James Madison University

Final Activity Report:

CaTs Lab

Grant # NAG-1-2155

CHAOS and Thermal Sciences Laboratory

by

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to

The NASA Langley Research Center

CaTs GRANT:

FINAL ACTIVITY REPORT

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The CHAOS and Thermal Sciences Laboratory (CaTs) at James Madison University evolved into a noteworthy effort to increase minority representation in the sciences and mathematics. Serving ten students and faculty directly, and nearly 50 students indirectly, CaTs, through recruitment efforts, workshops, mentoring programs, tutorial services and research and computational laboratories, fulfilled its intent to initiate an academically enriched research program aimed at strengthening the academic and self-actualization skills of undergraduate students with potential to pursue doctoral study in the sciences. The stated goal of the program was to increase by 5% the number of enrolled mathematics and science students into the program. Success far exceeded the program goals by producing 100% graduation rate of all supported recipients during its tenure, with 30% of the students subsequently in pursuit of graduate degrees. Student retention in the program exceeded 90% and faculty participation exceeded the three members involved in mentoring and tutoring, gaining multi-disciplinary support. Aggressive marketing of the program resulted in several paid summer internships and commitments from NASA and an ongoing relationship with CHROME, a nationally recognized organization which focuses on developing minority students in the sciences and mathematics. Success of the program was only limited by the limited fiscal resources at NASA which resulted in phasing out of the program.

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Executive Summary

Introduction

Since its inception and successful implementation in 1997 at James Madison University, the CHAOS and Thermal SciencesLaboratory (CaTs) funded by the NASA Langley Research Center is evolving into one of the University's premier and exemplary efforts to increase minority representation in the sciences and mathematics. Serving ten (10) students and faculty directly

and almost fifty (50) students indirectly, CaTs, through its recruitment efforts, workshops, mentoring program, tutorial services and its research and computational laboratories has marked the completion of its support from NASA totaling more than $140,000. Beginning as an innovative academic research and mentoring program for underrepresented minority science and mathematics students, the program now boasts a constituency which consists of 100% graduating seniors in the spring of 2000 with 20% planning to go to graduate school. The program's intent is to initiate an academically enriched research program aimed at strengthening the academic and self actualization skills of undergraduate students with the potential to pursue doctoral study in the sciences. The program provides financial assistance, academic enrichment, and professional and personal development support for minority students who demonstrate the potential and strong desire to pursue careers in the sciences and mathematics.

James Madison University was awarded the final $100,000, in April 1999 , by The NASA Langley Research Center for establishment and support of its CHAOS and Thermal SciencesLaboratory (CaTs). This support enabled the CaTs program to initiate and continue the stellar achievments and maintain the distinction of excellence which has characterized it throughout its implementation..

Activities Timeline

Current Status

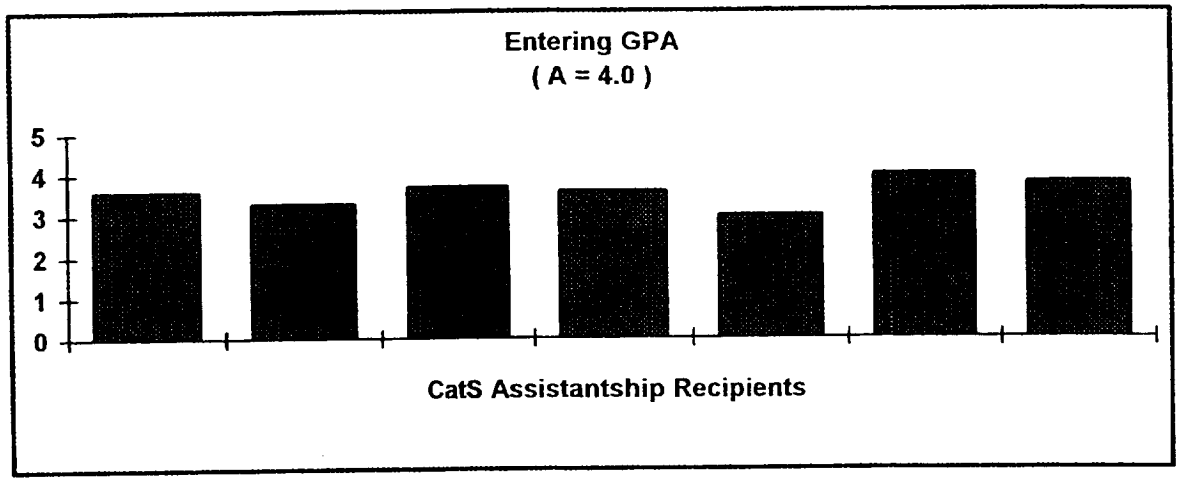
In April 1998, James Madison University received a $25,000 first installment from The NASA Langley Research Center for support of the*second year* of the CATS program. The enrollment constituency of the program in this first year, resulting from long term recruitment efforts which have been ongoing and continuous since the program's implementation, have resulted in a pool of seven highly talented science and mathematics students who are primarily sophomores, juniors and seniors. Ninety percent (90%) of these CATS recruits are full scholarship recipients while the remaining ten percent (10%) African-American science majors were awarded book and instructional supplies awards for the 1998-1999 academic year. It is important to note that approximately fifty percent (50%) of the current *fully-awarded* program participants are seniors with about fifty percent (50%) of that total slated to graduate in the Spring of 2000!

Advisement, consultation, academic review and evaluation sessions were held with the continuing recipients at the end of the spring 1999 semester and another was held at the beginning of the Fall 2000 session with the Program Director, Faculty Mentors, and CaTs support staff. for the new recipients to acquaint them with the Laboratory and the purpose and

expectations of the program. The students were afforded an opportunity to meet assigned faculty mentors and other scholarship recipients. Below is the grade point average (GPA) distribution of the seven (7) *inaugural* CATS awardees in the Fall 1997 semester. Evidently, from the graphs, the entering GPA academic measure is indicative of the quality of the program participants. We attribute this measure to the academic support in the form of tutorial service, computer aided study and review support, as well as early identification of good recruits through successful marketing of the CATS program.

1998-1999 Research Assistantship Recipients

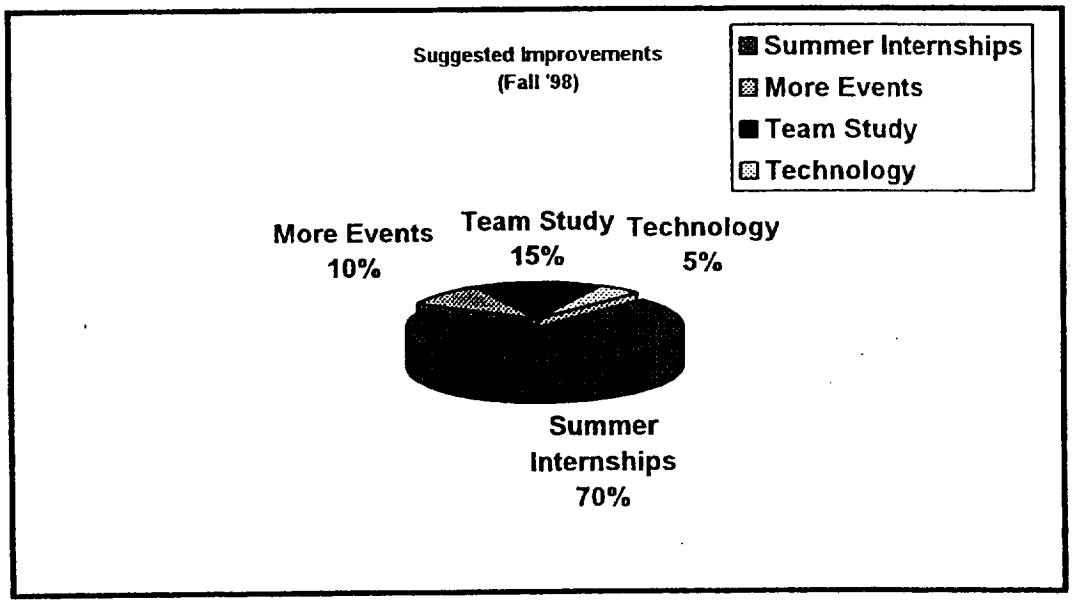
(Mean GPA = 3.4/4.0)



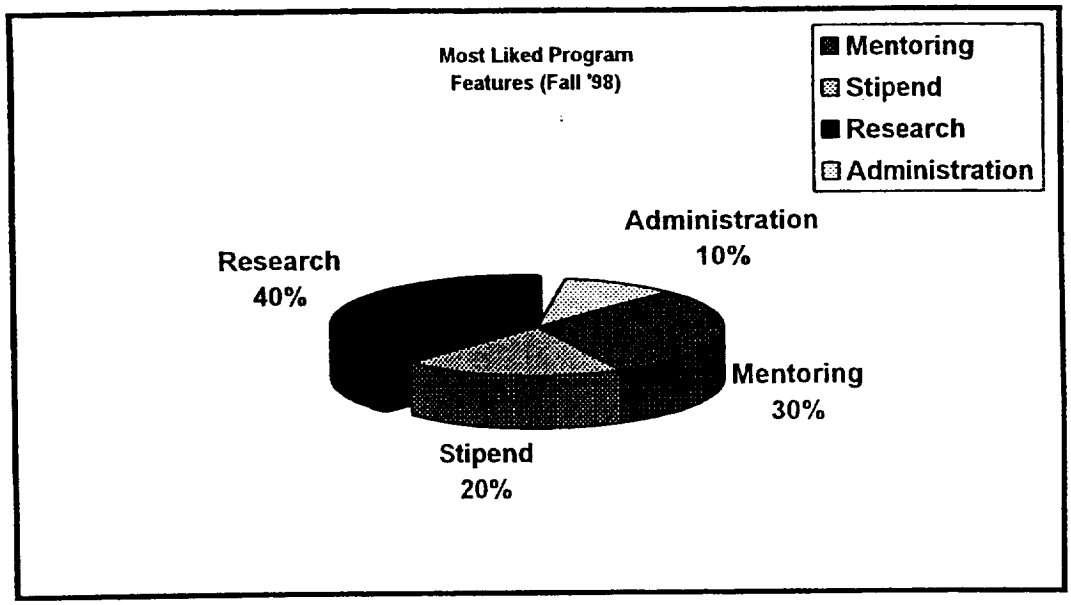
Clearly, all of the recipients are maintaing above average status. This is especially significant for the sophomores in the program since numerous studies indicate that the freshman to sophomore transition year is the most probable period of attrition.

Minority student retention in the sciences and mathematics hinges largely upon participation in the research and discovery process which many studies have shown is *essential* to nurturing and sustaining interest in these critical disciplines and is necessary to the successful encouragement of students to consider and subsequently enroll in graduate programs in these areas. Because of the immense value of providing minority students with *early research experiences and more substantive training*, the program Director has aggressively sought academic year and summer

science internships, and succeeded in placing several CATS students in *paid summer internships* with such agencies as the National Aeronautics and Space Administration (NASA) and the Environmental Protection Agency (EPA). Many other CATS students conduct research during the academic year in their various departments. These research internships will not only become part of the formal instructional program, but will also be developed as outreach and enrichment projects. They will improve the range of research opportunities for minority undergraduate students, and, along with those provided by industry and national laboratories, will supplement the variety of research internship programs that currently complement academic opportunities. Results obtained from a student evaluation questionnaire, graphically indicated below, show that *summer internships were the most desired component of the program which the students felt was lacking.*



However, almost *forty percent* of the respondents felt that research was the most informative and rewarding aspect of the program.



Workshops are also held to keep CATS students informed of secured summer internships, new and available CO-OP programs, and to upgrade their professional interviewing and marketing skills. Dissemination of graduate school information along with the expectations and requirements for successful matriculation into graduate school are continuously emphasized at these workshops

JMU has made a major commitment to its science, mathematics and technology programs, which are now supported by an infrastructure and modern facilities, including a new $18 million multi-story science and technology complex first occupied in Fall 1997, housing Integrated Science and Technology (ISAT) (with programs in engineering and manufacturing, energy, biotechnology, information and knowledge management, and environmental science) and Computer Science. JMU has also has received approval to construct a $23 million interconnected science building that was completed in 1999 which will house the Geologic Information Center, Health Sciences, Nursing, Communication Sciences and part of ISAT. This arrangement promotes great cross-disciplinary interaction among faculty and students in research and affords excellent curriculum development.

The Fall 1998 semester commenced with the CaTs program being partially housed in the new science complex! The new, much larger, research lab has been also computer equipped,

including state of the art software, reference materials and audio/visual aides designed to facilitate instruction and learning in science and mathematics. Being centrally located in the same building where *all mathematics and science faculty are housed,* will also provide convenient access to an atmosphere conducive to study and research.

The following sections provide a detailed outline of accomplished activities and objectives for The NASA Langley Research Center Grant by James Madison University during the period of May 1, 1998 through December 31,2000. A detailed budget has been included for expenditure of funds during the same period.

Research and Faculty Development

Synopsis of Activities and Accomplishments

- The multi-year research grant award from the NASA Langley Research Center provided core funding for the establishment and implementation of the JMU Thermal-Structures and Materials Testing Laboratory (CaTs). Ongoing development of CaTs has resulted in:
  - Refurnishing one of the old CISAT modular trailers with modern computational tools for the purpose of establishing the Computational Sciences and Engineering Division of CaTs.
  - Established and awarded the CaTs Undergraduate Research Assistantship. Five (5) new financial aid packages for CISAT/ ISAT underrepresented women and minorities students in science were created. The total amount awarded for the Fall 1998 and Spring 1999 academic year was $16,000.
  - Established the CaTs (paid) Summer Research Internship that supports ISAT students conducting summer research at JMU.
  - ISAT Research infrastructure enhancement through equipment purchases.
  - Faculty research and curriculum development. One of CaTs's funded researchers (Joe Blandino) successfully defended his doctoral dissertation proposal that was approved his UVA thesis committee.
  - Submitted a research paper for publication to the American Journal of Physics.

- Have began writing a book highlighting past and current research with emphasis on new approaches to solving fundamental problems in physics and engineering.

- Consistent with the objectives of the research grant from NASA Langley to JMU to establish and implement the CaTs Lab, the Lab's outreach plan, in part, calls for establishing a formal liaison between research institutions and centers external to JMU. This phase of the outreach plan has initially involved:

- The CaTs Director and Senior Researcher, Dr. Anthony A. Teate, along with two of CaTs's undergraduate researchers also visited the Georgia Institute of Technology to explore graduate school opportunities in the Materials Science and Computer Science Divisions. Dr. Teate has been invited to give a series of seminars on recent observations of Thermally Induced Stochastic Resonance in Mechanical Beams by CaTs researchers.

- Invited to give paper at the fourth annual conference for African-Americans in Mathematical Sciences (Houston, TX - June 1998).

- Established a research liaison with Merck Pharmaceuticals researcher to investigate nonlinear stochastic phenomena in science and engineering.

- Invited to give a paper at Lucent Technologies (Bell Laboratories), Murray Hill, NJ.

Student Research and Development

Tabular Delineation of Accomplished Activities

ACTIVITY	DATE ACCOMPLISHED	STATUS OF ACTIVITY
Establishment and support of the CHAOS and Thermal Sciences (CaTs) Lab	April 98-December 1999	Completed.. CaTs is located in one of the CISAT modular trailers with modern computational tools for the purpose of supporting its Computational Sciences and Engineering Division. CaTs also has its thermal vibration lab in the main CISAT building.
Prepare and distribute guidelines for awarding research assitantships.	September , 1998	Completed. 1998 -1999 funding provided sufficient resources to recruit five new applicants already enrolled at JMU, one matriculatiing student, and one graduate student..

ACTIVITY	DATE ACCOMPLISHED	STATUS OF ACTIVITY
Review academic performance of already enrolled students. Assist the students in processing new applications for assistantship awards for 1998-99.	September 1998	Completed. The seven(7) new inaugural awardees have been processed for continuing support for the 1998-1999 Academic Year (AY).
Notification of all selected students for scholarships and stipend awards.	September 1998	Completed. As of September 15, 1998 all new recipients were notified of their awards. 100% accepted! One alternate was awarded as a result of a withdrawal from the first group.
Orientation Session with inagural scholarship recipients.	September 1998, January 1999	Completed. Two orientation sessions were planned with the new recipients. .
Plan research mentorship program for faculty/student for 1998-99.	March 1, 1998 - September 1, 1999	Ongoing. one (1) CaTs recipients have been placed in summer research internships with NASA. Support from NASA Langley permitted research to be conducted by two (2) students JMU during the summer.
Maintain on going assessment of student and faculty participation in program activities.	September 1,1997 - April 30, 1999	Ongoing. Student/Faculty participation will be measured through the, workshops, research, tutoring, mentoring, etc.
Prepare and distribute for completion by faculty and student participants assessment/evaluation forms for the programs.	September 1,1997 - April 30, 1999	Ongoing. Evaluation forms have been distributed and collected from students for the Fall semester. Statistical results will be reported in the Annual Report.
Prepare evaluation/progress report for submission NASA LaRC	May 1999 or as requested by agency	FINAL REPORT.

Program Evaluation

Evaluation Plan

Evaluation of the program has been continuous. Each activity held has been evaluated, and the program was evaluated every six months to determine the extent to which the objectives and anticipated outcomes have been achieved. **Due to NASA budget cuts, the program was not re-funded funding for its final implementation phase**. Not withstanding. The program objectives have met with considerable successand has produced a 100% graduation rate of all supported recipients during its tenure with 30% of the students currently pursuing graduate degrees.

Accomplished Objectives

Some salient features of the assessment and evaluation of the program which will provide the basis for planning for the following year deserve comment. The general evaluation plan for evaluation of the program objectives and their current status are showing considerable success. The program has seen increased enrollment of matriculating African-American freshmen in the sciences and mathematics. The program served seven (10) students directly and more than 40 indirectly through recruitment, research and workshops. This *far exceeds* the program's goal of increasing by 5% the number of currently enrolled mathematics and science students into the

program and *is limited only by the limited resources of the program.* Student retention in the program has exceeded 90% and faculty participation has not only exceeded the three (3) members involved in mentoring/tutoring and faculty development, but indeed has been truly multi-disciplinary in support! Finally, aggressive marketing of the program has resulted in the development of several paid summer internships and commitments from the National Aeronautics and Space Administration , and a developing relationship with CHROME, a nationally recognized organization which focuses on developing minority students in the sciences and mathematics..

It is unfortunate that buget cuts at NASA has resulted in phasing out the program.