Public Service impact has been strong.***

In summary, over the past four years, the OSGC has conducted many quality programs at all levels and has initiated many valuable collaborations such that a NASA presence has been established on campuses and in both formal and informal education places of learning throughout the State of Ohio. Further specific details and grants in each area have been detailed in the yearly budget proposals. The OSGC has been diligent in furthering its relationship with GRC. Collaboration with the Educational Programs Office (EPO) has especially flourished to create new initiatives (e.g., Student Bridge Program, Pre-Service Teacher Scholarship Program, Satellite Program, Explorer School, Explorer Post). The Office of University Programs at GRC has been another great asset in its mission to facilitate collaboration in research to cultivate a successful generation of scientists and engineers. The OSGC will continue in the future to provide quality programs and activities highlighting the vast array of STEM content inherent in the NASA mission throughout the State of Ohio in an effort to *Inspire the next generation of explorers . . . as only NASA can.*

## MAJOR OSGC PROGRAMS

### FELLOWSHIP/SCHOLARSHIP PROGRAM

#### Description

The OSGC *Fellowship and Scholarship Program* represents the major effort and commitment of funding by OSGC and its affiliate and participating members. The purpose and objective of the program is to encourage U. S. citizens to pursue studies in science, engineering, mathematics and technology for both their undergraduate and graduate education. An increase in the number of U. S. students receiving degrees in these areas is necessary in order for industry and government in the U. S. to reduce their current dependence on international students,

especially at the graduate level. A very important part of the program is the aerospace research experience for every undergraduate scholar (this has always been true for the graduate fellows). This research component has resulted in the students gaining insights into the methodologies, pressures, rewards and uncertainties of real-world, goal-oriented research; insights which will help them in their careers. The OSGC goals are to increase the number of well-qualified engineers and scientists who are U. S. citizens, especially the number of women and underrepresented minorities to reflect state enrollment statistics and census data, for careers in Ohio aerospace science, technology, and allied fields.

The total funding available for these programs has averaged \$464.95K per year for 2001-2005. This has been comprised of the following averages: \$114.11K OSGC (24.02% of NASA Space Grant funds), \$105K OAI, \$41.84K industry (BFGoodrich, TRW), and \$188.75K university contribution (CMIS Income Funding Matrix 1998-2002). The university contribution is comprised of graduate tuition and cost-sharing for fellowship and scholarship stipends. Students attending all OSGC member institutions except the Air Force Institute of Technology<sup>1</sup> are eligible for support through these programs. Fellowship and Scholarship advertisements (including personalized recruitment posters and application packets for each campus) are placed in engineering and science departments early in the academic year at each affiliate and participating college/university by the campus representative, who also sends email information to each department's graduate and undergraduate advisor. Student organizations such as the Society of Black Engineers (SBE) and the Society of Women Engineers (SWE), and university offices of Multicultural Affairs and Disability Services at each of the OSGC universities are particularly informed of these opportunities. The fellowship and scholarship opportunities are also advertised on the OSGC website and are available to be downloaded. The OSGC is convinced that this process has assured timely, open, and equal access to all interested and qualified students. Materials are also distributed through various collaborative efforts where applicable (e.g., Congress/Senate visits, Project ASTRO workshops, campus events, etc.)

#### Core Criteria

The **Graduate Fellowship** program, for graduate students studying in an aerospace-related field, provides Doctoral student awards of \$18K (\$13K OSGC, \$5K University plus tuition) per calendar year for a period of 36 months, and \$14K (\$11K OSGC, \$3K University plus tuition) per calendar year for a period of 18 months for M.S. students. The policy of requiring university financial contributions has been in effect since Fall, 1995 (only tuition was previously required) and has been successful in increasing university interest in the program as it is now viewed as a method to leverage their student resources. Fellowship award winners are selected by the OSGC Executive Committee from nominations received from all universities that offer graduate programs. Each nomination is recommended by a host university committee based on overall quality and diversity. The applicant/nominee ratio must be at least 4/1, and each university may nominate up to 4 candidates. Over the last 4 years, an average of 3 new Ph.D. and 3 new M.S. awards have been made each year, and an average of 12 Fellows (new plus continuing) are active during each year. The number of nominated students always greatly exceeds the available number of awards. The research-intensive universities initially dominated these awards since they have nominated more top-quality students. This has changed since 1998 when OSGC adopted the policy of equitability (not necessarily equality) over time among the universities for fellowship awards. This policy has worked well, and all affiliates feel the policy is fair and should continue.

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<sup>1</sup> AFIT students receive their military salary and support from the U. S. Government.

During 2001-2005, as shown in the following table, 10 new Ph.D. 3-year awards and 11 new M.S. 1.5 year awards (total of 21 awards) were made from an initial applicant pool of 85 students (25% awarded). The following table shows the new fellowship awards along with the total active students (since fellowships are multi-year awards) during each year for the past 4 years. It also shows the student diversity.

**OSGC FELLOWSHIP AWARDS 2001 – 2005**

	2001-02								2002-03							
	New				Continuing				New				Continuing			
	N	F	UM	NFM	TA	F	UM	NFM	N	F	UM	NFM	TA	F	UM	NFM
MS	3	2	0	1	6	2	1	4	2	0	0	2	3	0	0	3
PhD	3	1	0	2	10	3	0	7	2	1	0	1	7	4	0	3
Total	6	3	0	3	16	5	0	11	4	2	0	3	10	4	0	6
%		50	0	50		31	0	69		50	0	75		40	0	60

  

	2003-04								2004-05							
	New				Continuing				New				Continuing			
	N	F	UM	NFM	TA	F	UM	NFM	N	F	UM	NFM	TA	F	UM	NFM
MS	3	0	0	3	5	0	0	5	3	1	1	2	6	1	1	5
PhD	3	1	1	1	5	2	1	2	2	0	0	2	7	2	1	4
Total	6	1	1	4	10	2	1	7	5	1	1	4	13	3	2	9
%		17	17	67		20	10	30		20	20	80		23	15	69

N	=	New Fellowship students
F	=	Females
UM	=	Underrepresented Minority Students (African American, Hispanic, Native American, Pacific Islander, Disabled)
NFM	=	Not Female or Underrepresented Minority
TA	=	Total Active students (includes New students)

These tables illustrate that the percentage of active female fellows increased from 31% to 40% for a high over the 4-year period, and females are reasonably well represented in the OSGC Fellowship awards, having received 14 of the 49 graduate awards (Avg. = 29%). The Ohio Board of Regents (OBOR) representative, Owen N. Daniels, provided data showing that 46.85% or 39,957 of the 85,293 students in Ohio public institutions studying engineering and science are females. These numbers represent both undergraduate and graduate students. A more meaningful measure on the graduate level is the number of graduate degrees awarded in engineering in 2002, and was provided by Michael Gibbons of the American Society of Engineering Education (ASEE). The number of engineering graduate degrees (MS and PhD) awarded in 2002 was 1,747, with 330 of these being awarded to females (18.68%). The OSGC average female representation of 29% is thus an acceptable number.

As shown in the above tables, the percentage of Underrepresented Minority award winners increased from 0% to 4% over the same period, with no awards being made from 2001-2002 (very few nominations were received). The OBOR statistics show that 14.04% or 11,976 of the students studying engineering and science (all degree levels) are underrepresented minority students (UM). The ASEE figures for graduate degrees awarded in engineering show that UM received 32 of the 1,767 graduate degrees, for a percentage of 1.81%. This is lower

than the OSGC percentage. However, it is below the desired OSGC value. The OSGC member schools have identified this as a concern which will be addressed. Each university is committed to an aggressive recruitment effort to increase the number of qualified underrepresented minority students. OSGC has discussed this issue and desires that at least one fellowship nominee on each campus be a qualified female or underrepresented minority student. This has resulted in a significant improvement in the number of female award winners, but the number of UM applications has been lacking. OSGC will make a strong effort to improve the UM representation in the future. It should be mentioned that 1,062 (60.84%) of the 1,747 engineering graduate degrees awarded in 2002 were to international students.

During this period, OSGC universities awarded 11 Doctoral degrees and 11 Master's degrees. These graduates have all done well. Daniel A. Kingsley, Ph.D. (Biorobotics and Mechanical Engineering), Case Western Reserve University, 2004, is employed as an Engineer II in Robotics Design at Sarcos in Salt Lake City, Utah, Catherine Corrigan, Ph.D. (Geological Sciences), Case Western Reserve University, 2003, is now employed by the Smithsonian Institution and is doing research classifying Antarctic meteorites; Gregg Jessen, Ph.D. (Electrical Engineering), The Ohio State University, 2002, is employed at Wright-Patterson Air Force Base and is doing novel materials science research; Susanne Bellante, M.S. (Mechanical Engineering), The University of Toledo, 2002, is employed at the Goodrich Corporation, Cleveland, Ohio, as a design engineer, and Daniel LeMaster, M.S. (Electrical Engineering), Air Force Institute of Technology, 2004, is employed as a Research Engineer in National Air Intelligence Center for Riverside Research Institute in Beavercreek, Ohio. OSGC publishes an updated Congressional District Activities booklet every year to Members of Congress and the booklet is widely distributed among the Space Grant community, NASA Centers, and at NASA HQ. All of the OSGC scholars and fellows from 1989 to the present are listed in the booklet. OSGC is convinced that this graduate fellowship program is important to Ohio industry, universities, and NASA, and continued efforts will be made to seek out additional funding to increase the number of graduate fellows, particularly Ph.D. students. Efforts to increase the number of awards to females and, especially to underrepresented minority students, will continue.

The **Undergraduate Scholarship** program for undergraduate students studying in an aerospace-related field provides awards of \$3,000 (\$2,500 OSGC, \$500 University) for Seniors, \$2,000 (\$1,500 OSGC, \$500 University) for Juniors, and \$1,000 (\$750 OSGC, \$250 Com. Col.) for Sophomore Community College students. All scholarships are 1-year awards, and most Junior scholars are renewed as Seniors. Prior to 1995, four-year scholarships were awarded (\$2,000 Fr., So. and \$3,000 Jr., Sr.) and university cost-sharing was not required. This change in scholarship award structure and policy was made in order to emphasize the undergraduate research experience which utilizes the acquired capabilities of the Junior and Senior students and serves to increase their interest in attending graduate school. In addition, the university cost-sharing provided student departments the opportunity to make a financial investment in their own students which was leveraged by the OSGC funds, thereby giving the departments an additional manner to reward good students. Finally, this change has reduced student attrition, as students early in their programs often switch to other majors.

Scholarship award winners are chosen by committees from each affiliate and participating college/university with an applicant/awardee ratio of at least 3 applications for each award. Each affiliate university may award up to 4 scholarships, and each participating university may award up to 2 scholarships. Two awards are also available for each of the

community colleges. This policy of allowing each member to have a set number of scholarships has created equity in the scholarship awards which has fostered greater cooperation among all OSGC members.

Over the 2001-2005 period, an average of 53 OSGC scholars participated during each year. The number of outstanding students that apply always exceeds the available number of awards. During the last 4 years, the affiliate and participating members received 725 applications, and 238 Scholarship awards were made (32.8% awarded). The number of B.S. degrees over this period was 149, along with 10 community college students that transferred to 4-year schools. ***Sixty-nine students (46%) continued on to graduate school (full-time), which is almost identical to the percentage (47%) for the 1997 five-year review.*** Thirty-five of these students went to Ohio graduate schools, and 34 went out-of-state for their studies. These students have been prepared to lead the U. S. in the future. It is our judgment that the OSGC Scholarship program is very successful. It is satisfying one of its major objectives, which is to excite students through undergraduate research projects (see below) to attend graduate school.

The following table shows the Scholarship awards over the past 4 years. As the table illustrates, female scholarship winners have a consistent representation with respect to yearly percentage variation, and the Avg. = 39%. As cited above, the OBOR statistics show that females represent 46.85% of the 85,293 students studying science and engineering in Ohio public institutions at all levels. ASEE lists the number of BS degrees awarded in engineering in 2002 to be 2,709, of which 535 (20%) are females. The OSGC average (39%) is well above this.

The underrepresented minority student scholarship winners remained rather constant in percentage over the last four years, and the percentage Avg. = 22%. Again, as cited above, the OBOR statistics show that 11,976 or 14.04% underrepresented minority students are studying engineering and science in Ohio public institutions at all degree levels. The ASEE numbers are more specific, and show that for undergraduate engineering degrees, underrepresented minority students received 116 or 4.28% of the 2,709 B.S. degrees awarded in Ohio. The OSGC is thus satisfied with the average of 22% undergraduate scholarship representation over the past four years and we are convinced that this is a reasonable value. Having two HBCUs, Wilberforce University and Central State University, has been a significant factor in the increase of these percentages. However, all institutions have successfully encouraged their underrepresented minority students to apply for this program and have contributed to this increase.

### OSGC SCHOLARSHIP AWARDS 2001 – 2005

#### 2001-02

Total	F	UM	NFM
51	24 (7UM)	10 (7F)	41
Percent	47%	20%	

#### 2002-03

Total	F	UM	NFM
50	21 (4UM)	10 (4F)	40
	42%	20%	

#### 2003-04

Total	F	UM	NFM
54	23 (5UM)	12 (5F)	44
Percent	41%	21%	

#### 2004-05

Total	F	UM	NFM
55	14 (5UM)	14 (5F)	41
	25%	25%	

F = Females  
 UM = Underrepresented Minority Students  
 (African American, Hispanic, Native  
 American, Pacific Islander, Disabled)  
 NFM = Not Female or Underrepresented Minority

All graduate fellowships and undergraduate scholarships have a research component as part of the award requirement. The dissertation research conducted by the Ph.D. students must be of importance to NASA or AFRL and the student must have a co-advisor from one of these agencies. The OSGC Director and the campus representative, along with the student's university advisor, ensure that this requirement is fulfilled. At NASA GRC, a co-advisor is frequently located with the help of the Director of the Office of University Affairs. The student must be in frequent contact with the government co-advisor and make visits to the laboratory. In cases where use of specialized governmental facilities is required for the work, the students spend time on-site at the laboratory. The M.S. students do not currently have this requirement of a government co-advisor, but the OSGC is considering its implementation. This should promote university faculty-government scientist/engineer collaboration. The senior and junior scholarship students are required to do a research project with a faculty mentor. The campus representative undertakes the responsibility to help arrange suitable student-mentor associations in order that the undergraduate research experience is definitely meaningful and important.

The OSGC affiliate and participating universities are very satisfied with the research component at all student levels, and especially at the undergraduate level where many universities do not have this experience as a requirement. *This research component has resulted in the students gaining insights into the methodologies, pressures, rewards and uncertainties of real-world, goal-oriented research; insights which will help them in their pursuit of graduate degrees and technical careers. In addition, particularly at the less research-intensive universities, it has stimulated the faculty members to seek out more contracts and grants for NASA-related research in order to meet both their own developmental needs and the students' need for more research opportunities that are relevant to the technical problems of today. Many of the universities have reported closer ties between professors and undergraduates, and more access by students to professors for both academic and non-academic guidance. OSGC is convinced that this research experience is a strong motivator for pursuing a graduate degree in engineering or science, as is evidenced by 46% of our scholars over the past 5 years continuing on to graduate school. Finally, the exposure to NASA-related research activities has stimulated many of the students to view the aerospace industry as an extremely attracting, interesting, and challenging area for a rewarding professional career.*

The OSGC has committed itself to equality of scholarship and equitability of fellowship funding, over time, among its members. During the last 4 years, the distribution of scholarships and fellowships is beginning to reflect this policy, as is shown in the table below. The total dollars are the sum of NASA Space Grant, Affiliate stipend and tuition contribution, OAI, and Industry funds (CMIS Table IV-B). This table illustrates that the affiliate universities, which are allotted 4 scholars, are proceeding toward that number, as are the participating schools which are allotted 2 scholars. OSGC has found that community college students are non-traditional in that a large majority have employment and other activities outside of school. They are generally more mature and focused than typical undergraduates. The participation of community college students in the scholarship program has been gradual, but will increase in the future as the past students have been extremely satisfied with the experience. On the graduate level, there is a more even spread of M.S. and Ph.D. awards among the universities. The total OSGC fellowship/scholarship funds provided to each university are skewed due to the larger allocation made for graduate awards, but OSGC is striving to make a fair distribution of funds among its members. The large number of qualified applicants to both the scholarship and fellowship programs and the small percentage of awards that can be made clearly show that demand is

higher than available award funds. The OSGC has made an effort to attract industry funding, with some significant success (TRW Foundation, which recently closed, bequeathed a 35K award to OSGC for future fellowships), and OAI has also helped in this respect. It is our intent to continue our efforts to find additional sources of funding for scholarships and fellowships.

**OSGC SCHOLARS AND FELLOWS 2001 – 2005**

University	01-02			02-03			03-04			04-05			No.	Amount \$K
	S	M	D	S	M	D	S	M	D	S	M	D		
AFIT	0	0	0	0	0	0	0	1	0	0	1	0	2	\$62.376
Akron	4	1	0	4	0	0	4	0	0	4	1	0	18	81.535
Case Western	4	0	4	1	0	2	2	0	1	3	0	2	19	315.620
Cedarville	3	-	-	3	-	-	4	-	-	5	-	-	15	37.0
Central St.	4	-	-	5	-	-	5	-	-	5	-	-	19	48.
Cincinnati	4	0	1	4	0	1	4	0	1	4	0	1	20	149.336
Cleveland St.	4	1	0	4	1	0	4	1	0	2	0	0	17	78.945
Dayton	4	0	0	2	1	0	4	2	0	5	1	0	19	132.667
Marietta	2	-	-	2	-	-	2	-	-	2	-	-	8	20.000
Miami	2	-	-	2	-	-	3	-	-	2	-	-	9	23.000
Ohio Northern	2	-	-	3	-	-	4	-	-	4	-	-	13	32.000
Ohio State	3	0	4	2	0	4	0	1	2	1	2	2	21	405.568
Ohio Univ.	0	1	0	0	0	0	0	0	0	2	0	0	3	14.264
Toledo	4	2	1	4	0	0	4	0	0	4	1	1	21	172.759
Wilberforce	4	-	-	5	-	-	5	-	-	5	-	-	19	43.000
Wright State	4	1	0	4	1	0	4	0	1	4		1	20	137.542
Youngs. State	2	0	0	2	0	0	2	0	0	2	0	0	8	20.000
Col. St. CC	0	-	-	0	-	-	0	-	-	0	-	-	0	0
Cuyahoga CC	0	-	-	0	-	-	0	-	-	0	-	-	0	0
Lakeland CC	1	-	-	0	-	-	1	-	-	0	-	-	2	2.000
Lorain CC*	-	-	-	0	-	-	0	-	-	1	-	-	1	1.000
Owens CC	0	-	-	2	-	-	2	-	-	1	-	-	5	5.000
Terra CC	0	-	-	1	-	-	2	-	-	0	-	-	3	3.000
	51	6	10	50	3	7	56	5	5	56	6	7		
<b>Totals</b>	<b>67</b>			<b>60</b>			<b>66</b>			<b>69</b>			<b>262</b>	
	<b>\$568.831</b>			<b>\$353.173K</b>			<b>\$397.930#</b>			<b>\$464.678##</b>				<b>\$1,784.612</b>

\* Joined OSGC in 2002.

# Does not include \$27.699 carryover from previous year (CMIS total = \$425.629).

## Does not include \$43.000 carryover from previous year and \$4.500 affiliate contribution for pre-service teacher scholarships (CMIS total = \$512.178).

S	=	Scholarships
M	=	Master's
D	=	Doctoral
Dash (-)	=	No graduate program (ineligible for fellowships)

All Senior, Master, and Doctoral students are required to prepare a 5-page paper on their research and make a 15-minute oral presentation at the Annual OSGC Student Research Symposium, held in April of each year. Juniors and community college students present a poster describing their project and submit a 2-page paper describing their initial research work. All

papers are published in the OSGC Annual Student Research Symposium Proceedings, which is widely distributed. The students also publish their research in scholarly journals in conjunction with their advisors, and OSGC sponsorship is acknowledged in these publications. Over the past 4 years, the students have published 260 papers, with all being in the OSGC Proceedings and 28 also being in professional journals. In addition, many students have received campus awards for their research projects. OSGC is very pleased with the research experience of the undergraduate scholars and graduate fellows. Performance of the campus representatives in operating both of these programs to produce truly excellent graduates and quality research has been outstanding.

### **Impact/Results**

The OSGC Scholarship and Fellowship Program constitute the major effort and commitment by all of the affiliate and participating universities. A measure of equality among all members with regard to the number of scholarships and equitability in fellowships awarded to each member institution has been achieved. The program is strong and has an impact in Ohio. The total funding utilized, average of \$450K, is considerable and represents a true collaboration between the various funding sources toward an investment in Ohio's future. The graduates at the undergraduate (149 B.S.) and graduate (9 Ph.D., 17 M.S.) levels have gone on to the aerospace industry, government, university teaching and, at the B.S. level, 46% have gone directly into full-time graduate studies. This latter large percentage is a result of the research requirement of the undergraduates which has provided a very positive experience and results to the students and faculty in the areas of increased research, mentoring, student access, increased graduate school interest, and aerospace careers. The doctoral students are fully committed to the NASA and AFRL laboratory interaction, as are the faculty mentors, which promotes further collaboration. The effort and performance of the Campus Representatives at all of the Affiliates in the management and implementation of this program has been truly outstanding. Female scholars and fellows are well represented, as are undergraduate underrepresented minority (UM) students. The number of UM students on the graduate level needs to be increased. OSGC will continue its efforts to secure additional funding in order to increase the size of the program, particularly the number of doctoral fellows. The scholarship/fellowship program has had an impact on campuses, aerospace industry, and government laboratories, and has promoted the NASA mission to "*Inspire the next generation of explorers . . . as only NASA can*" throughout Ohio. *Further information about the Fellowship and Scholarship Program is in the yearly budget proposal narratives.*

## **RESEARCH INFRASTRUCTURE PROGRAM**

### **Description**

The purpose of the OSGC *Research Infrastructure Program* is to promote faculty research interactions between OSGC faculty, NASA and AFRL scientists/engineers, and aerospace industry researchers. OSGC objectives in the research are in line with the Space Grant Strategic Plan and NASA's Strategic Enterprises (SE). Our goal is to establish close technical collaborations among these researchers, including students, and to enhance the relationships by student and faculty internships at government laboratories and in industry. A second objective is to increase the research interaction between faculty and students from different institutions. The major OSGC program in the research infrastructure area is the faculty seed grant for younger not-yet-established faculty members and is designed to encourage these faculty to do aerospace research with NASA and other government agency and industry scientists, and also to include these scientists in joint student mentorship. Currently, the research topic chosen for this seed

grant must be done in collaboration with, and be of technical interest to, the government scientist and NASA. The maximum \$10,000 award is meant to support the faculty member for approximately 1 month and a graduate student for a 3-month period. The results obtained using this funding are expected to lead to one or more full proposals submitted to funding agencies at the end of the grant period. Collaboration between faculty at research and non-research intensive institutions is encouraged, and current programs include geospatial and remote sensing applications and the balloon and cricket satellite programs. These programs stress diversity among participating undergraduate and graduate students. During the period 1998-2002, the OSGC leveraged university and industry contributions and utilized an average of \$33.23K (2.2%) of total funds and \$9.28K (1.9%) of Space Grant funds (CMIS data) in the Research Infrastructure area. This program is working very well, but needs additional funds.

All grants (indirect costs not allowed) require an equal amount of university matching funds which is often exceeded, as shown in CMIS Table III-A (NASA plus match dollars) and the table below, by supplementary industry or other funds. The University Affairs Officers at NASA GRC and AFRL provide help to OSGC and the faculty member in obtaining government employee contacts. An initial problem with this program was that the OSGC funds were insufficient when compared with standard "start-up" packages given to new or not-yet-established faculty. However, the advantage of working with a NASA scientist/engineer, and in some instances also with an industry researcher, has made the program of value in increasing the visibility, technical expertise and funding opportunities of younger faculty members. During the past 4 years, 9 Seed Grants were awarded to OSGC faculty.

**OSGC RESEARCH INFRASTRUCTURE SEED GRANTS 1998 – 02**

2001			2002		
No.	OSGC	Match Funds	No.	OSGC	Match Funds
1	\$10,000	\$22,700	2	\$11,387	\$12,000*

  

2003			2004		
No.	OSGC	Match Funds	No.	OSGC	Match Funds
3	\$50,697	\$63,627**	5	\$26,000	\$119,332***

\*(8K) of these funds were workforce development supplemental funds from 2002.  
 \*\*(51,267K) of these funds were workforce development supplemental funds from 2003.  
 \*\*\*(73,718) of these funds were workforce development funds from 2004.

Representative grant titles are:

- "Development of Computational Models for Shape Memory Alloys Embedded in Smart Materials", Pizhong Qiao, The University of Akron-2001 [with GRC. (Aerospace SE)]
- OSGC is very pleased with the interest shown by university faculty in working with government laboratory personnel. For young faculty members, this collaboration with NASA is a benefit that can affect their long-term career. An example is Pizhong Qiao, cited above, who subsequently received a 3-year NSF award, Partnerships for Innovation (PFI), for \$104K. Other faculty successes have been discussed in the OSGC yearly reports.
- *2003 Workforce Development Programs Include:* "Geospatial at Stennis", Abinash Agrawal, Wright State University-2003, (\$22,740); "Geospatial Program", Nathan Watermeirer, The Ohio State University Extension-2003, (\$28,887).
  - *2004 Workforce Development Programs Include:* "Continuation of Geospatial at Stennis", Abinash Agrawal, Wright State University-2004, (\$22,740); "Continued Geospatial

Program”, Nathan Watermeirer, The Ohio State University Extension-2004, (\$19,572); “Ohio Geospatial Technology”, The Ohio State University-2004, (\$11,260).

- “Using Landsat Imagery in the Development of a Land Use Classification Map of Massies Creek Watershed in Greene County, OH, in Support of Water Quality Monitoring and Conversation”, John Silvius, Cedarville University-2003.
- “GIS Mapping of the Massies Creek Watershed in Greene County, OH, in Support of Water Quality Monitoring and Conservation, John Silvius, Cedarville University-2003.
- “Characterizing and Managing Variability in Quality and Yield of Wine Grapes in Ohio Using Remote Sensing and GIS”, M. Reza Ehsani, The Ohio State University-2004.
- “Synthesis of Anti-Microbial Coating Materials through Enzymatic Polymerization of Renewable Resources”, Dong-Shik Kim, The University of Toledo-2004.
- “Ceramic Fiber Heterostructures”, H. Daniel Young, Wright State University-2004.

### Core Criteria

OSGC seed grants have been given to collaborating faculty in engineering and the sciences. They have also helped inspire faculty at the less research intensive and undergraduate universities to initiate research activities, often with a faculty member from a larger university. The program adheres to alignment with the NASA research enterprises of initiating research, increasing research capability, and faculty-NASA collaboration. OSGC supports activities related to the NASA SE and details are in the yearly reports. Some additional activities are:

- Initiated an OSGC University-Industry Seed Grant program and a University-Industry Internship program (Aerospace SE).
- The formulation of a method to have increased interaction of Ohio faculty members of all university ranks with GRC and AFRL personnel on technical matters (see yearly reports).
- A student satellite program (Space Science SE) started in 2001 at Wright State University, Central State University, University of Cincinnati, and Wilberforce University.
- A Geospatial program (Earth Science SE) began in Ohio in 2002 with OSU faculty, Drs. N. Watermeier and B. Slater, with a workshop for faculty and students on geospatial and remote sensing applications (Earth Science SE). Both faculty are OSGC’s representatives on the National SG Geospatial program (also funded under Higher Education).
- Initiation of Remote Sensing (RS) OSGC research program (Space Science SE) with NASA SSC by Dr. A. Agrawal, Wright State University, and 2 students spending a semester at SSC for research. Dr. Agrawal is the OSGC representative to the National RS program.
- Research papers are sent to William Saettel (GRC Tech Tran. Office) for NASA follow up.
- OSGC advertises and distributes GSRP and NASA Intern applications, yearly sponsors a student to the NASA Academies, and its website is linked to all NASA pages.

### Impact/Results

OSGC has been successful in developing research infrastructure to promote activities supporting the NASA space grant strategic plan and the strategic enterprises in Ohio. The seed grants discussed above have “seeded creativity” in helping faculty to develop in the areas of aerospace technical expertise, collaboration with NASA and AFRL, and in obtaining additional research funding. The increased funding is critical to their research and to their expertise in graduate student mentorship at this early part of their research career. OSGC has begun new initiatives in university/industry seed grants and faculty/student/industry intern programs. OSGC programs have led to new research and academic courses in remote sensing, geospatial technology, and in teaching the physics of satellites to students. The program is strong, but additional funds are needed for more faculty to receive grants in the research infrastructure area.

Further information on grants awarded in the Research Infrastructure area is in the yearly budget proposal narratives.

## HIGHER EDUCATION PROGRAM

### Description

The purpose of the OSGC *Higher Education Program* is to stimulate excitement about NASA and aerospace studies/applications among university faculty and students at the undergraduate and community college level. The goal is to accomplish this in a manner that increases the NASA visibility on each campus and increases the internal collaborations between engineering, science and education faculty and externally with NASA. OSGC's major effort in higher education is the OSGC Seed Grant program whose purpose is to "seed creativity". Grants are given for development of new interdisciplinary courses, instructional technology, precollege teacher training, and partnerships with informal education organizations. Participation of women and underrepresented minorities and persons with disabilities is stressed in both grant awards and as participants. This grant opportunity is advertised on all affiliate campuses, and also on the OSGC website from which applications can be downloaded. Over the past 4 years, OSGC utilized an average of \$21.85K per year of National Space Grant Funds (4.6%) and a total funding of \$55.46K per year (3.84%) for its efforts in Higher Education.

### Core Criteria

The Seed Grant program focuses on proposals for aerospace-related educational programs and activities, including curriculum development, design, and implementation of new courses or enhancement of existing courses at the university, college or community college level. Proposals where principal investigators from different disciplines and/or different universities or colleges collaborate are encouraged. Of particular interest is collaboration among education and engineering/science faculty to enhance the science methods classes for preservice (precollege) teachers by incorporation of NASA aerospace materials and resources. A desired outcome is a NASA-related program, activity, or course materials/syllabus that can be used by faculty at other institutions. Since 1998, OSGC has maintained these Seed Grants at a level up to \$2,500, except for exceptional awards. The table below shows the number of Seed Grants awarded in the last 5 years. All grants require an equal amount of university matching funds and no indirect costs. OSGC feels that the program has been successful, and that increased benefits will result from the program as universities increase the number of interdisciplinary classes.

### OSGC HIGHER EDUCATION SEED GRANTS 2001 – 2005

2001			2002		
No.	OSGC	Match Funds	No.	OSGC	Match Funds
2	\$8,264	\$74,462	6	\$76,664	\$87,500

  

2003			2004		
No.	OSGC	Match Funds	No.	OSGC	Match Funds
6	\$226,460	\$260,720	6	\$89,971	\$125,253

Representative grant titles are:

- “GLOBE at CSU”, Ruth Bombaugh, Cleveland State University. [Incorporation of GLOBE program and aerospace material into her pre-service teacher methods class.]
- “Smart Engineering Structures”, Gambing Song, The University of Akron. [New engineering course with syllabus for distribution to other institutions.]
- “A Pilot Program for Geospatial Extension in Ohio”, Nathan Watermeier, The Ohio State University [geospatial workshop/materials for Ohio university faculty and students.]
- “The Miami Mission to Mars Project”, Rita Kay Voltmer, Miami University. [project scope/materials to stimulate interest in space science among non-science majors. Dr. Voltmer also received a \$40K NASA IDEAS grant for this higher education project.]
- “Student Satellite University Program”, Mahmoud Abdallah and Augustus Morris, Central State; Trevor Williams, Cincinnati; Ruby Mawasha, Wright State; and Edward Asikele, Wilberforce, to institute student satellite programs on campus. Dr. Mawasha introduced the CricketSat project to 80 Freshmen students at Wright State.

All projects had very sufficient matching funds, and all involved undergraduate students, including females and underrepresented minorities. Other grants are in the OSGC yearly reports. Additional OSGC activities in the Higher Education area include:

- All OSGC affiliate campuses have at least one student OSGC activity per year.
- Providing students and faculty the opportunity to attend the Geospatial Workshop and to implement the material in their engineering and education courses on campus.
- The Annual OSGC Student Research Symposium (discussed in the Fellowships and Scholarships section).
- Supporting students from Ohio Northern University and The University of Toledo to conduct undergraduate microgravity research projects aboard the KC-135 aircraft in Houston, Texas, in March, 1998.
- *2003 Workforce Development Programs Include:* “Student Satellite Programs (\$19,316 each) at: Central State University, University of Cincinnati, Wright State University and Wilberforce University.
- *2004 Workforce Development Programs Include:* “Magnetic Field Investigation of Mars (MIMIC) (\$20K); Continuation of Student Satellite Program (\$38,282)

### Impact/Results

The OSGC is satisfied with the recent effort to increase our activities in the area of Higher Education. A NASA presence is occurring on campuses through many course activities along with lists of available NASA educational materials. The campus representatives are the initiators of these higher education activities, and on one campus a new OSGC scholar is a preservice science teacher. Additional interdisciplinary courses in the preservice teacher area which stress the need for teacher science capability will result with OSGC aid and the leadership of college of education representatives on the Advisory Committee. The Seed Grant program will continue and the resulting course and program additions should prove beneficial to increasing the awareness of students to aerospace technical subjects and NASA contributions. The OSGC strength in this program is the willingness of faculty from different disciplines to collaborate. The only weakness is in the limited funds available for Higher Education. *Further information on grants awarded in the Higher Education area is in the yearly budget proposal narratives.*

## PRECOLLEGE EDUCATION PROGRAM

### Description

The *Precollege Education Program* section is divided into two sub-sections: A) Precollege Outreach and B) K-12 Activities, due to significant activities in both areas. The areas overlap in activities, but because OSGC views Precollege Outreach as primarily in-service teacher training and K-12 as primarily student programs and activities, the discussion below is split into these areas. The goal of the Precollege Outreach education program is to have quality science/aerospace educational programs for in-service teachers (programs for preservice teachers are under Higher Education). The K-12 goal is to have student activities and programs which teach understanding of scientific principles and applications, with an emphasis on NASA-related activities. The objective of both programs is the same and is to improve the overall understanding and capability of both students and teachers in science, engineering, mathematics and technology principles. OSGC supports Ohio local and state systemic education reform efforts. Cooperative partnerships with informal education groups (museums, planetariums, forestry services) are encouraged. As in the other OSGC programs, recruitment of women and underrepresented minorities and persons with disabilities is stressed. The Precollege Education program is OSGC's second largest activity. Over the past 4 years, OSGC utilized a yearly average of \$35.8K (7.54%) of Space Grant funds and total average yearly funds of \$178.31K (12.64%) due to significant matching funds (cash and in-kind) from affiliates, universities, schools, and participants. The programs and activities that OSGC has initiated or have been established through collaborations have been of quality and have had impact.

### *Core Criteria*

#### **A) Precollege Outreach**

OSGC has a widely advertised Seed Grant program for the Precollege Outreach area (normally up to \$2,500, but special programs can receive more) that has proven to be successful. Similar to other OSGC programs, these opportunities are advertised on the OSGC website and are available to be downloaded. This area focuses on aerospace-related proposals for activities, courses, or workshops for in-service K-12 teachers (although preservice student teachers often attend with the consent of their instructors). The proposals can also be for remediation or curriculum modification on the K-12 level, and all programs align with state standards in science, technology, engineering, or mathematics (STEM). The programs or activities can be new, or used for support of existing successful programs. It is expected that the programs will involve university, college, and/or community college faculty from technical and/or educational disciplines as instructors. Collaborative proposals involving a combination of instructors and participants from different institutions are particularly encouraged. Major emphasis is placed on the extent to which the project promotes Ohio's and NASA's education goals and objectives, and also on the feasibility of replicating the project throughout the state. Thus far, we have achieved success in this area, and the interest by teachers in teacher workshops (many provide university credit) is increasing due to new certification requirements. The following table shows the number of Seed Grants awarded in the last 4 years in the area of Precollege Outreach (all grants require an equal amount of university/college matching funds):

**OSGC PRECOLLEGE OUTREACH SEED GRANTS 2001 – 2005**

2001		2002		2003		2004	
No.	SG Total						
4	\$10,611	6	\$29,986	5	\$32,670	4	\$39,000

Representative grant titles are:

- Seed Grant Awarded to Lorain Middle School, NASA Explorer School (First Year of Program), for “Mars, Robotics and Aeronautics” [Supplement technology program at Lorain Middle School with units focusing on robotics and aeronautics.]
- “Science and Math Skills Improvement for Teachers at Inner City High Schools and Migrant Students”, Mark Pickett, The University of Toledo. [Workshop for inner-city teachers who then implement the material in their own classrooms and also to migrant students.]
- “World in Motion II”, Paul Lam, The University of Akron. [Workshop for teachers to learn how to teach this program to their students.]
- “The Earth/Moon/Sun System” and “Expanding Our Horizons”, Pat Kramer, Cincinnati Science Coordinator and Larry Cooper, NASA Office of Space Science. [Series of workshops for teachers to increase knowledge in astronomy and space sciences.]
- “Insights into Astronomy”, Paul Nohr and Anita Howard, Cincinnati Observatory Center. [Workshop on astronomy for 6<sup>th</sup> and 10<sup>th</sup> grade science teachers.]
- “International Space Station (ISS) Educators Workshop”, Wendy O’Toole, WPAFB Educational Outreach Office. [Workshop for 22 Dayton area teachers who then teach an ISS unit to their students in grades 1-10.]
- “Project ASTRO”, Larry Cooper, NASA Office of Space Science. [Multiple workshops for teachers in 4 Ohio cities on this Astronomical Society of the Pacific program.]

OSGC is extremely pleased with the above seed grant results for teacher training programs, and many other Precollege Outreach programs are listed in the OSGC yearly reports. Many of the PIs have used the OSGC seed funding to obtain additional funding from local and state agencies. Mark Pickett at The University of Toledo subsequently received two OBOR Eisenhower Professional Development Program grants for additional programs. Dr. Pickett has been very successful in training teachers at the inner-city schools (over 300 in the 5-year period), in Toledo and Fremont. Using OSGC seed funding, his largest grant was from the U. S. Department of Education for “Getting Early Awareness and Readiness for Undergraduate Programs”, GEAR-UP, total funding of \$7M and inner-city teachers and students are targeted in the program. Similarly, Paul Lam at The University of Akron has instructed over 200 K-8 teachers in the “World in Motion” (WIM II) program. They have subsequently presented the material to over 1,000 students. Finally, during 1998-2002, OSGC contributed to 3 very successful GLOBE workshops attended by 162 teachers. OSGC has obtained a GLOBE franchise in collaboration with the Cuyahoga Valley Environmental Education Center (CVEEC) (Harley Beale) and Cleveland State University (Ruth Bombaugh). The OSGC funds are leveraged by OBOR Professional Development Program grants. Finally, OSGC submitted a successful proposal to the Aerospace States Association (ASA) for funding to support 3 teachers attending the Colorado Space Initiative Conference for Education. OSGC is studying methods to implement the most successful programs throughout Ohio.

**B) K-12 Activities**

The grant program for the K-12 area is the minigrant, usually for up to \$1,000, although the amount can be increased for special projects. These grants are given to K-12 teachers for activities with their students involving science, technology, engineering, mathematics (STEM) or computer projects demonstrating space-related interests and meeting the goals of the Ohio consortium to contribute to the National Space Grant Program. These grants are widely advertised to the Ohio K-12 teachers by the OSGC website, teacher list-servers in districts that have them, teachers union magazine and the state science teacher newsletter, and by providing flyers to science coordinators at resource centers and planetariums. Email distribution is now the most used method. As with all OSGC grants, projects require at least equal matching funds, which is very often exceeded. Major emphasis is placed on student science and technology opportunities, curriculum development, programs targeting underrepresented and underserved groups, the extent to which the project promotes Ohio’s education goals and objectives, and also on the feasibility of replicating the project throughout the State. The following table shows the number of minigrants awarded in the last 5 years:

**OSGC K-12 MINIGRANTS 2001-2005**

2001		2002		2003		2004	
No.	SG Total						
14	\$10,035	12	\$9,825	13	\$9,935	28	\$40,318

Representative grant titles are:

- “A Celebration of Spectacular Space Science”, Lois Klamer, Jamison CompuTech, Cleveland. [Involves a space camp week with many students, teachers, and activities. Many funding sources provide excellent leveraging of funds.]
- M.A.R.S. (Moving at Remarkable Speed), Kathleen Carpenter, Ada Exempted Schools, Ada. [Research and knowledge of flight to include Space—specifically, exploration of Mars.]
- “Discover Math and Science”, Karen Linser, Straight School, Zanesville. [Team of teachers for 64 multi-handicapped students from grades 2-8. The teachers find math and science software to be a valuable aid in enabling these students to learn these subjects.]
- “ARIES Traveling Astronomy Program”, Richard Shea, Rogers High School, Toledo. [High school students are trained in 6 different astronomy programs and then present the programs at K-8 schools].
- “Deeper Into Inner Space”, David LeBrun, Fairview High School, Fairview Park. [30 AP biology students will study structure and organization of living things from all five kingdoms at the cellular level.]
- “Physics-Interactive Lecture Demonstrations”, Sharon Wallace, Buckeye High School, Rayland. [Learning of physics principles by implementing microcomputer based laboratories with interactive lectures.]
- “The Spring Nighttime Sky in Northeast Ohio: Stars, Constellations, and Planets”, Sandra Ammon, Jane Addams Business Careers Center, Cleveland. [Students will learn about 5 circumpolar constellations, major stars that comprise them and the constellations.]

All materials/supplies purchased with minigrant funds are labeled with the OSGC logo. OSGC has experienced many successful minigrant activities as discussed in the yearly OSGC

reports. Teachers put their full effort into making their programs innovative and instructive. Minigrants have been awarded to teachers in 15 of the 18 Ohio congressional districts.

OSGC has three special ongoing programs:

(1) The OSGC is the major sponsor of the highly regarded B-WISER (Buckeye Women in Science, Engineering and Research) program which is held at The College of Wooster every June. Approximately 100 seventh grade girls attend this 1-week camp and receive instruction in science, mathematics, computers, etc., from 13-15 award-winning Ohio K-12 teachers. A follow-up day in November emphasizes science, engineering, and math courses of study in high school and college (82% of the students take high school science and math courses, and approximately 36% major in technical areas in college). This program was praised by then Ohio Governor George Voinovich (now U. S. Senator Voinovich) as being truly outstanding. OSGC faculty and NASA summer interns help in the program, which receives extensive newspaper, radio and television publicity. The OSGC funds are highly leveraged.

(2) OSGC has a partnership with Sandra Preston of the StarDate program at the McDonald Observatory at The University of Texas (CDs containing NASA space activities are being distributed monthly to approximately 50 Ohio teachers for use in their classrooms) and

(3) OSGC has collaborated each year with Space Explorers, Inc., in De Pere, Wisconsin, for successful space-related programs (Moonlink®, NEARlink®, Marslink® and Mission: Solar System (M:SS)). These programs have been effective. A special geospatial proposal with Space Explorers has been proposed to Rep. Ralph Regula (R-16-OH).

#### **Impact/Results**

OSGC has a very good program in the Precollege Education area, as described in the sections above and as evidenced by the large amount of matching funds. We are continuing to form partnerships, particularly with NASA GRC, and with organizations that will enable increasing the number of successful programs in Ohio. The program could blossom further, particularly in the Precollege Outreach (teacher workshop) area with additional funds. Establishment of the present program has resulted from considerable efforts by the OSGC office and the campus representatives, and all programs in both areas are well attended and promote the STEM objectives in Ohio. *Further information on grants awarded in the Precollege Education area is in the yearly budget proposal narratives.*

### **PUBLIC SERVICE PROGRAM: GENERAL PUBLIC AND EXTERNAL RELATIONS**

#### **Description**

The OSGC *Public Service Program* conducted during the last 4 years in *General Public* used an average of \$4.8K per year of Space Grant funds (1.6%) and total funding of \$30.19K (2.2%) directed to this area. In *External Relations*, the corresponding amounts are \$2.86K of Space Grant funds (0.96%) and \$14.54K (1.06%) of total funds. The purpose of this Public Service program is to provide and sponsor aerospace-related programs and activities for "students of all ages and professions." The objective for these programs is to stimulate interest in and understanding of scientific and technical disciplines and promote lifelong learning. The goal is to have quality programs throughout Ohio, attended by many citizens, which communicate information about NASA research, technology and enterprises. OSGC has both Seed and Minigrant programs in the area of Public Service. OSGC sponsored and/or contributed to a large number of programs/activities from 2001-2005 and has established many networking cooperative extension activities and partnerships with informal education groups. Programs for participation of females, underrepresented minorities, and disabled are stressed. A number of

these programs are listed below.

### Core Criteria

#### *General Public:*

- OSGC contributed towards the *African Americans in Space Science* exhibit and outreach materials (PI, Larry Cooper, OAI and OSGC, and Co-PI, Dr. Willie Mackey, NASA GRC). This exhibit has been at NASA, schools and other Space Grants, etc.
- OSGC, in collaboration with The Ohio State University (OSU) Department of Physics and the Center Of Science and Industry (COSI), digitized planetary data for an interactive COSI exhibit. This garnered very positive public relations for NASA and OSGC.
- Seed grant funding to the Lucas County Educational Service Center to establish a Challenger Learning Center, in Oregon, Ohio. This facility will open in Fall, 2003, and will prove to be an extremely valuable cooperative extension partner.
- Seed grant funding for an Interactive Science, Space, Aeronautics Center for Education (iSPACE) program in Cincinnati for over 200 students and parents for a robotics competition (with WPAFB Educational Outreach Office-an informal education partner).
- Seed grant funding to the Ohio Mathematics and Science Coalition (William Steenken) for efforts to improve mathematics, science, and technology education in Ohio.
- OSGC provided partial sponsorship towards the AFRL Tech-Trek traveling van containing a scanning electron microscope. The van displays the OSGC-NASA logo.

#### External Relations (other informal education partners):

- Cleveland Museum of African American History (Director Nancy Nolan-Jones). The Museum is the permanent home of the “African Americans in Space Science Exhibit.”
- Cleveland Museum of Natural History (Pam Keiper) hosted two Project ASTRO workshops per year with 40 teachers attending each session.
- COSI (Toledo, Columbus) is a hands-on science center that creates programs and experiences that makes learning science fun through discovery. COSI is a great resource.
- Cuyahoga Valley Environmental Education Center (CVEEC), Cleveland, with whom we have collaborated with to obtain a GLOBE franchise for teachers and the general public.
- Drake Science Center in Cincinnati, which conducts structured visits for teachers, students, and parents (over 20K students annually) in astronomy topics. The Director, Pam Bowers, works closely with OSGC and distributes OSGC public literature.
- Lake Erie Nature and Science Center and the Walter R. Schuele Planetarium (Jay Reynolds, Director), Bay Village, hosted a GLOBE workshop for science teachers and interested general public persons in 2002 and is an active informal education partner.

Other General Public and External Relations collaborations to promote science, technology, engineering, and mathematics (STEM) disciplines have been listed in the yearly OSGC reports. These activities have generated interest in these disciplines as evidenced by the large student and general public attendance at such activities.

### Impact/Results

The impact of the OSGC Public Service program in Ohio has been strong as evidenced by the large amount of matching funds from the affiliates, state government, industry and workshop participants (match of \$64.9K for \$10.4K of Space Grant funds). The quality of the joint programs between OSGC and informal education partners has been very good and OSGC and NASA have received recognition in newspapers, radio and television, and on websites (B-WISER, African American Exhibit, GLOBE, etc.). The goal of these activities is to increase public awareness of aerospace science and to promote STEM disciplines. A second goal was to

make OSGC a very visible NASA representative in Ohio where teachers, students and the general public can seek aerospace and STEM information. These goals have been achieved on a reasonable scale. The strengths of the program are in the success OSGC has achieved in contacting and collaborating with other organizations on quality activities. Improvement in the number of network affiliates, including active industry participation, in all areas of the state, should make possible the vision of an Ohio Public Service Program where activities can be shared and funds leveraged to produce quality STEM activities and programs. *Further information on grants awarded in the General Public and External Relations areas is in the yearly budget proposal narratives.*

In summary, the OSGC has contributed significantly to NASA's overall mission to *Inspire the next generation of explorers . . . as only NASA can.*