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THE FLORIDA SPACE GRANT CONSORTIUM

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1. Introduction

The *Florida Space Grant Consortium* (FSGC) is a voluntary association of Florida universities working in cooperation with affiliated public agencies and private industry to foster an ensemble of interrelated space-related educational and research programs. It is part of a national network of such consortia created in September 1989 by the *NASA Space Grant College and Fellowship Consortium Program*. In the ensuing sections the development of the NASA program and FSGC are described.

Henry Rosovsky, long-time Dean of Arts and Sciences at Harvard, in his recent book, *The University: An Owner's Manual*¹, presents a particularly articulate defense of the role of research and its compatibility with teaching in a university of distinction. This paper, written for presentation at the 28th Space Congress session on *Space Education*, will explore the manner in which space-related research and education programs can and should be inextricably intertwined to their mutual benefit. In particular, programs sponsored by Florida's universities under the rubric of the FSGC are highlighted.

Just as we define education broadly, so too is "space" defined in an inclusive sense. For the purpose of this paper, the term "space" shall include diverse fields of aeronautics and astronautics, remote-sensing, atmospheric sciences, and other fundamental physical and social sciences and technologies, relying on and/or directly impacting space technological resources.

Such is the breadth of NASA's and FSGC's missions.

2. NASA's Space Grant College and Fellowship Consortium Program

The introduction to NASA's RFP for Phase I of this program calls for universities to join them in increasing "the understanding, assessment, development, and utilization of space resources." NASA states that the program shall promote "partnerships and cooperation among universities, federal, state and local governments, and aerospace industries to encourage and facilitate the application of university resources to aerospace and related fields."

The specific program objectives as defined by NASA are:

"To establish a national network of universities with interests and capabilities in aeronautics, space, and related fields;

To encourage cooperative programs among universities, aerospace industry, and federal, state, and local governments;

¹ W. W. Norton, New York, 1990.

To encourage interdisciplinary training, research and public service programs related to aerospace;

To recruit and train professionals, Especially women and under-represented minorities, for careers in aerospace science, technology, and allied fields; and

To promote a strong science, math, and technology educational base from elementary through university levels.*

To accomplish these objectives NASA, in 1989, solicited proposals only from those universities or consortia with an established track record of space-related research.² Their announced intention was to fund twelve universities or preferably statewide consortia. Upon review of the proposals they elected to fund seventeen charter members of the Space Grant Program with a maximum of \$325,000 per annum for five years. The grantees were required to commit a minimum of \$225,000 per annum in matching funds. During FY 90 they secured additional funding to raise the total number of Phase I Consortia to twenty one. The Phase I participants include nearly all of the most populous states. Thus a most ambitious national program serving most of the nation was inaugurated with the modest combined commitment of state, federal, and private resources of approximately \$10 million dollars per annum.

Following in the tradition of the Land Grant and Sea Grant Programs, NASA launched the Space Grant Program in cooperation with the nation's strongest research universities. Note however that the scale of funding of the Land, Sea, and Space Grant programs are in inverse proportion to the size of their respective domains.

In January 1990 the *First NASA Space Grant Conference* was held at Johns Hopkins University at which time an autonomous *Space Grant Directors' Council* was created. By the time of the *28th Space Congress* NASA will have announced the selection of Phase II grantees for smaller awards and representatives from nearly all of the states will have met in Huntsville, Alabama for the *Second NASA Space Grant Conference*. NASA will have met its first program objective.

3. The History and Organization of the FSGC

On February 8-9, 1989 there was convened in Orlando, Florida a *Florida Space Research and Development Workshop* attended by more than 200 university, industry, and government leaders to chart plans to accelerate the development of the state's aerospace R&D activities. The workshop was jointly sponsored by the Astronauts Memorial Foundation's Florida Space Research Foundation, the Florida High Technology and Industry Council and NASA's Southern Technology Applications Center. At that meeting there was established a University Advisory Council to the Space Research Foundation, consisting of the VP's for Research of Florida's twelve major universities with aerospace related programs.

This Council endorsed and encouraged Florida's most well established universities: Florida, Florida A&M, Florida State, and Miami to form an independent *Florida Space Grant Consortium (FSGC)* to represent the State of Florida in the newly established NASA National Space Grant Consortium and Fellowship Program. These four universities were the formal signatories to the successful proposal submitted in June 1989 to NASA.

* A minimum of \$2 million per year in NASA funding for each of FY 86, 87, and 88 was required of Phase I applicants.

The four signatory universities had in AY 88/89 combined FTE undergraduate and graduate enrollments of 49,674, and 12,822, respectively; 5,187 faculty; and separately budgeted federal and non-federal research expenditures of \$214 million and \$126 million, respectively. Among the 5,627 Master's and 1,405 PhD degrees conferred in 436 Masters and 251 PhD programs the aerospace-related PhD program subset includes 61 programs with 5,071 students enrolled, and approximately 550 PhD degrees granted in AY 88/89.

Not all students in these programs were pursuing aerospace-related studies. The 5-year data for the subset of students pursuing aerospace-related PhD studies are:

Aerospace PhD	AY 84/85	AY 85/86	AY 86/87	AY 87/88	AY 88/89	TOTAL
Programs	61	61	61	61	61	
Enrollment	1200	1236	1273	1279	1341	
Degrees	83	93	86	112	112	446

These data understate the scale of the educational programs of the consortium since the Florida Space Grant Consortium consists of twelve affiliated universities all of which are eligible to compete on an equal basis by responding to the RFPs issued as authorized by a *Consortium Executive Board*. In addition to the four signatory members (Florida, Florida A&M, Florida State, and Miami)³ the Universities of Central Florida and South Florida are represented on the governing *Consortium Executive Board*. These, plus Embry-Riddle, Florida Atlantic University, Florida Institute of Technology, Florida International, North Florida, and West Florida are represented on a *Consortium Advisory Council*.

The Consortium Executive Board, chaired ex-officio by the Director, meets on a monthly basis. On alternate months it convenes at the centrally located Orlando Airport. Other meetings are hosted by the affiliates and typically include tours of relevant facilities. In this way we combine the advantages of a centrally located venue of convenience and the goal of building a better understanding of the unique resources that each member of the Consortium brings to the partnership.

The Consortium Advisory Council, currently chaired by Mike Bass of UCF, meets every four months in conjunction with an Executive Board meeting. Council members are high level administrators appointed by their university presidents. Advisory Council and Executive Board meetings are public and enjoy regular participation by representatives from NASA and industrial affiliates.⁴ Day-to-day operations of the consortium are handled by the Consortium Director, Martin A. Eisenberg, and Consortium Administrator, Bill McClure, at the *Program Office* headquartered in the Department of Aerospace Engineering, Mechanics & Engineering Science at the University of Florida.

³ These are the only members for which the above statistics were compiled in preparation of the proposal that led to the formation of the FSGC.

⁴ NASA has designated Bill Martin of KSC as consortium liaison. He and Stan Mosier, representing Pratt & Whitney have played a particularly active role in helping to guide consortium affairs.

4. FSGC Program Structure

The global objectives of the Consortium are to increase the flow of highly qualified and motivated personnel educated for and dedicated to aerospace-related careers and, in the process, to increase public awareness of and informed support for the development of and exploitation of aerospace-related science and technology. The global strategy to achieve these goals is to emphasize interinstitutional cooperation among universities, industries, and agencies, public and private, with significant interests and strengths in aerospace-related efforts, primarily, but not exclusively, located within Florida. Toward these ends, the Consortium designed a number of programs:

- o The Interinstitutional Space Research Program (ISRP) provides seed money for development of extramural funded cooperative research in aerospace-related areas to be conducted by colleagues drawn from different institutions. University -university, -industry, and -private/government laboratory interaction are fostered. Technical quality and promise of the proposed research, and potential for developing long-range cooperative efforts are two key criteria for funding. Under the aegis of the ISRP, research workshops are also sponsored. The emphasis is on grass-roots, researcher-to-researcher cooperative initiatives.
- o The Space Grant Fellowship Program (SGFP), in addition to recognizing, recruiting, and rewarding outstanding scholars, enhances interinstitutional cooperation by coupling Academic Year Fellowships with Summer internships in aerospace-related industries, Kennedy and other NASA centers, and FSGC programs.
- o The Space Assistantship Enhancement Program (SAEP) provides supplemental funding for graduate assistants participating in aerospace-related programs, thereby improving retention rate in key academic programs and providing crucial support for research programs of particular promise.
- o The Undergraduate Space Research Participation Program (USRP), modelled after the highly successful NSF programs but restricted to aerospace-related research, provides superb opportunities for students from throughout Florida (and from historically black institutions in neighboring states) to become actively involved in ongoing research programs. It provides a vehicle for recruitment of under-represented minorities and women into graduate study and careers in a wide variety of aerospace related areas.
- o The Space Education Development Program (SEDP) sponsor several complementary and innovative aerospace-related educational initiatives to: a) Enhance curricular offerings in the above and related areas; b) Develop programs to train a cadre of aerospace-literate K-12 teachers -- via new graduates and continuing education; c) Develop aerospace-related K-12 math and science curricula; d) Develop broadly-based multi-disciplinary undergraduate aerospace-related general education courses; e) Develop systems for communication, replication, and transfer of courses and curricula; and f) Enhance systems for interinstitutional sharing of expertise and resources, and state-wide coordination of aerospace curricular offerings.
- o The Space Lectureship Program (SLP) is designed to recruit lecturers from academia, industry and government labs; and vigorously promote lectures appropriate to K-12 schools, to undergraduate student technical societies, graduate seminars, and to civic groups throughout the State of Florida -- thereby enhancing public understanding of and support for the space program.
- o Through meetings, conferences, and other means of intra- and extra-consortium communications, the Consortium will participate in fora for interaction among the larger community of researchers, educators, industry, governmental leaders, and public concerned with the issues of aerospace science, technology, and policy.

5. Initial Efforts

Created in September 1989, the FSGC devoted the Fall to development of RFPs and governance procedures, By Spring 1990 the first round of programs were funded.

Under the Interinstitutional Space Research Program five projects involved faculty and graduate students from four universities and one corporation in research projects involving diverse topics in single crystal fiber growth, astrophysics, tracking of space objects, stability and control of large space structures, and applications of radiating gas flows to space propulsion. Each project involved multiple PIs bringing diverse expertise to the intrinsically interdisciplinary projects.

Six Space Grant Fellows are engaged in study of diverse topics from astronomy, computer sciences, engineering mechanics, neuroscience, meteorology, and aerospace engineering. Each will be engaging in an externship at a government or industry lab assuring diversity of perspective beyond that offered by the faculty of their home departments.

Nineteen Graduate Research Assistants from four universities are engaged in research in astronomy, atmospheric sciences, climatology, geology, biology, computational fluid dynamics, materials processing and optics, space flight systems, and structural dynamics and control. Most projects have interdisciplinary aspects to them. Among the more intrinsically interdisciplinary projects are those associated with the NASA CELSS Project, biosphere atmospheric modelling astronomical effects on global sea levels, and materials processing in reduced gravity environments.

Twenty Four undergraduate students from six universities worked on Undergraduate Space Research Participation Program sponsored research projects in an even more diverse range of subjects. For many students the research was carried on under the mentorship of faculty from departments other than their own. All students were forced to stretch their horizons, learn to work in ongoing team projects and integrate knowledge gained from numerous courses. In addition to their work on individual projects each student was invited to attend the Florida Space Conference during which they were exposed to diverse issues on subjects related to the general theme of space commercialization.

The Space Education Development Program sponsored four projects oriented toward development of competencies of K-12 teachers in aerospace related subjects. For all such teachers the subject matter represented an extension of their competency in dealing with interdisciplinary applications of their subject specializations.

The Space Lectureship Program under the leadership of Ron Thornton, Director of NASA's Southern Technology Applications Center, and relying on STAC's professional staff, delivered lectures to more than 3,000 K-12 students throughout Florida on interdisciplinary space-related subjects.

Each of the above programs as implemented in the first year had a primary impact on addressing the needs of faculty (ISRP), PhD candidates (SGFP), graduate student support (SAEP), undergraduate students (USRP), K-12 teachers (SEDP), and K-12 students (SLP). But note that each has significant effects on other members of the community.

The whole range of scholars in the pipeline were affected by these programs. As intrinsically significant as university research may be, its greater long-term value lies in the unifying thread that it provides to the process of human resource development. Students and teachers sharing the intellectual challenges and joys of exploring the unknown is the hallmark of both research and first rate education. Our continued technological competitiveness depends on expanding research/education opportunities such as those described above.

6. Plans for the Future

In the Florida Space Grant Consortium a second round of grants for the above programs will have been funded by April 1991 and the first year grants nearing completion. Besides fine tuning the programs one significant shift in emphasis has been made. In Year-1, the Space Education Development Program concentrated on K-12 teacher workshops, in Year-2 we have shifted our focus on university education and are now developing plans for a Florida workshop on aerospace-related curricular and course development to be held in Cocoa Beach in October 1991.

As you review the progress briefly summarized in the preceding sections, note that the entire budget devoted to meeting these needs for the State of Florida was \$550,000 of which \$225,000 was diverted from existing university resources. No new state funds were allocated. The FSGC has embarked on a program that can not long be sustained at current levels of funding. This scenario is being played out in every large Space Grant Consortium in the country.

From the experiences gained in the Florida Space Grant Consortium during the first full year of operation and from the insights gained via the Space Grant Directors' Council in which my Director peers from throughout the country have freely shared their experiences, the following facts are manifest:

- a) NASA, in forming the Space Grant Program, has struck a sympathetic chord. The Program is directed toward addressing urgently felt and widespread needs. It is on target.
- b) NASA has succeeded in coopting human and fiscal resources far in excess of the mandated cost sharing. Therein lies its greatest success and, paradoxically, its greatest weakness.
- c) If the Florida experience is representative, and I believe it is, the devotion of managerial expertise and human resources by the State is disproportionate to the cash value of the grant. For example, there is no way that we can justify on fiscal grounds, the monthly meeting and extended travel by six VP or Associate VPs to oversee and plan the operations of a Consortium that receives \$325,000 in new federal funds. The nation's universities' leaders and the consortium directors are devoting their personal efforts in recognition of the importance and urgency of the job.
- d) The level of effort being devoted by the State Consortia is therefore a collective act of faith -- faith that eventually there will be developed resources appropriate to the perceived need.
- e) That collective faith will result in collective disillusionment if the Federal Government does not in the near future increase the level of funding for the Space Grant Program by a factor of ten.

The National Space Grant Program is off to a great start. It has captured the energies of the nations major research universities. The current low level of funding is good for it tests commitment and inhibits waste. We are experimenting in the development of programs at the proof-of-concept level. For the reasons stated above, continued funding at this level will be disastrous.