

22:55:13

OCA PAD AMENDMENT - PROJECT HEADER INFORMATION

07/24/92

Active

Project #: E-25-542 Cost share #: E-25-221 Rev #: 2
Center # : 10/11-6-P5087-0A0 Center shr #: 10/11-1-C5087-0A0 OCA file #:
Contract#: USE-915389 Mod #: ADM REV Work type : INST
Prime # : Document : GRANT
Contract entity: GTRC

Subprojects ? : N CFDA: 47.071
Main project #: PE #: N/A

Project unit: MECH ENGR Unit code: 02.010.126
Project director(s):
COLTON J S MECH ENGR (404)894-7407

Sponsor/division names: NATL SCIENCE FOUNDATION / GENERAL
Sponsor/division codes: 107 / 000

Award period: 910415 to 930930 (performance) 931231 (reports)

Sponsor amount	New this change	Total to date
Contract value	0.00	85,250.00
Funded	0.00	85,250.00
Cost sharing amount		85,250.00

Does subcontracting plan apply ? : N

Title: UNDERGRADUATE LABORATORY IN COMPOSITES MANUFACTURE AND TESTING

PROJECT ADMINISTRATION DATA

OCA contact: Mildred S. Heyser 894-4820

Sponsor technical contact Sponsor issuing office

KAREN L. FRAIR THOMAS G. NOEL
(202)357-7051 (202)357-9602

NATIONAL SCIENCE FOUNDATION NATIONAL SCIENCE FOUNDATION
1800 G STREET, N.W. 1800 G STREET, N.W.
WASHINGTON, D.C. 20550 WASHINGTON, D.C. 20550

Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : N/A NSF supplemental sheet
Equipment title vests with: Sponsor GIT X

Administrative comments -
TO CORRECT DELIVERABLE SCHEDULE



GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 07/20/93

Project No. E-25-542 _____ Center No. 10/11-6-P5087-0A0_

Project Director COLTON J S _____ School/Lab MECH ENGR _____

Sponsor NATL SCIENCE FOUNDATION/GENERAL _____

Contract/Grant No. USE-915389 _____ Contract Entity GTRC

Prime Contract No. _____

Title UNDERGRADUATE LABORATORY IN COMPOSITES MANUFACTURE AND TESTING _____

Effective Completion Date 930930 (Performance) 931231 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	_____
Final Report of Inventions and/or Subcontracts	N	_____
Government Property Inventory & Related Certificate	N	_____
Classified Material Certificate	N	_____
Release and Assignment	N	_____
Other _____	N	_____

Comments EFFECTIVE DATE 4-15-91. CONTRACT VALUE \$85,250. _____

Subproject Under Main Project No. _____

Continues Project No. _____

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Management	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other CARL BAXTER-FMD _____	Y
FRED CAIN-OOD _____	Y

Georgia Tech

THE GEORGE W. WOODRUFF SCHOOL OF
MECHANICAL ENGINEERING

June 14, 1993

Georgia Institute of Technology
Atlanta, Georgia 30332-0405
USA

Dr. Karen Friar
USEME/EHR
National Science Foundation
1800 G St., N.W.
Washington, DC 20550

Dear Dr. Friar:

Enclosed please find the final report for ILI grant USE-9151389: Development and Upgrading of the Laboratory in Composites Manufacture and Testing. I would like to thank you and the NSF for funding this project. It has greatly improved the course and has had additional benefits in our curriculum. Other courses have used the equipment for their students, undergraduate and graduate students are performing research on the equipment, and local industry has utilized the equipment to test out ideas. The results of this grant have positively impacted education at Georgia Tech.

Sincerely,

Jonathan S. Colton
Associate Professor and
Woodruff Faculty Fellow

**NATIONAL SCIENCE FOUNDATION
1800 G STREET, NW
WASHINGTON, DC 20550**

**BULK RATE
POSTAGE & FEES PAID
National Science Foundation
Permit No. G-69**

PI/PD Name and Address

NATIONAL SCIENCE FOUNDATION FINAL PROJECT REPORT

PART I - PROJECT IDENTIFICATION INFORMATION	
1. Program Official/Org.	Karen Friar / USEME/EHR
2. Program Name	ILI
3. Award Dates (MM/YY)	From: 4/91 To: 9/93
4. Institution and Address	Georgia Tech Research Corp. Georgia Institute of Technology Atlanta, GA 30332-0420
5. Award Number	USE-9151389
6. Project Title	Development and upgrading of the Laboratory in Composites Manufacture and Testing

**This Packet Contains
NSF Form 98A
And 1 Return Envelope**

NSF Grant Conditions (Article 17, GC-1, and Article 9, FDP-11) require submission of a Final Project Report (NSF Form 98A) to the NSF program officer no later than 90 days after the expiration of the award. Final Project Reports for expired awards must be received before new awards can be made (NSF Grants Policy Manual Section 677).

Below, or on a separate page attached to this form, provide a summary of the completed projects and technical information. Be sure to include your name and award number on each separate page. See below for more instructions.

PART II - SUMMARY OF COMPLETED PROJECT (for public use)

The summary (about 200 words) must be self-contained and intelligible to a scientifically literate reader. Without restating the project title, it should begin with a topic sentence stating the project's major thesis. The summary should include, if pertinent to the project being described, the following items:

- The primary objectives and scope of the project
- The techniques or approaches used only to the degree necessary for comprehension
- The findings and implications stated as concisely and informatively as possible

See Attached

PART III - TECHNICAL INFORMATION (for program management use)

List references to publications resulting from this award and briefly describe primary data, samples, physical collections, inventions, software, etc. created or gathered in the course of the research and, if appropriate, how they are being made available to the research community. Provide the NSF Invention Disclosure number for any invention.

See Attached

I certify to the best of my knowledge (1) the statements herein (excluding scientific hypotheses and scientific opinion) are true and complete, and (2) the text and graphics in this report as well as any accompanying publications or other documents, unless otherwise indicated, are the original work of the signatories or of individuals working under their supervision. I understand that willfully making a false statement or concealing a material fact in this report or any other communication submitted to NSF is a criminal offense (U.S. Code, Title 18, Section 1001).

	6/14/93
Principal Investigator/Project Director Signature	Date

IMPORTANT: MAILING INSTRUCTIONS

Return this *entire* packet plus all attachments in the envelope attached to the back of this form. Please copy the information from Part I, Block I to the *Attention block* on the envelope.

PART II - SUMMARY OF COMPLETED PROJECT

This project purchased a filament winding machine and an ultrasonic non-destructive testing system for incorporation into an undergraduate course in composites manufacture and testing. The equipment was industrial scale and quality. Laboratory experiments were developed that posed open-ended problems, yet in a directed manner. The filament winding experiment required the students to wind a specific pattern onto a mandrel, yet the processing conditions were determined by the students. Similarly, the students were required to inspect the parts that they had made during the course, yet they had to determine the testing parameters.

The filament winding machine purchased was an EnTec PW-18. This is a computer controlled, 5-axis machine. Programming is performed off-line and downloaded to the machine. The software provides an interface to finite element packages, allowing analyses of the designed parts before production.

The ultrasonic apparatus was a Physical Acoustics Ultrapac II. The scanner is computer controlled (486-based) and provides for off-line analysis of the resulting scans and false color images. It supports A-, B- and C-scanning capabilities, as well as their signal storage.

The students have gained much by the incorporation of this equipment into the course. First, they can run their experiments with state-of-the-art equipment equal to those they will find in industry. Secondly, they have operated the equipment and hence have gained experience that can only be obtained by hands-on learning, that book learning itself cannot provide. Third, they have developed group problem solving skills in determining the processing and testing conditions. All of these experiences will better prepare them for their careers.

PART III - TECHNICAL INFORMATION

References:

1. ENG 4794 - Laboratory in Composites Manufacture and Testing - Laboratory Notebook (attached)
2. An ASEE paper is in preparation for presentation at next year's conference.

The results have also been disseminated through participation in a General Electric Foundation grant for the development of an undergraduate curriculum in advanced materials. As a result, a number of other institutions teaching in similar area have obtained the results of this work, which may not have otherwise happened.

Primary Data, etc.

Two laboratory experiments, one in filament winding and one in ultrasonic, non-destructive testing, were developed for incorporation into a senior level, elective laboratory course in composites manufacture and testing. The laboratory notebook is attached for further details.

A third experiment, on resin transfer molding (RTM), was to have been developed under this grant, but cost overruns due to the delay between proposal submittal (initial equipment quotes), as well as the desire to add capabilities not originally known, prevented the development of the RTM lab. The PI used his personal GT foundation funds to develop the RTM lab. The experiment is contained in the attached laboratory notebook.

The data requested below are important for the development of a statistical profile on the personnel supported by Federal grants. The information on this part is solicited in response to Public Law 99-383 and 42 USC 1885C. All information provided will be treated as confidential and will be safeguarded in accordance with the provisions of the Privacy Act of 1974. You should submit a single copy of this part with each final project report. However, submission of the requested information is not mandatory and is not a precondition of future award(s). Check the "Decline to Provide Information" box below if you do not wish to provide the information.

Please enter the numbers of individuals supported under this grant.
Do not enter information for individuals working less than 40 hours in any calendar year.

	Senior Staff		Post-Doctorals		Graduate Students		Under-Graduates		Other Participants ¹	
	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.
A. Total, U.S. Citizens	1									
B. Total, Permanent Residents										
U.S. Citizens or Permanent Residents ² :										
American Indian or Alaskan Native										
Asian										
Black, Not of Hispanic Origin										
Hispanic										
Pacific Islander										
White, Not of Hispanic Origin	1									
C. Total, Other Non-U.S. Citizens										
Specify Country										
1.										
2.										
3.										
D. Total, All participants (A + B + C)	1									
Disabled³										

Decline to Provide Information: Check box if you do not wish to provide this information (you are still required to return this page along with Parts I-III).

¹ Category includes, for example, college and precollege teachers, conference and workshop participants.

² Use the category that best describes the ethnic/racial status for all U.S. Citizens and Non-citizens with Permanent Residency. (If more than one category applies, use the one category that most closely reflects the person's recognition in the community.)

³ A person having a physical or mental impairment that substantially limits one or more major life activities; who has a record of such impairment; or who is regarded as having such impairment. (Disabled individuals also should be counted under the appropriate ethnic/racial group unless they are classified as "Other Non-U.S. Citizens.")

AMERICAN INDIAN OR ALASKAN NATIVE: A person having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition.

ASIAN: A person having origins in any of the original peoples of East Asia, Southeast Asia or the Indian subcontinent. This area includes, for example, China, India, Indonesia, Japan, Korea and Vietnam.

BLACK, NOT OF HISPANIC ORIGIN: A person having origins in any of the black racial groups of Africa.

HISPANIC: A person of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race.

PACIFIC ISLANDER: A person having origins in any of the original peoples of Hawaii; the U.S. Pacific territories of Guam, American Samoa, and the Northern Marianas; the U.S. Trust Territory of Palau; the islands of Micronesia and Melanesia; or the Philippines.

WHITE, NOT OF HISPANIC ORIGIN: A person having origins in any of the original peoples of Europe, North Africa, or the Middle East.

(Please keep this form until you are ready to file your project's final report)

Georgia Institute of Technology
Institution
Jonathan S. Colton
Principal Investigator

6/14/93
Date
USE- 9151389
Grant No.

FUNDS:

1. What was the actual dollar amount of matching funds spent for the equipment?

\$ 91,250

2. Please list the specific sources of your matching funds and the amount contributed by each:

85,250 - State of Georgia Quality Improvement Funds
6,000 - PI's personal GT Foundation funds

3. If the College provided matching funds, were these monies that the department would have received normally in that budget cycle?

yes ___ no x

Was it extra funds x, or received early ___ ?

4. Were other costs to the department (e.g., faculty time, maintenance contracts, building or facility modification, upgrading of related operations and maintenance, expendable supplies or materials) incurred as a result of the grant? Please list by category and estimate a dollar value for each:

faculty time - \$15,000 installation - \$2,000 maintenance - \$2,000
supplies - \$1,000 _____

What were the sources of these funds? _____

faculty time - sweat equity, installation - Executive VP's office,
maintenance - PI's personal GT Foundation funds, supplies - Dean of Eng. office

5. Was released time provided to faculty as a result of this grant? yes ___ no x

If not, did time limitations prevent you from carrying out the project as well as you might otherwise have done?

yes x no ___

OPERATIONS:

1. After your grant letter arrived, about how many months elapsed before you had ordered the majority of items for the project?

- Less than 3 months
- 3 - 6 months
- 6 - 9 months
- 9 - 12 months
- More than 12 months

2. If the answer to #1 above is six months or more, what caused the delay?

- Release of matching funds
- Equipment no longer available
- Changes in plans
- Planning took that long
- Other (Explain) _____

3. How many semesters after the award (not counting summers) elapsed before the majority of the equipment purchased under the award was substantially incorporated into the curriculum?

- one two three four more

IMPLEMENTATION

Now that you have essentially completed your project, how would you answer the following:

1. How many students do you expect will directly benefit during the next five years? (#students/course X #courses) 200

2. Who is using the equipment beyond the originally proposed audience? Undergraduate students in professional societies (e.g., SAE team is making composite race car parts), design classes are making projects, undergraduate students doing research, graduate students doing research

Are you using the equipment differently from the ways originally proposed? How? no, but in addition, other classes are using the equipment, research is being performed, and industrial extension is being performed.

3. Will this equipment serve the needs of special target audiences, beyond those described in your ILI-funded proposal? (These special audiences include women, minority members, disabled students and pre-service teachers.)

yes ___ no x

If yes, indicate which special audience(s): ___, ___, ___.

4. To what extent have you made use of the Government Surplus Property provisions made possible under the grant?

None

-
5. What features of the NSF program administration have you found supportive? What features did you find hindered your work? On the basis of your experience, what suggestions would you make for streamlining the process?

None, the NSF system seemed to work well in this case. The only change would be some provision for the fact that the equipment costs more than the initial quote by the time all of the paper work is completed.

PUBLICITY AND DISSEMINATION

1. Have any articles about the your project been published in newspapers, college magazines, etc.? (We do not refer here to scholarly papers in professional media, but to items in the popular press.) Have you sent copies to the NSF? (Please do!) None

2. Do you feel that your project has explored approaches or achieved goals that should be shared with teaching scientists on other campuses or in other fields? Please explain:

Yes, open-ended, hands-on, but directed, laboratory experiences with industrial scale equipment helps teh students integrate book learning and to see the difficulties with real processes that are not evident in classroom learning experiences.

3. If your answer to question 2 is yes, how do you plan to disseminate the results of your work? Check all that apply:

Publications x Speeches x Faculty Colloquia ___
Regional Meetings ___ National Meetings x

On behalf of the Foundation, the ILI staff thanks you for the careful administration of your project and for this information.