

15:51:17

## OCA PAD INITIATION - PROJECT HEADER INFORMATION

05/17/95

Active

Project #: G-33-E97                      Cost share #: G-33-346                      Rev #: 0  
Center # : 10/24-6-R8524-0A0              Center shr #: 10/22-1-F8524-0A0              OCA file #:  
Contract#: DUE-9551664                      Mod #:                      Work type : RES  
Prime # :                      Document : GRANT  
Contract entity: GTRC  
Subprojects ? : N                      CFDA: 47.076  
Main project #:                      PE #: N/A

Project unit:                      CHEMISTRY                      Unit code: 02.010.136  
Project director(s):  
COLLARD D M                      CHEMISTRY                      (404)894-4002

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

Award period:              950601              to              970531 (performance)              970831 (reports)

Sponsor amount	New this change	Total to date
Contract value	71,302.00	71,302.00
Funded	71,302.00	71,302.00
Cost sharing amount		71,302.00

Does subcontracting plan apply ? : N

Title: FT NMR SPECTROSCOPY IN THE UNDERGRADUATE LABORATORY

## PROJECT ADMINISTRATION DATA

OCA contact: Jacquelyn L. Bendall                      894-4820

Sponsor technical contact

Sponsor issuing office

GENE G. WUBBELS  
(703)306-1666

GRACIELA NARCHO  
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4201 WILSON BLVD.  
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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 -

INITIATION OF PROJECT. AS A CONDITION OF THIS AWARD, GIT MUST COST SHARE  
IN THE AMOUNT OF AT LEAST ONE-HALF OF TOTAL COSTS.

CA8120

Georgia Institute of Technology  
Office of Contract Administration  
PROJECT CLOSEOUT - NOTICEPage: 1  
03-JUL-1997 08:44

Closeout Notice Date 03-JUL-1997

Project Number G-33-E97

Doch Id 36431

Center Number 10/24-6-R8524-0A0

Project Director COLLARD, DAVID

Project Unit CHEMISTRY

Sponsor NATL SCIENCE FOUNDATION/GENERAL

Division Id 3393

Contract Number DUE-9551664

Contract Entity GTRC

Prime Contract Number

Title FT NMR SPECTROSCOPY IN THE UNDERGRADUATE LABORATORY

Effective Completion Date 31-MAY-1997 (Performance) 31-AUG-1997 (Reports)

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

## Comments

LETTER OF CREDIT APPLIES. 98A SATISFIES PATENT REPORT.

## Distribution Required:

Project Director/Principal Investigator	Y
Research Administrative Network	Y
Accounting	Y
Research Security Department	N
Reports Coordinator	Y
Research Property Team	Y
Supply Services Department	Y
Georgia Tech Research Corporation	Y
Project File	Y



6.33-E-97  
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OMB Number 345-0058

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Arlington, VA 22230

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Permit No. G-69

**PI/PD Name and Address**

David M. Collard  
Department of Chemistry and Biochemistry  
~~SA Tech Res Corp~~  
Atlanta GA 30332

# NATIONAL SCIENCE FOUNDATION FINAL PROJECT REPORT

## PART I - PROJECT IDENTIFICATION INFORMATION

1. Program Official/Org.	Gene G. Wubbels - DUE	
2. Program Name	LABORATORY SECTION	
3. Award Dates (MM/YY)	From: 06/95	To: 05/97
4. Institution and Address	<del>SA Tech Res Corp</del> - G11 Administration Building Atlanta GA 30332	
5. Award Number	9551664	
6. Project Title	NMR Spectroscopy in the Undergraduate Laboratory	

**\*\* You are encouraged to submit your Final Project Report electronically  
\*\* through the NSF FastLane home page ([www.fastlane.nsf.gov](http://www.fastlane.nsf.gov)).**

This Packet Contains  
NSF Form 98A  
And 1 Return Envelope

**Final Project Report**  
**FT NMR Spectroscopy in the Undergraduate Laboratory**  
**DUE 9551664**

**David M. Collard**  
**Georgia Institute of Technology**

**Part II**

The aim of the project was to introduce high field Fourier transform Nuclear Magnetic Resonance spectrometry in the undergraduate chemistry laboratories in the Boggs Chemistry Building at the Georgia Institute of Technology, and to investigate new pedagogical approaches for structure determination. A variable temperature multinuclear ( $^1\text{H}$ ,  $^{13}\text{C}$ ,  $^{19}\text{F}$  and  $^{31}\text{P}$ ) Varian 300 MHz spectrometer was purchased with the aid of the award. In the first nine months of operation we have limited use of the instrument to the sophomore-level organic laboratories. The instrument is used by three pairs of students per afternoon for between two (summer quarter) and five (fall quarter) days per week. Approximately 300 students pass through our three-quarter laboratory sequence per year. All of these students will acquire, optimize and print their own spectra.

We have carefully developed a sequence of experiments over the three quarters to introduce students to the concepts of NMR spectroscopy. Students take the laboratory after they have been introduced to spectroscopy in the lecture series. Initial "unknowns" in the laboratory for  $^1\text{H}$  NMR spectroscopy are compounds which display either a quartet and triplet of an ethyl group, or a septet and doublet of an isopropyl group, along with a methyl or butyl group (both appearing as singlets). Thus, there are a number of structures possible, and each group working on this assignment can have a different unknown. Students have responded well to their collection of real spectra which are both as simple as expected, but also contain some features which are not discussed in the lecture coverage of spectroscopy (i.e., "tenting" of coupled multiplets, residual  $\text{CHCl}_3$  in the deuterated solvent, a small signal for water in the solvent, baseline noise, and spinning side bands). The fact that the spectra really do consist of identifiable multiplets which allow for structural determination is confidence-building and makes the topic of spectroscopy more relevant to the students. The other features allow us to introduce new discussion. Other unknowns become progressively more challenging in the first quarter.

In the second and third quarters students perform a number of syntheses and characterizations. By the time they progress to the advanced organic laboratory they are solving complex structures on mixtures of compounds. The spectrometer has allowed us to completely



revamp what was a classical qualitative analysis laboratory into a modern instrument-based course.

Students are also introduced to infrared spectroscopy, gas chromatography in the first quarter of laboratory. By their senior year they have experience and access to a whole suite of techniques available to our researchers.

Plans for incorporation of NMR into inorganic, physical and analytical laboratories are progressing. In particular, the instrument will have a large impact on the redesign of our entire curriculum in response to a change from a quarter based academic calendar to one based on semesters.

### **Part III**

No publications have resulted from the award to date. The original proposal, and some discussion of our approach has been made to individuals upon request.