

PROJECT ADMINISTRATION DATA SHEET



ORIGINAL



REVISION NO. _____

Project No. G-35-676

GTRI/ATX

DATE 5 / 23 / 84Project Director: Drs. John Hall, Luther Roland & C.S.School: ATX

Geo. Sciences

Sponsor: National Science FoundationKiangType Agreement: Grant No. ATM-8317231Award Period: From 4/15/84 To 9/30/85 (Performance) 12/31/85 (Reports)

Sponsor Amount:

This Change

9/30/87

Total to Date

Estimated: \$

\$ 615,500 (estimated for 3 year period)

Funded: \$

\$ 216,000Cost Sharing Amount: \$ 70,713 (1st year)Cost Sharing No: G-35-318Title: "A Proposal for the Development of Graduate Research Opportunities in Earth and Atmospheric Sciences"

ADMINISTRATIVE DATA

OCA Contact

Lynn Boyd x4820

1) Sponsor Technical Contact:

Jay S. Fein, Program DirectorGlobal Atmospheric Research ProgramAAEO; National Science Foundation1800 G. StreetWashington, DC 20550(202) 357-9887

2) Sponsor Admin/Contractual Matters:

Mary Frances O'ConnellGrants OfficialNational Science FoundationWashington, DC 20550(202) 357-9602Defense Priority Rating: n/aMilitary Security Classification: n/a(or) Company/Industrial Proprietary: n/a

RESTRICTIONS

See Attached NSF Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval - Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of \$500 or 125% of approved proposal budget category.

Equipment: Title vests with GIT

COMMENTS:

First year of continuing grant.* includes usual 6 month unfunded flexibility period.Follow on to G-35-679.

COPIES TO:

Sponsor I.D. #02.107.000.84.005

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Other Newton

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEETDate 5/11/88Project No. G-35-676 School/Dept Geo SciIncludes Subproject No.(s) N/AProject Director(s) J. H. Hall GTRC/GIT ~~XXX~~Sponsor National Science Foundationdevelopment of
Title ☒ Graduate Research Opportunities in Earth and Atmospheric SciencesEffective Completion Date: 9/30/87 (Performance) 12/31/87 (Reports)

Grant/Contract Closeout Actions Remaining:

☒ None☐ Final Invoice or Copy of Last Invoice Serving as Final☐ Release and Assignment☐ Final Report of Inventions and/or Subcontract:
Patent and Subcontract Questionnaire
sent to Project Director ☐☐ Govt. Property Inventory & Related Certificate☐ Classified Material Certificate☐ Other _____

Continues Project No. _____ Continued by Project No. _____

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School of Geophysical Sciences
Georgia Institute of Technology

Dr. John H. Hall, Jr., Principal Investigator

NSF Grant No: AIM8317231

DEVELOPMENT OF RESEARCH OPPORTUNITIES
IN EARTH AND ATMOSPHERIC SCIENCES

PROGRESS REPORT

January 1985

Submitted to:

The National Science Foundation

NSF PROGRESS REPORT

The primary objective of our program is the development of graduate research opportunities at Georgia Tech and the Atlanta University Center through:

- (a) Joint development of research capabilities involving faculty at both Georgia Tech and AUC.
- (b) Seminar and short course arrangements between Georgia Tech, AUC and other regional minority colleges.
- (c) Joint development of research programs involving students and faculty at Georgia Tech, AUC, and other regional minority colleges.

Figure 1 gives a flow chart of our program components. The progress towards these objectives is now given.

Joint Development of Research Capabilities

The proposed plan was to develop joint research programs centered around the research of Drs. Hall, Lewis, and Roland. To our pleasure, the program has expanded to involve other researchers at both the AUC and Georgia Tech. There are presently two new joint appointments with the AUC: Dr. F. Alyea and Dr. A. Coletti. We plan at least two additional appointments in the near future. Additionally, the AUC has added Dr. Arthur Stelson to the research staff of the Earth and Atmospheric Sciences Program at the AUC. These appointments have resulted in the development of the AUC capabilities, expansion of AUC and Georgia Tech cooperative programs, as well as the formulation of several new research programs. These joint research programs are summarized in Table 1.

Additionally, Dr. James King, the Manager of the Space Sciences Division at the Jet Propulsion Laboratory has joined our program as Visiting Professor at the AUC and Morehouse College.

Subsequent to a Workshop on Global Chemical Climatology held here in Atlanta (see below) and coordinated by Dr. King and myself, it was decided that the AUC should establish an Atmospheric Lifetime Experiment (ALE) on the coast of Georgia. Dr. J. King, Dr. F. Alyea and Dr. D. Cunnold are responsible for the configuration and construction of the ALE site, which will be near the Skidaway Oceanographic Institute. The scientists at Skidaway will assist us in maintaining the site, as well as provide additional projects for collaboration (e.g., trace metal analysis in oceanic waters). There are also plans for an ALE station in Hongzhou, Zhejiang, China (see Table 2). Additional joint projects are being developed with Jackson State University. These projects also involve the measurement of acid precipitation.

Installation of the Seismic Display Station

It was also proposed that both the AUC and Georgia Tech would install seismic display stations. These stations (the AUC station and the ATL station) are presently on order. The AUC system consists of an intermediate period (5 second) seismometer, amplifier, helical recorder, and clock. Students shall be responsible for record changing, record cataloging, and system calibration. Installation is to be performed by AUC personnel with assistance available from the Georgia Tech Geophysical Sciences Instrumentation Technician. Examples of seismograms, travel time curves, and an illustration of earthquake location will be displayed.

The ATL system is an upgrade to the World Wide Standard Seismograph (WWSS) station, designated ATL and located in Lovejoy, Georgia, to a digital WWSS (DWWSS) compatible station. Digital recording of short, intermediate, and long period data may be performed by the AUC computer or the School of Geophysical

Sciences computer while analog recording of long period data will take place at Georgia Tech. The ATL system provides digital seismic data. Additional benefits of a DWS compatible station are:

- a) the prestige of running a DWS station and contribution useful data to the DWS network;
- b) the availability of the system for study and improvement by students interested in instrumentation; and
- c) the unique data available for research.

These systems have been ordered, and delivery is expected in February, 1985. The Faculty and Staff involved are Dr. T. L. Long and Mr. John Duckworth (Technician).

Seminars, Workshops, and Short Course Arrangements

We are establishing this semester, an AUC/Georgia Tech Colloquium in environmental sciences. This colloquium will be coordinated by Dr. Arthur Stelson.

A short course on acid rain was conducted from the funding of another NSF grant with Dr. C. G. Justus as principal investigator.

In October, 1984, the AUC and Georgia Tech co-sponsored a Workshop on "Global Chemical Climatology." The working participants were Dr. Ron Prim of MIT, Dr. Jerry Mahlman of Princeton, Dr. Ralph Cicerone of NCAR, Dr. Volker Mohnen of SUNY at Albany, Dr. Douglas Davis and Dr. C. S. Kiang of Georgia Tech and myself. Other observers included faculty and staff from Georgia Tech and Atlanta University. Scientific rationale for a chemical climatology network was discussed, along with presentations of existing networks (see Appendix B). The role to be played by the AUC in establishing such a network was discussed. It was agreed that a logical role for the AUC would be to coordinate the establishment of regional sites, and that the ALE program might agree to incorporate one or two AUC sites. Subsequent approval for the ALE team for this strategy was given at the last ALE meeting in Australia. The proceedings from this workshop is discussed in detail in Appendix A.

Installation of New LIDAR in the Mobile Instrument Research Vehicle (MIRV)

As proposed in our original award, we have purchased the components and completely rebuilt the LIDAR in the MIRV. Additionally, the AUC has provided a PDP 11/23 computer and an IBM PC for the real-time data acquisition. The faculty and staff involved are Dr. G. Grams and Mr. C. Wyman (Technician).

Student Participation

A primary objective this year has been to increase the student participation in our program. The NSF funded Undergraduate Research Program in Earth and Atmospheric Sciences (URPEAS) at Morehouse College has been instrumental in helping us to meet this objective. Tables 3a and 3b lists the URPEAS students that participated both in last Academic Year's programs, as well as the summer research program. Additionally, Table 3c lists the non-URPEAS students participating in research in our program. We have supported one Georgia Tech graduate student and two of the summer URPEAS students from this grant.

Last academic year, Morehouse instituted an undergraduate minor in Earth and Atmospheric Sciences (see Appendix B). After careful consideration, we have decided that in order to truly attract a large number of students into our program, Morehouse College must offer a major degree. We have received approval from the President of Morehouse to pursue this effort. We are now developing a curriculum and expect a degree program in AY 1985-1986. With the addition of new staff, we are in a particularly good position to do this.

Additionally, the following courses were offered at Morehouse College and supported by this grant.

<u>COURSE</u>	<u>PROFESSOR</u>	<u>YEAR</u>
Introduction to Geophysics	Dr. R. Lowell	AY 1983-84
Introduction to Geochemistry	Dr. M. Wampler	AY 1984-85
Introduction to Physical Meteorology	Dr. L. Roland	AY 1984-85

Proposed Activities for Second Year

The emphasis in the second year will again be on increasing student participation, and developing joint research programs with the AUC and other regional colleges. To increase student participation, we will rely heavily on the following.

- 1) Implementation of an undergraduate degree program in earth and atmospheric sciences at Morehouse College, which will serve as a "feeder" into our graduate program.
- 2) continued implementation and increase in scope of the URPEAS program.
- 3) Increased visibility of our program through high school recruiting.
- 4) Increased visibility through implementation of the ALE-type sites, the seismic display station, and use of the MIRV.
- 5) Increased visibility through short courses and seminars.

Towards the goal of developing joint programs, Drs. Hall, Kiang, and Roland will continue to coordinate the interactions of AUC and Georgia Tech faculty. Also, Dr. Coletti now has a joint appointment with the AUC, and will be instrumental in aiding this development. Thus, we request one month of Dr. Coletti's time, in place of Dr. Chameides.

A final objective will be to increase the participation of the Atlanta University chemistry and physics faculty in this program. We have already begun this effort inasmuch as Dr. J. Reid from the Atlanta University Chemistry Department will be a co-principal investigator on the ALE research proposal.

Unexpended Funds

As of March 31, 1985; there will be no residual funds remaining in Grant No. ATM 8317231.

Publications

S. C. Bhatia and J. H. Hall, Jr. Ab-initio Self Consistent Field Studies of ClNO_x ($x = 1, 2, 3$). J. Chem. Phys., in press.

CURRENT AND PENDING SUPPORT OF
PRINCIPAL AND CO-PRINCIPAL INVESTIGATORS

PROJECT TITLE	AGENCY	MAN MONTHS	AWARD AMOUNT	PERIOD COVERED
Theoretical Studies and Laser Raman Spectroscopy of Biologi- cal Molecules PRINCIPAL INVESTIGATOR: J. H. Hall, Jr.	NIH	4	\$297,133	1983-87
Matrix-Isolation FTIR Studies of Transient Molecular Species PRINCIPAL INVESTIGATOR: J. H. Hall, Jr.	NASA	1	130,000	1984-
An Undergraduate Research Program in Earth and Atmospheric Sciences at the Atlanta Univer- sity Center CO-PRINCIPAL INVESTIGATOR: Luther Roland	NSF	2	189,518	1983-1986

TABLE 1

JOINT AUC/GEORGIA TECH RESEARCH PROGRAM

PROJECT TITLE	PRINCIPAL INVESTIGATORS	STATUS	AGENCY
Light scattering of Atmospheric Aerosol in the Visible and Infra-red Regions	A. Coletti ^a S. Bhatia ^b	P	ARO
A Chemical Climatological Study of Photochemical Oxidants	D. O. Davis ^a J. H. Hall ^a	To Be Submitted	NSF
An ALE (Atmospheric Lifetime Experiment) Site in Savannah Georgia	F. Alyea ^a D. Cunnold ^c J. Reid ^d	To Be Submitted	NASA
Theoretical and Experimental Studies of Transient Species of Atmospheric Interest	J. H. Hall ^a A. Coletti ^a S. C. Bhatia ^b	P	NASA
Acid Precipitation at a Southeastern Urban Site	A. Thompson L. Roland	P	NSF
An Investigation of Acid Precipitation in the Southeast United States	L. Roland	P	EPA

^aJoint AUC/Georgia Tech Appointment^bAUC Research Staff^cGeorgia Tech Faculty^dAtlanta University Faculty^eSpelman College Faculty

TABLE 2
PRESENT AND PROPOSED ATMOSPHERIC LIFETIMES EXPERIMENT
(ALE) SITES

PRESENT ALE SITES

Adrigole, Ireland

Cape Meares, Oregon

Ragged Point, Barbados

Point Matatula, American Samoa

Cape Grim, Tasmania

PROPOSED
ATLANTA UNIVERSITY CENTER SITES

Skidaway Island, Georgia

Hongzhou, Zhejiang, China

TABLE 3a
 "1983 - 84 URPEAS STUDENTS' PROJECTS"

<u>Student</u>	<u>Project</u>	<u>Project Advisor</u>
Henry Baffoe-Bonnie Morehouse	Acid Precipitation at a Southeastern Urban Site	Luther Roland
Michael Boakye- Morehouse	The Identification and Characterization of Transient and Inter- mediate Species by Matrix-Isolation and Raman Spectroscopy	John Hall
Sarjo Bajang Morris Brown	Relationship Between Heat Flow and Tectonic Activity in Continental Regions	J.C. Mareschal
Sandra Rucker Morris Brown	A Numerical Study of the Visual Impact of Smog Particle	Jerry Grams
Sybil Stephen Spelman	Modelling of Satel- lite Data by Di- rectional Reflec- tance	Jere Justus

TABLE 3b
URPEAS STUDENTS PROJECTS FOR SUMMER '84'

<u>Student</u>	<u>Project</u>	<u>Project Advisor</u>
Henry Baffoe-Bonnie Morehouse	The Identification and Characterization of Transient and Inter- mediate Species by Matrix Isolation and Raman Spectro- scopy	John Hall
Michael Boakye-Danquah Morehouse	GC and GC/MS Charac- terization of Low Molecular Weight Fatty Acids in Precipitation	Luther Roland
Sarjo Bojang Morris Brown	Digital Processing of Seismic Earth- quake Data	L.T. Long
Sandra Rucker Morris Brown	A Numerical Study of the Visual Impact of Smog Particles	Jerry Grams
Stanley Eatman Stilman College	Cloud-Screening for Remote Sensing of Surface Features	Jere Justus
Wendell Pickens Jackson State University	Gaussian Dispersion Modelling	Luther Roland
Livia Davis Jackson State University	Statistical Study of the Occurrence of Earthquakes in the Southeastern United States	L.T. Long
Melvin Grant Jackson State University	Volcanic Processes	R.P. Lowell
Ira Roberts Benedict College	Salt Mineralogy and Geochemistry	C.E. Weaver
Pamela Cox Benedict College	Modelling of Satel- lite Data by Direc- tional Reflectance	Jere Justus

TABLE 3c
NON-URPEAS STUDENTS

<u>STUDENT</u>	<u>INSTITUTION</u>	<u>PROJECT</u>
Phelesia Jones	Atlanta University (Ph.D. Candidate)	Theoretical Studies of the $O(^1D) + H_2O$ Potential Energy Surface.
Vernon Morris	Morehouse College (Undergraduate)	Matrix-Isolation Studies of Chlorine Nitrate
M. Jasmine	Georgia Tech (Ph.D. Candidate)	Matrix-Isolation Studies of Transient Species

NSF PROGRESS REPORT

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- b) Seminar and short course arrangements between Georgia Tech, AUC, and other regional minority colleges.
- c) Joint development of research programs involving students and faculty at Georgia Tech, AUC, and other regional minority colleges.

The progress towards these objectives is now given.

The emphasis in the second year has been on increasing student participation and developing joint research programs with the AUC and other regional colleges. To increase student participation, we will have relied on the following:

- 1) Increased research activity directed towards student training.
- 2) Continued implementation and increase in scope of URPEAS program.
- 3) Increased visibility through short courses and seminars.
- 4) Implementation of an undergraduate degree program in earth and atmospheric sciences at Morehouse College which will serve as a "feeder" into our graduate program.

Towards the goal of developing joint research programs, Drs. Hall, Kiang and Roland continue to coordinate the interactions of AUC and Georgia Tech faculty.

Joint Development of Research Capabilities

This past year we have been successful in developing a number of joint , research programs with the Atlanta University Center. Dr. Arthur Stelson was appointed as a Research Scientist at the AUC in January, 1985. He and Dr. Roland have received funding from NASA to measure the methane flux and production in the Okefenokee Swamp in southern Georgia. This proposal emphasizes the use of a monitoring station for undergraduate and graduate student training, in order to increase student participation in our program.

Dr. Stelson has also received funding from DOE for a project entitled, "Heterogeneous Removal of Sulfur Dioxide by Hydroxide Aerosols." This three-year project provides resources for student participation, as well as for the development of a research capability at the AUC. In a similar effort, Drs. Kiang and Stelson are collaborating with the Fesbat Institute in Bologna, Italy on a project to access the impact of sulfate accumulation in fogs.

Dr. Roland has also received a grant from the Amoco Foundation to provide funding for the Undergraduate Research Program under his direction.

Drs. Hall and Coletti have received a grant from NASA to characterize transient atmospheric species using matrix isolation and spectroscopic methods. Each of these efforts involves the participation of both undergraduate and/or graduate students.

Drs. Coletti and Alyea retain their joint appointments with Georgia Tech and the AUC. Dr. James King has also opted, with the approval of NASA, to remain at the AUC for an additional year in order to aid in the development of our joint research efforts.

Courses and Seminars

During the past year, we have had the following seminar presentations:

Dr. Mario Molina	Jet Propulsion Laboratory
Dr. William Guillory	University of Utah
Dr. Wolfgang Seiler	Max Planck Institute fur Chemie
Dr. Marilyn Jacox	National Bureau of Standards
Dr. Robert Harris	NASA
Dr. James King	Jet Propulsion Laboratory

The following courses were offered to students at the Atlanta University Center:

Instrumental Methods in Atmospheric Chemistry

Introduction to Physical Meteorology

Introduction to Atmospheric Science

Additionally, the AUC is co-sponsoring with NASA, a conference designed to increase the participation of HBCUs in the atmospheric sciences. Principal Investigators from HBCUs are invited, along with students, to give papers and listen to presentations by NASA scientists. This conference will be held in Atlanta in April, 1986 and is described in more detail in the Appendix.

Student Recruiting

This semester, Morehouse College will approve a major degree program in atmospheric science. A description of the proposed curriculum is given in the Appendix. In order to attract students, we are establishing at the Atlanta University Center Science Research Institute a recruiting office. It is planned for this office to be coordinated by Ms. Patricia Brown, the Director of the EEO office of the National Weather Service here in Atlanta.

The development of our joint research programs will concentrate on the development of the research capabilities of our scientists and their research programs. The AUC atmospheric sciences program is housed in the Dolphus E. Milligan Science Research Institute of the Atlanta University Center. Drs. Hall, Kiang, and Roland are continuing to provide coordination with the AUC.

Pending proposals and proposals to be submitted include a project in airport security (FAA), a DOD equipment proposal for an FTIR, several DOE equipment proposals for small support items (i.e., oscilloscopes, GCMS, etc.), two proposals to DOE by Drs. Roland and Coletti, and a proposal by Drs. Davis and Hall for a site to study photochemical oxidation processes. Additionally, the mobile van will be used for some field research programs, as well as for recruitment of students.

This year, we will petition to establish a full-scale B.S. degree program at Morehouse College. Dr. Fred Alyea has taken the responsibility of coordinating the curriculum development efforts at the undergraduate level.

We are involving Atlanta University and Georgia Tech graduate students on each of our research projects, including the NASA-funded proposal to measure methane production in the Okefenokee Swamp. A memorandum of understanding between AUC and Atlanta University exists regarding the joint use of resources, graduate students, and scientific personnel in the AUC/GIT joint program in atmospheric sciences.

Unexpended Funds

As of March 31, 1986, there will be no residual funds remaining in Grant No. ATM8317231.

Publications

S. C. Bhatia and J. H. Hall, Jr. Ab-Initio Self Consistent Field Studies of ClNO_x ($x = 1, 2, 3$). J. Chem. Phys., **82**, 15 February, 1985.

Stelson, A. W., Kiang, C. S. and Fuzzi, S. (1985) Relative Times for Sulfate Accumulation in Fog. Presented at the "Symposium on Heterogeneous Processes in Source-Dominated Atmospheres," October 8-11, 1985, New York, New York.

Stelson, A. W., Kiang, C. S. and Fuzzi, S. (1986) Relative Times for Sulfate Accumulation in Fog. To be submitted to the Journal of Geophysical Research.

CURRENT AND PENDING SUPPORT
PRINCIPAL AND CO-PRINCIPAL INVESTIGATORS

NAME	AGENCY	STATUS	PROJECT TITLE	AWARD AMOUNT	PERIOD COVERED	MONTHS COMMITTED
Luther Roland	NSF	*AF	An Undergraduate Research Program in Earth & Atmospheric Sciences at the Atlanta University Center	\$189,518	7/83 - 6/86	4 Months
Luther Roland	NSF	AF	Acid Precipitation at an Urban Southeastern Site	140,000	2/85 - 1/87	0.5 Months
Luther Roland	NASA	A	An Investigation of the Atmospheric Methane Abundance due to Anaerobic Mineralization of Organic Matter	357,531	10/85 - 9/87	2.0 Months
Luther Roland	NSF	P	An Undergraduate Research Program in Earth and Atmospheric Sciences at the Atlanta University Center	266,261	7/86 - 6/89	3 Months
John H. Hall, Jr.	NIH	AF	Theoretical Studies and Laser Raman Spectroscopy of Biological Molecules	297,133	9/83 - 8/87	1 Month
John H. Hall, Jr.	NASA	AF	Matrix-Isolation IR Studies of Transient Molecular Species	100,556	6/85 - 5/86	1 Month

*AF - Indicates Approved Funded.
A - Indicates Approved
P - Pending

CURRENT AND PENDING SUPPORT CONTINUED
PRINCIPAL AND CO-PRINCIPAL INVESTIGATORS

NAME	AGENCY	STATUS	PROJECT TITLE	AWARD AMOUNT	PERIOD COVERED	MONTHS COMMITTED
John H. Hall, Jr.	DOD	P	Acquisition of a FTIR Spectrophotometer to Enhance Research Capabilities in Atmospheric Sciences	\$172,800	4/86 -	_____
John H. Hall, Jr.	FAA	P	Detection and Characterization of the Vapors from Common Explosives and Flammables	99,000	4/86 - 3/87	1 Month

NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550FINAL PROJECT REPORT
NSF FORM 98A

PLEASE READ INSTRUCTIONS ON REVERSE BEFORE COMPLETING

PART I—PROJECT IDENTIFICATION INFORMATION

1. Institution and Address GEORGIA INSTITUTE OF TECHNOLOGY Atlanta, GA 30332	2. NSF Program Earth & Atmos. Sciences	3. NSF Award Number ATM 8317231
	4. Award Period From 1983 To 1987	5. Cumulative Award Amount
6. Project Title DEVELOPMENT OF GRADUATE RESEARCH OPPORTUNITIES IN EARTH AND ATMOSPHERIC SCIENCES		

PART II—SUMMARY OF COMPLETED PROJECT (FOR PUBLIC USE)

The primary objective of our program is the development of graduate research opportunities at Georgia Tech and Atlanta University Center (AUC) through; a) joint development of research capabilities involving faculty at both Georgia Tech and AUC; b) seminar and short course arrangements between Georgia Tech, AUC and other regional minority colleges; and, c) joint development of research programs involving students and faculty at Georgia Tech, AUC and other regional minority colleges.

The support we have received from the National Science Foundation for this particular project has had an impact far beyond the earth and atmospheric sciences. The environment produced by this program has led to increased productivity in our biochemistry and theoretical chemistry programs.

PART III—TECHNICAL INFORMATION (FOR PROGRAM MANAGEMENT USES)

1. ITEM (Check appropriate blocks)	NONE	ATTACHED	PREVIOUSLY FURNISHED	TO BE FURNISHED SEPARATELY TO PROGRAM	
				Check (✓)	Approx. Date
a. Abstracts of Theses					
b. Publication Citations					
c. Data on Scientific Collaborators					
d. Information on Inventions					
e. Technical Description of Project and Results					
f. Other (specify)					
2. Principal Investigator/Project Director Name (Typed) John H. Hall, Jr.	3. Principal Investigator/Project Director Signature			4. Date 9/87	

SCHOOL OF GEOPHYSICAL SCIENCES
GEORGIA INSTITUTE OF TECHNOLOGY

Dr. John H. Hall, Jr., Principal Investigator

NSF Grant #ATM 8317231

**DEVELOPMENT OF GRADUATE RESEARCH OPPORTUNITIES
IN EARTH AND ATMOSPHERIC SCIENCES**

NSF PROGRESS REPORT

September, 1987

Submitted to:

THE NATIONAL SCIENCE FOUNDATION

NSF PROGRESS REPORT

The primary objective of our program is the development of graduate research opportunities at Georgia Tech and Atlanta University Center (AUC) through; a) joint development of research capabilities involving faculty at both Georgia Tech and AUC; b) seminar and short course arrangements between Georgia Tech, AUC and other regional minority colleges; and, c) joint development of research programs involving students and faculty at Georgia Tech, AUC and other regional minority colleges. The progress towards each of these objectives will now be discussed.

Joint Development of Research Capabilities

The proposed plan was to develop joint research programs centered around the research of Drs. Hall, Lewis and Roland. Since the submission of our proposal, Dr. Lewis has taken a permanent position in the Physics and Atmospheric Sciences department at Jackson State University. Drs. Hall and Roland hold joint appointments with the AUC. The atmospheric sciences program at the AUC has grown with the appointments of Dr. Arthur Stelson, a graduate of California Institute of Technology, and Dr. Robert Stickel, formerly a research associate in the research group of Dr. Douglas Davis at Georgia Tech. Drs. Fred Alyea, A. Coletti, C. S. Kiang, Tim Long and Doug Davis have all played important parts in the development of joint research programs. Dr. James King, Manager, Space Sciences Division at the Jet Propulsion Laboratory also joined our staff for two years, and in his second year, was acting director of the Dolphus E. Milligan Science Research Institute -- the AUC research organization that houses the atmospheric sciences program. Other scientists at the Atlanta University Center who have contributed significantly to the development of our program in atmospheric sciences are Drs. Beatriz Cardelino and Subhash Bhatia.

The last three years have seen a great development in our research programs. Drs. Roland and Stelson have received funding for the establishment of a methane monitoring site at the Okefenokee Swamp in Georgia. This project is joint with Dr. Wolfgang Seiler,

the director of the Fraunhofer Institute in Garmisch-Partenkirchen, Germany. Drs. Hall and Bhatia have received funding from Marshall Space Flight Center for the experimental theoretical studies of bulk phase associations in the succinonitrile water system, and Drs. Bhatia, Cardelino and Stickel have received funding for the theoretical and experimental studies of nonlinear optical properties of pi-conjugated polymers. The three above projects listed were all funded by NASA. Drs. Hall and Bhatia have received funding from the Department of Energy for the study of the intermediates produced in coal transformations with the objective to determine those compounds that may lead to atmospheric pollution when coal is burned. A program to be funded by the National Science Foundation involves measurement of gas and liquid phase hydrogen peroxide NO_x and ozone in the urban troposphere over Atlanta. This last project is a joint project between Georgia Tech and Atlanta University Center involving Drs. Hall and Stickel from the Atlanta University Center, and Dr. Doug Davis and his group at Georgia Tech.

Dr. James King's visit resulted in the Atlanta University Center hosting the first two NASA/HBCU conferences in Atlanta where researchers from the NASA laboratories and the HBCUs present scientific papers highlighting the NASA-related research at the historically black colleges and universities.

Finally, both the AUC and Georgia Tech have installed seismic display stations. The AUC system consists of an intermediate period seismometer, amplifier, helical recorder and clock. Students are responsible for record changing, record cataloging, and system calibration. This system supports our earth sciences component.

Seminars, Workshops and Short Course Arrangements

We have conducted a number of seminars and short courses during the tenure of this grant. Georgia Tech and AUC co-sponsored a workshop on ***Global Chemical Climatology*** in 1984, as well as a number of short courses at Georgia Tech in Remote Sensing, Hazardous Waste Management, and Acid Rain.

Seminars are given weekly at Georgia Tech and the AUC. Participants are scientists from across the country, students and faculty.

Student Participation

A primary objective of this program has been to increase the student participation in the earth and atmospheric sciences. The NSF funded Undergraduate Research Program in Earth and Atmospheric Sciences (URPEAS) has been instrumental in helping us to meet this objective. Table 1 list the URPEAS students that have participated in our program for the last three years. In addition, we have received funding from the Chemistry Division at NSF for an Undergraduate Research Program in Chemistry (URPC). Table 2 list the students who have actively participated in this program for the last two years. The students in the URPEAS and URPC programs were selected on the basis of their academic achievement in under-graduate school and their desire to enter Ph.D. programs in chemistry and the earth and atmospheric sciences. These programs should provide a valuable feed mechanism for our, and other graduate programs.

During the tenure of this grant, Ms. M. George-Taylor received a Masters degree in atmospheric chemistry from Georgia Tech, and we have two very promising black students in the Ph.D. program at Georgia Tech -- Mr. Vernon Morris and Ms. Trina Cheeks. Additionally, one of our former undergraduate students, Mr. Henry Baffoe-Bonnie, is a second year graduate student in chemistry at the University of California at Berkeley.

Morehouse College has an undergraduate minor program in Earth and Atmospheric Sciences and last year, there were ten (10) undergraduate students in the introductory class in atmospheric chemistry.

The number of students in our URPC and URPEAS programs points to a bright future for the development of our graduate programs at Georgia Tech and the Atlanta University Center.

Table 3 list the seminar speakers for both our URPC and URPEAS programs for the past two years.

Joint Development of Research Programs Involving Students and Faculty at Georgia Tech, AUC and other Regional Minority Colleges

As stated earlier, we have developed several joint efforts. There is a joint research program to be funded by NSF to establish a laboratory at Stone Mountain. This program involves students and researchers from Georgia Tech and the Atlanta University Center. There is also the methane monitoring station in the Okefenokee Swamp which also involves students and researchers from the Atlanta University Center, Georgia Tech, and the Fraunhofer Institute in Garmisch Partenkirchen. The contracts with Marshall Space Flight Center directly involves students and researchers at Georgia Tech and the Atlanta University Center. In particular, the project dealing with the experimental studies of non-linear optical properties of pi-conjugated polymers involves the participation of researchers in the polymer program at Georgia Institute of Technology.

We have also established a very strong working relationship with Dr. Isiah Warner in the Department of Chemistry at Emory University, and one of our undergraduate research students has participated in his research program for the past two years resulting in several presentations and publications.

Finally, I would like to say that the support we have received from the National Science Foundation for this particular project, namely, to develop our graduate research opportunities, has had an impact far beyond the earth and atmospheric sciences. The environment produced by this program has led to increased productivity in our biochemistry and theoretical chemistry programs. We presently have a proposal submitted for funding of an ***International Conference in Theoretical Chemistry*** here at the Atlanta University Center, and our students in biochemistry and theoretical chemistry have made a number of presentations at prestigious scientific meetings, and have a number of publications to their credit. We feel that all of this is a direct result of the environment created by our program to develop graduate research opportunities.

TABLE 1
LIST OF STUDENTS AND PROJECTS FOR URPEAS PROGRAM

STUDENT	PROJECT	PROJECT ADVISOR
Henry Baffoe-Bonnie	The Identification and Characterization of Transient and Intermediate Species by Matrix-Isolation and Raman Spectroscopy	John H. Hall
M. Baffoe-Bonnie	GC and GC/MS Characterization of Low Molecular Weight Acids in Precipitation	Luther Roland
Sarjo Bojang	Digital Processing of Seismic Earthquake Data	L. T. Long
Sandra Rucker	A Numerical Study of the Visual Impact of Smog Particles	Jerry Grams
Stanley Eatman	Cloud-Screening for Remote Sensing of Surface Features	Jere Justus
Wendell Pickens	Gaussian Dispersion Modelling	Luther Roland
Livia Davis	Statistical Study of the Occurrence of Earthquakes in the Southeastern United States	L. T. Long
Melvin Grant	Volcanic Processes	R. P. Lowell
Ira Robert	Salt Mineralogy & Geochem.	C. E. Weaver
Pamela Cox	Modelling of Satellite Data by Directional Reflectance	Jere Justus
H. Baffoe-Bonnie	Lidar Studies of the Upper Atmosphere	G. W. Grams
M. Boakye-Danquah	Low Molecular Weight Free Fatty Acids in Precipitation	L. F. Roland
Natalie Carter	Lidar Studies of the Upper Atmosphere	G. W. Grams
Sheryl Good	Potassium Argon Dating of Rock Salt	M. Wampler

J. Smiley	The Polo Duro Salt Basin Test Procedures	M. Wampler
Sharmayn Champion	Acid Precipitation at an Urban Southeastern Site	A. Thompson
Lillian Grant	Satellite Ground-Truth Studies Using Agristars Field Condition Report Data	T. Long
Melvin Grant	Analog to Digital Conver- sion of Earthquakes	T. Long
Blanche Y. Lamb	Raman Spectroscopy	J. H. Hall
Cynthia McCloud	Acid Precipitation at an Urban Southeastern Site	A. Thompson
Wendell Pickens	Dispersion Modelling	A. Stelson
Burlinda Radney	Analysis of Long Period Data	T. Long
Ira Roberts	Potassium-Argon and $^{40}\text{Ar}-^{29}\text{Ar}$ Analysis of Rock Specimens for Radiometric Age Deter- mination	M. Wampler
Mattie Taylor	Light Scattering by Spheroids	A. Coletti
Rudolph Small	Relationship between Terpene Emission & High Oxidant Levels in Southeastern United States	L. Roland
Jeffrey Charlton	Comparison of Different Meterological Instruments	G. Grams
Joe Ross	Analysis of Atmospheric Pollutants by use of AA and Laser Raman Spectroscopy	S. Bhatia
Brenda Jackson	Variations of P_n -wave travel time and Delays for the South- eastern United States	T. Long

Jacqueline Carr	A Study of Gravity Data in the Georgia Institute of Technology area using Autocorrelation	T. Long
Lillian Grant	A Comparison of Different Dispersion Models	L. Roland
Leslie Burton	The Detection and Effects of Volatile Organic Acids (C ₁ - C ₅) in the Atmosphere	L. Roland
Tracey Thurmond	Meteorological Aspects of Acid Rain in a Southeastern Region	L. Roland
Lisa Jackson	Acid Precipitation at an Urban Southeastern Site: Quantitative Data Analysis	A. Thompson

TABLE 2
STUDENTS IN THE UNDERGRADUATE RESEARCH TRAINING PROGRAM
(URPC)

NAME	COLLEGE
Kenneth Fowler	Morehouse
Edward Baffoe-Bonnie	Morehouse
Noel H. Whelchel	Morehouse
K. W. Barnwell	Morehouse
Lyndon F. S. Barnwell	Morehouse
Mia E. Hunt	Rust College
Barbara English	Talladega College
Martha Mamo	Alabama A&M University
Cherie Bluncson	Spelman
Adriene King	Spelman
Ezetta R. Washington	Spelman
Greta L. Mitchell	Spelman
ZaaZaax Scruggs	Spelman

TABLE 3

**UNDERGRADUATE RESEARCH TRAINING PROGRAM IN CHEMISTRY (URPC)
SEMINAR SCHEDULE**

SPEAKER	TOPIC	SCHOOL
B. Cardelino	Orbital Energies	DEMSRI
B. Evans	Solid State Chemisry	University of Michiga
A. Stelson	SO ₂ Chemistry in Atmo- sphere	DEMSRI
S. Bhatia	Matrix-Isolation	DEMSRI
C. S. Kiang	Acid Rain	Georgia Institute of Technology
Peter Han	Immoblized Enzymes	DEMSRI
Al Thompson	Synthesis and pK_a Studies of Water Soluble Porphyrins	Spelman
D. Kennedy	Chemistry of Carbenes	Morehouse
R. Challa	Polymers Chemistry	DEMSRI
L. Roland	Identification of Organics in Water Sewage	DEMSRI
R. Stickel	Two Photon Spectroscopy	DEMSRI
N. K. Bose	Synthesis of Nucleic Acid	DEMSRI
D. Sylvester	Mimetic Membranes	DEMSRI
C. Merideth	Challenge and Jubilation in Graduate School	AUC
H. McBay	Concept of Temperature Transmission Operator	Atlanta University
J. King	Space Science and Appli- cations Program	Jet Propulsion Lab
I. Warner	Influence of Cyclodextrins on Properties of in- cluded porphyrins	Emory University
D. Frazier	Separation Process in in Monotactic Alloys	NASA Marshall Space Center
J. Hall	Theoretical Chemistry	DEMSRI
M. Mitchell	Surface Vibrational Spectroscopy	Union Carbide Corporation

TABLE 3A

URPEAS
Seminar Speakers and Topics

<u>Speaker</u>	<u>Topic</u>	<u>School</u>
Dr. C.S. Kiang	Overview of Atmospheric and Geophysical Sciences	Georgia Tech
Dr. Franco Einaudi	Geophysical Fluid Dynamics	Georgia Tech
Dr. John Hall	Using the DEC 20 Computer System	DEMSRI
Dr. Jere Justus	Remote Sensing	Georgia Tech
Dr. Jim King		
Dr. Luther Roland		DEMSRI
Dr. Duane Stephens		

PART II - PUBLICATIONS AND PRESENTATIONS

PUBLICATIONS

S. C. Bhatia and J. H. Hall, Jr. "**Ab-Initio** Self Consistent Field Studies of ClNO_x ($x = 1, 2, 3$)". J. Chem. Phys. **82**, 1991(1984).

V. Morris, S. C. Bhatia and J. H. Hall, Jr. "A Study of the Gas Phase Reaction of NO_2 with O_3 by Matrix-Isolation Infrared Spectroscopy." J. Phys. Chem. **91**, 3359(1987).

S. C. Bhatia and J. H. Hall, Jr. "A Spectroscopic Identification of the Products formed in the Gas-Phase Reactions of OH with Atmospheric Sulfur Compounds." The Chemistry of Acid Rain: Sources and Atmospheric Processes, Edited by R. W. Johnson and G. E. Gordon, ACS Symposium Series, 349 (1987).

PRESENTATIONS

V. Morris, S. C. Bhatia and J. H. Hall, Jr. "A Matrix-Isolation Infrared Spectroscopic Study of the Pyrolysis of Pyridine." Gordon Research Conference on Spectroscopy of Matrix-Isolated Species, August, 1987.

PUBLICATIONS IN PREPARATION

S. C. Bhatia and J. H. Hall, Jr. "**Ab-Initio** SCF Studies of Electronic Structures of Halogen Nitrates II FNO_x ($x = 1, 2, 3$)."

S. C. Bhatia and J. H. Hall, Jr. "A Study of the Gas-Phase Reactions of Cl and ClO with NO_2 by Matrix-Isolation Infrared Spectroscopy."

S. C. Bhatia and J. H. Hall, Jr. "**Ab-Initio** Self Consistent Field Calculations on the ClO dimer."