

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

Date: 10/30/80

Project Title: Science Support for Earth Radiation Budget Satellite (ERBS)/Stratospheric
Aerosol and Gas Experiment (SAGE)

Project No: G-35-675

Project Director: Dr. D. M. Cunnold

Sponsor: NASA, Langley Research Center; Hampton, VA 23665

~~5-31-87~~
~~8-28-87~~
~~8-31-86~~
~~8-31-85~~
~~8/6/85~~

Agreement Period: From 8/7/80 Until 8/6/85

Type Agreement: Contract No. NAS1-16357

Amount: \$182,420 NASA (Partially funded for \$26,528 thru 8/6/81)
9,601 GIT (G-35-353) (Partially funded for \$1,396 thru 8/6/81)
\$192,021 TOTAL

Reports Required: Science Team Progress Reports; Monthly Financial Management Report;
Informal Final Report

Sponsor Contact Person (s):

Technical Matters

Mr. L. R. McMaster
Technical Representative
Mail Stop 234
National Aeronautics & Space Adm.
Langley Research Center
Hampton, VA 23665
804/827-2466

Contractual Matters
(thru OCA)

Mr. E. Steelman Ketchum
Contracting Officer
Mail Stop 126
National Aeronautics & Space Administration
Langley Research Center
Hampton, VA 23665
804/827-3247

Defense Priority Rating: None

Assigned to: Geophysical Science (School/~~XXX~~)

COPIES TO:

Project Director
Division Chief (EES)
School/Laboratory Director
Dean/Director-EES
Accounting Office
Procurement Office
Security Coordinator (OCA)
Reports Coordinator (OCA)

Library, Technical Reports Section
EES Information Office
EES Reports & Procedures
Project File (OCA)
Project Code (GTRI)
Other OCA Research Property Coordinator

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 6-15-87

Project No. G-35-675 School XXX Geo. Sci. XXX

Includes Subproject No.(s) N/A

Project Director(s) Dr. D.M. Cunnold GTRC / XXX

Sponsor NASA, Langley Research Center, Hampton, VA 23665

Title Science Support for Earth Radiation Budget Satellite (ERBS)/Stratospheric
Aerosol and Gas Experiment (SAGE)

Effective Completion Date: 5/31/87 (Performance) 5/31/87 (Reports)

Grant/Contract Closeout Actions Remaining:

- None
- Final Invoice or Final Fiscal Report
- Closing Documents
- Final Report of Inventions - Questionnaire sent to P.I.
- Govt. Property Inventory & Related Certificate
- Classified Material Certificate
- Other _____

Continues Project No. _____ Continued by Project No. _____

COPIES TO:

- Project Director
- Research Administrative Network
- Research Property Management
- Accounting
- Procurement/GTRI Supply Services
- Research Security Services
- Reports Coordinator (OCA)
- ~~Legal Services~~

- Library
- GTRC
- ~~Research Communication~~ (2)
- Project File
- Other Duane H.
- Angela DuBose
- Russ Embry

G 35-675
1/28/81
Rec'd 1 copy @

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

OFFICE OF
THE
COMPTROLLER

January 19, 1981

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Dear Mr. Ketchum:

Enclosed are the Monthly Contractor Financial Management Reports
(Form 533M) for Contract No. NAS1-16357 for the months of October and
November, 1980.

If you have questions or require additional information, please
let us know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS/jb
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. E. Weaver
Mr. J. W. Dees
Mr. O. H. Rodgers ✓
File G-35-675
Tech Rep. M/S 234
NASA Exp. Scientist/Cost Acctg. M/S 135 - 2 copies

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

OFFICE OF
THE
COMPTROLLER

March 13, 1981

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Dear Mr. Ketchum:

Enclosed is the Monthly Contractor Financial Management Report
(Form 533M) for contract No. NAS1-16357 for the month of January, 1981.

If you have questions or require additional information, please
let us know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS/jb
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. E. Weaver
Mr. J. W. Dees ✓
Mr. O. H. Rodgers
File G-35-675
Tech Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 copies

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

OFFICE OF
THE
COMPTROLLER

April 29, 1981

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

file
only

Dear Mr. Ketchum:

Enclosed is the Monthly Contractor Financial Management Report
(Form 533M) for contract No. NAS1-16357 for the month of March, 1981

If you have questions or require additional information, please
let us know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS/jb
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. E. Weaver
Mr. J. W. Dees

File G-35-675
Tech Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 copies

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

OFFICE OF
THE
COMPTROLLER

G-35-675

June 5, 1981

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Dear Mr. Ketchum:

Enclosed is the Monthly Contractor Financial Management Report
(Form 533M) for contract No. NAS1-16357 for the month of April & February, 1981.

If you have questions or require additional information, please
let us know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS/jb
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. E. Weaver
Mr. J. W. Dees ✓
Mr. O. H. Rodgers
File G-35-675
Tech Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 copies

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ATLANTA, GEORGIA 30332

RAIK

OFFICE OF
THE
COMPTROLLER

June 30, 1981

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Dear Mr. Ketchum:

Enclosed is the Monthly Contractor Financial Management Report
(Form 533M) for contract No. NAS1-16357 for the month of May, 1981.

If you have questions or require additional information, please
let us know.

Sincerely,



David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS/jb
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. E. Weaver
Mr. J. W. Dees ✓
Mr. O. H. Rodgers

~~File G-35-675~~

Tech Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 copies

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Form Approved
Budget Bureau No. 104-R0011

PAGE 1 OF 1
2. REPORT FOR MONTH ENDING AND NUMBER OF OPERATING DAYS

5/31/81

21

TO: NASA-Langley Research Center
Attn: Mr. E. Steelman Ketchum
Financial Management Division M/S 126
Hampton, VA 23665

FROM: Georgia Tech Research Institute
Atlanta, Georgia 30332

3. CONTRACT VALUE

a. COSTS

b. FEE

\$ 182

\$ -0-

1. DESCRIPTION OF CONTRACT

a. TYPE

Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS 1-16357

4. FUND LIMITATION

\$ 182

\$ -0-

5. BILLING

a. INVOICE AMTS BILLED

\$ 14

b. TOTAL PYTS REC'D

\$ 13

c. SCOPE OF WORK
ERBS/SAGE

d. AUTH. CONTR. REP (Signature)

DATE

6/25/81

6. REPORTING CATEGORY

7. COSTS INCURRED/HOURS WORKED

8. ESTIMATED COSTS/HRS. TO COMPLETE

9. ESTIMATED FINAL COSTS/HOURS

10. UN-FILL ORDE. OUT-STANDING

DURING MONTH

CUM. TO DATE

DETAIL

BALANCE OF CONTRACT

CONTRACTOR ESTIMATE

CONTRACT VALUE

ACTUAL

PLANNED

ACTUAL

PLANNED

a.

b.

c.

a.

b.

Direct Labor Hours

-

-

.7

1.4

.7

1.4

1.4

Direct Labor Dollars

-

-

7

14

7

14

14

Overhead

-

-

6

9

3

9

9

Fringe Benefits

1

1

1

1

-

1

1

Other Direct Costs

-

-

-

2

2

2

2

Total Costs

1

1

14

26

12

26

26

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

G-35-675

OFFICE OF
THE
COMPTROLLER

July 30, 1981

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Dear Mr. Ketchum:

Enclosed is the Monthly Contractor Financial Management Report
(Form 533M) for contract No. NAS1-16357 for the month of June, 1981.

If you have questions or require additional information, please
let us know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Acctg.

DVW/BITS/el
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. E. Weaver
Mr. J. W. Dees ✓
File G-35-675
Tech Rep. M/S 234
NASA Exp. Scientist
Cost Accounting M/S 135 - 2 copies

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ATLANTA, GEORGIA 30332

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OFFICE OF
THE
COMPTROLLER

GRANTS AND CONTRACTS
ACCOUNTING DEPARTMENT
404/894-4624

September 10, 1981

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Dear Mr. Ketchum:

Enclosed is the Monthly Contractor Financial Management Report
(From 533M) for contract No. NASJ-16357 for the month of July, 1981.

If you have questions or require additional information, please
let us know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS/jb
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. E. Weaver
Mr. J. W. Dees ✓
File G-35-675
Tech Rep. M/S 234
NASA Extp. Scientist
Cost Accounting M/S 135 - 2 copies

DSH

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

OFFICE OF
THE
COMPTROLLER

October 5, 1981

GRANTS AND CONTRACTS
ACCOUNTING DEPARTMENT
404/894-4624

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Dear Mr. Ketchum:

Enclosed is the Monthly Contractor Financial Management Report
(Form 533M) for contract No. NAS1-16357 for the month of August, 1981.

If you have questions or require additional information, please
let us know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS/el
Enclosure
CC: Dr. D. M. Cunnold
School Director
Mr. J. W. Dees ✓
File G-35-675
Tech Rep. M/S 234
NASA Exp. Scientist
Cost Accounting M/S 135 - 2 copies

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ATLANTA, GEORGIA 30332

OFFICE OF
THE
COMPTROLLER

November 16, 1981

GRANTS AND CONTRACTS
ACCOUNTING DEPARTMENT
404/894-4624

Mr. E. Steelman Ketchum, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Dear Mr. Ketchum:

Enclosed is the Monthly Contractor Financial Management Report (Form 533M)
for contract No. NAS1-16357 for the month of September, 1981.

If you have questions or require additional information, please let us
know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS:el
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. E. Weaver
Mr. J. W. Dees ✓
File G-35-675
Tech Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135- 2 copies

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

OFFICE OF
THE
COMPTROLLER

July 1, 1982

Mr. E. Steelman Ketchum Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Dear Mr. Ketchum:

Enclosed are the Monthly Contractor Financial Management Reports
(Form 533M) for contract No. NAS1-16357 for the months of March,
April and May, 1982.

If you have questions or require additional information, please
let us know.

Sincerely,

David V. Welch, Manager
Grants and Contracts Accounting

DVW/BITS/dld
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. S. Kiang
Mr. D. S. Hasty ✓
File G-35-675
Tech Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 copies

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

5/31/82

21

TO: NASA-Langley Research Center
Attn: Mr. E. Steelman Ketchum
Financial Management Division M/S 126
Hampton, VA 23665

FROM: Georgia Tech Research Institute
Atlanta, Georgia 30332

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 182	\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE
Cost Reimbursable

c. SCOPE OF WORK
ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
NAS1-16357

4. FUND LIMITATION
\$ 132

5. BILLING

d. AUTH. CONTR. REP. (Signature) | DATE

a. INVOICE AMTS BILLED
\$ 50

b. TOTAL PYTS REC'D
\$ 45

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
a.	b.	c.	d.	e.	b.	c.	e.	b.		
Direct Labor Hours	.3	.3	2.8	4.4			1.6	4.4	4.4	
Direct Labor Dollars	3	3	19 *	44			16	44	44	
Overhead	2	2	19	32			13	32	32	
Fringe Benefits	-	-	2	3			1	3	3	
Other Direct Costs	-	-	1	6			5	6	6	
Total Costs	5	5	50	85			35	85	85	
* TYPOGRAPHICAL ERROR - SHOULD BE 28										

Associate Vice President
(Finance)

Georgia Institute of Technology
Atlanta, Georgia 30332



G-35-675

(404) 894-4622

May 25, 1983

Mr. C. L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, Virginia 23665

Mr. Crowder:

Enclosed are the Cumulative Monthly Contractor Financial Management Reports
for contract no. NAS1-16357 for the months June 1982 through April 1983.

If you have questions or require additional information, please let me know.

Sincerely,

Sybil P. Small, Assistant Manager
Grants and Contracts Accounting

SPS/LMK/dld
Enclosure

cc: Dr. D. M. Cunnold
Dr. C. S. Kiang
Mr. D. S. Hasty ✓
File R5380-OA0
Tech Rep M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 copies

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
 MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT
 June 1982 - March 1983

Costs Incurred/Hours Worked

<u>Reporting Category</u>	<u>June 1982</u>	<u>July 1982</u>	<u>August 1982</u>	<u>Sept. 1982</u>	<u>Oct. 1982</u>	<u>Nov. 1982</u>	<u>Dec. 1982</u>	<u>Jan. 1983</u>	<u>Feb. 1983</u>	<u>March 1983</u>
Direct Labor Hours	.3	.1	.2	.2	.2	.1	.1	.1	-	.2
Direct Labor Dollars	3	1	2	2	2	1	1	1	-	2
Overhead	2	-	1	1	1	1	-	-	1	2
Fringe Benefits	-	-	1	-	-	-	-	-	-	1
Other Direct Costs	-	-	-	-	-	-	-	-	1	-
Total Costs	5	1	4	3	3	2	1	1	2	5

G-35-675

(Finance)

Georgia Institute of Technology
Atlanta, Georgia 30332

(404) 894-4622



to CO w file

June 10, 1983

Mr. C. L. Crowder, Contracting Officer
NASA -- Langley Research Center --
Financial Management Division M/S 126
Hampton, Virginia 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report
for Contract No. NAS1-16357 for the month ended May 31, 1983.

If you have questions or require additional information, please
contact this office.

Sincerely,

Sybil P. Small, Assistant Manager
Grants and Contracts Accounting

SPS/LMK/vdh
Enclosure

cc: Dr. C. S. Kiang
Dr. D. M. Cunnold
Mr. D. S. Hasty ✓
Technical Rep M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 copies
File: R5380-OAO

G-35-675

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



October 18, 1983

Mr. C.L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended September 30, 1983.

If you have questions or require additional information, please
contact this office.

Sincerely,

Sybil P. Small, Assistant Manager
Grants and Contracts Accounting

SPS/LMK/jlv

Enclosure

- cc: Dr. C.S. Kiang
- Dr. D.H. Cunnold
- Mr. D.S. Hasty ✓
- Tech. Rep. M/S 234
- NASA Expt. Scientist
- Cost Accounting M/S 135 - 2 Copies
- File: R5380-OAO

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.



G-35-675

(404) 894-4624 OR 2629

November 10, 1983

Mr. C.L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended October 31,
1983.

If you have questions or require additional information, please
contact this office.

Sincerely,

Sybil P. Small, Assistant Manager
Grants & Contracts Accounting

SPS/LMK/jlv

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Mr. F.H. Huff ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 Copies
File: R5380-OA0

NASA-Langley Research Center
 Attn: Mr. C.L. Crowder
 Financial Management Division M/S 126
 Hampton, VA 23665

Georgia Tech Research Institute
 Atlanta, Georgia 30332

FROM: " COSTS

5. FEE

\$ 97

\$ - 0 -

1. DESCRIPTION
 OF
 CONTRACT

4. TYPE

Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMEND-
 MENT NO.

NAS1-16357

4. FUND LIMITATION

\$ 97

\$ - 0 -

5. BILLING

c. SCOPE OF WORK

ERBS/SAGE

d. AUTH. CONTR. REP. (Signature)

DATE

11/10/83

a. INVOICE AMTS BILLED

\$ 88

b. TOTAL PYTS REC'D

\$ 86

6. REPORTING CATEGORY

7. COSTS INCURRED/HOURS WORKED

8. ESTIMATED COSTS/HRS. TO COMPLETE

9. ESTIMATED FINAL COSTS/HOURS

10. UN-
 FILLED
 ORDERS
 OUT-
 STANDING

DURING MONTH

CUM. TO DATE

DETAIL

ACTUAL

PLANNED

ACTUAL

PLANNED

a.

b.

BALANCE
 OF
 CONTRACT

c.

CON-
 TRACTOR
 ESTIMATE

a.

CONTRACT
 VALUE

b.

Direct Labor Hours

.1

.1

5.0

5.1

.1

5.1

5.1

Direct Labor Dollars

1

1

50

51

1

51

51

Overhead

-

-

32

35

3

35

35

Fringe Benefits

-

-

4

5

1

5

5

Other Direct Costs

-

-

2

6

4

6

6

Total Costs

1

1

88

97

9

97

97

G-35-675

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



December 13, 1983

Mr. C.L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended November 30,
1983.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/jlv

Enclosure

- cc: Dr. C.S. Kiang
- Dr. D.M. Cunnold
- Mr. F.H. Huff ✓
- Ms. Suzanne Zimmerman
- Tech. Rep. M/S 234
- NASA Expt. Scientist
- Cost Accounting M/S 135 - 2 Copies
- File: R5380-OA0

GEORGIA INSTITUTE OF TECHNOLOGY

ATLANTA, GEORGIA 30. 32

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



61-35-675

January 17, 1984

Mr. C.L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended December 31,
1983.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/jlv

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Mr. F.H. Huff ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 Copies
File: R5380-0A0

GEORGIA INSTITUTE OF TECHNOLOGY

ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



February 14, 1984

Mr. C.L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended January 31, 1984.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/jlv

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Ms. L. Boyd ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 Copies
File: R5380-OA0

TO: NASA-LANGLEY RESEARCH CENTER
 ATTN: MR. C.L. CROWDER
 FINANCIAL MANAGEMENT DIVISION M/S 126
 HAMPTON, VA 23665

FROM: GEORGIA TECH RESEARCH INSTITUTE
 ATLANTA, GEORGIA 30332

1751/84
 3. CONTRACT VALUE
 a. COSTS \$ 116
 b. FEE \$ -0-

1. DESCRIPTION OF CONTRACT
 h. TYPE
 Cost Reimbursable
 c. SCOPE OF WORK
 ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
 NAS1-16357
 d. AUTH. CONTR. REP. (Signature)
 DATE
 2/14/84

4. FUND LIMITATION
 \$ 116 \$ -0-
 5. BILLING
 a. INVOICE AMTS BILLED \$ 91
 b. TOTAL PYTS REC'D \$ 88

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE		9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING	
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE		CONTRACT VALUE
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.	e.	f.	g.	h.		
DIRECT LABOR HOURS*	.1	.1	5.1	6.1			1	6.1	6.1	
DIRECT LABOR DOLLARS	1	1	51	61			10	61	61	
OVERHEAD	1	1	33	41			8	41	41	
FRINGE BENEFITS	-	-	4	7			3	7	7	
OTHER DIRECT COSTS	-	-	3	7			4	7	7	
TOTAL COSTS	2	2	91	116			25	116	116	

DISCLAIMER: FOR PURPOSES OF THIS REPORT IT WAS ASSUMED THAT THE PROFESSORS WORKED A 40 HOUR WEEK. MANY WORK MORE THAN THIS.

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



March 8, 1984

Mr. C.L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended February 29, 1984.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/jlv

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Ms. L. Boyd ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 Copies
File: R5380-0A0

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

2/29/84

21

TO: NASA-Langley Research Center
Attn: Mr. C.L. Crowder
Financial Management Division M/S 126
Hampton, VA 23665

FROM: GEORGIA TECH RESEARCH INSTITUTE
ATLANTA, GEORGIA 30332

3. CONTRACT VALUE

a. COSTS	b. FEE
\$116	\$ - 0 -

1. DESCRIPTION OF CONTRACT
n. TYPE
Cost Reimbursable
c. SCOPE OF WORK
ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
NAS1-16357
d. AUTH. CONTR. REP. (Signature) | DATE
3/8/84

4. FUND LIMITATION	
\$116	\$ - 0 -
5. BILLING	
a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$106	\$ 88

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.			c.			
DIRECT LABOR HOURS*	.8	.8	5.9	5.9			.2	6.1	6.1	
DIRECT LABOR DOLLARS	8	8	59	59			2	61	61	
OVERHEAD	5	5	38	38			3	41	41	
FRINGE BENEFITS	2	2	6	6			1	7	7	
OTHER DIRECT COSTS	-	-	3	3			4	7	7	
TOTAL COSTS	15	15	106	106			10	116	116	
*DISCLAIMER: For purposes of the report it was assumed that the professors worked a 40 hour week.										
Many work more than this.										

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



April 16, 1984

Mr. C.L. Crowder, Contracting Office
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended March 31, 1984.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/jlv

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Ms. L. Boyd ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 Copies
File: R5380-OA0

TO: NASA-LANGLEY RESEARCH CENTER ATTN: MR. C.L. CROWDER FINANCIAL MANAGEMENT DIVISION M/S 126 HAMPTON, VA 23665		FROM: GEORGIA TECH RESEARCH INSTITUTE ATLANTA, GEORGIA 30332		3. CONTRACT VALUE a. COSTS \$ 116 b. FEE \$ - 0 -	
1. DESCRIPTION OF CONTRACT	11. TYPE Cost Reimbursable	12. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO. NAS1-16357		13. FUND LIMITATION \$ 116 \$ - 0 -	
	14. SCOPE OF WORK ERBS/SAGE			15. AUTH. CONTR. REP. (Signature) _____ DATE 4/16/84	

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDER OUTSTANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	e.	f.	g.	h.						
DIRECT LABOR HOURS*	-	-	5.9	5.9			.2	6.1	6.1	
DIRECT LABOR DOLLARS	-	-	59	59			2	61	61	
OVERHEAD	-	-	38	38			3	41	41	
FRINGE BENEFITS	-	-	6	6			1	7	7	
OTHER DIRECT COSTS	1	1	4	4			3	7	7	
TOTAL COSTS	1	1	107	107			9	116	116	

*DISCLAIMER: For Purposes of this Report it was Assumed that the Professor Worked a 40 Hour Week. Many Work More than this.

GEORGIA INSTITUTE OF TECHNOLOGY

ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



G-35675

May 15, 1984

Mr. C.L. Crowder, Contracting Office
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended April 30, 1984.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/vdh

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Ms. L. Boyd ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 Copies
File: R5380-OA0

TO: NASA-Langley Research Center
 Attn: MR. C.L. Crowder
 Financial Management Division, M/S 126
 Hampton, VA 23665

FROM: Georgia Tech Research Institute
 Atlanta, Georgia 30332

3. CONTRACT VALUE	
a. COSTS	b. F.L.C.
\$ 116	\$ - 0 -
4. FUND LIMITATION	
\$ 116	\$ - 0 -
5. BILLING	
a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 107	\$ 106

1. DESCRIPTION OF CONTRACT

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
 NAS1-16357

d. AUTH. CONTR. REP. (Signature) _____ DATE 5/15/84

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.	e.	f.	c.	e.	f.	
Direct Labor Hours *	.1	.1	6.0	6.0			.1	6.1	6.1	
Direct Labor Dollars	1	1	60	60			1	61	61	
Overhead	-	-	38	38			3	41	41	
Fringe Benefits	-	-	6	6			1	7	7	
Other Direct Costs	-	-	4	4			3	7	7	
Total Costs	1	1	108	108			8	116	116	

*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.

635-675

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



June 13, 1984

Mr. C.L. Crowder, Contracting Office
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended May 31, 1984.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/vdh

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Ms. L. Boyd ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 Copies
File: R5380-0A0

5/31/84

TO: NASA-Langley Research Center
 Attn: Mr. C.L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM: Georgia Tech Research Institute
 Atlanta, Georgia 30332

3. CONTRACT VALUE	
a. COSTS	b. FEES
\$ 136	\$ -0-

1. DESCRIPTION OF CONTRACT

ii. TYPE
 Cost Reimbursable

c. SCOPE OF WORK
 ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
 NASI-16357

d. AUTH. CONTR. REP. (Signature) _____ DATE
 6/13/84

4. FUND LIMITATION	
\$ 136	\$ -0-
5. BILLING	
a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 110	\$ 107

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUTSTANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	e.	b.				
	a.	b.	c.	d.	e.	b.	c.	a.	b.	
Direct Labor Hours*	.1	.1	6.1	6.1			.7	6.8	6.8	
Direct Labor Dollars	1	1	61	61			7	68	68	
Overhead	1	1	39	39			9	48	48	
Fringe Benefits	-	-	6	6			3	9	9	
Other Direct Costs	-	-	4	4			7	11	11	
Total Costs	2	2	110	110			26	136	136	

*Disclaimer: for purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT

(404) 894-6624 OR 2124



August 2, 1984

Mr. C.L. Crowder, Contracting Office
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the monthly Contractor Financial Management Report
for contract no. NAS1-16357 for the month ended June 30, 1984.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/so

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
✓ Ms. L. Boyd
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - 2 Copies
File: R5380-OA0

G-33-675 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Form Approved
 Budget Bureau No. 104-R0011

2 REPORT FOR MONTH ENDING AND NUMBER OF OPERATING DAYS
 6/30/84 21

TO: NASA-Langley Research Center
 Attn: Mr. C.L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM: Georgia Tech Research Corporation
 Atlanta, Georgia 30332

3. CONTRACT VALUE	
a. COSTS	b. FEE
\$ 136	\$ - 0 -
4 FUND LIMITATION	
\$ 136	\$ - 0 -
5. BILLING	
a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 113	\$ 107

1. DESCRIPTION OF CONTRACT
 a. TYPE: Cost Reimbursable
 c. SCOPE OF WORK: ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.: NAS1-16357
 d. AUTH. CONTR. REP. (Signature):
 DATE: 9/19/84

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CON-TRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	e.	b.	c.	d.			c.			
Direct Labor Hours*	-	-	6.1	6.1			.7	6.8	6.8	
Direct Labor Dollars	-	-	61	61			7	68	68	
Overhead	1	1	40	40			8	48	48	
Fringe Benefits	-	-	6	6			3	9	9	
Other Direct Costs	2	2	6	6			5	11	11	
Total Costs	3	3	113	113			23	136	136	

* Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.

GEORGIA INSTITUTE OF TECHNOLOGY

ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



September 20, 1984

Mr. C.L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended August 31, 1984. There was no activity in the month of July, 1984.

Also enclosed is a corrected report for the month ended June 30, 1984. Some incorrect figures were inadvertently used on the first one.

If you have questions or require additional information, please contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/so

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Ms. L. Boyd ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-2 Copies
File: R5380-OA0

ATTN: MR. C.L. CROWDER
 FINANCIAL MANAGEMENT, M/S 126
 HAMPTON, VA 23665

GEORGIA TECH RESEARCH CORPORATION
 ATLANTA, GEORGIA 30332

7. COSTS	\$ 136	8. FEE	\$ - 0 -
4. FUND LIMITATION	\$ 136		\$ - 0 -
5. BILLING			
a. INVOICE AMTS BILLED	\$ 113	b. TOTAL BYTS RECEIVED	\$ 107

1. DESCRIPTION OF CONTRACT	ii. TYPE	ii. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
	c. SCOPE OF WORK	ii. AUTH. CONTIN. REP. (Signature) DATE

COST REIMBURSABLE

NAS 1-16357

ERBS/SAGE

8/2/84

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED						
	a.	b.	c.	d.	e.	f.	c.	a.	b.	
DIRECT LABOR HOURS*	.1	.1	6.2	6.2			.6	6.8	6.8	
DIRECT LABOR DOLLARS	1	1	62	62			6	68	68	
OVERHEAD	1	1	40	40			8	48	48	
FRINGE BENEFITS	-	-	6	6			3	9	9	
OTHER DIRECT COSTS	2	2	6	6			5	11	11	
TOTAL COSTS	4	4	114	114			22	136	136	

*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.

A-35-625 D.F.

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



January 8, 1985

Mr. C.L. Crowder, Contracting Officer
NASA-Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report
for Contract No. NAS1-16357 for the month ended November 30,
1984.

If you have questions or require additional information, please
contact this office.

Sincerely,

Linda M. Krantz, Accountant III
Grants and Contracts Accounting

LMK/vdh

Enclosure

cc: Dr. C.S. Kiang
Dr. D.M. Cunnold
Mr. D. Farmer ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-2 Copies
File: R5380-OA0

TO: NASA-LANGLEY RESEARCH CENTER
 ATTN: Mr. C.L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM: Georgia Tech Research Corporation
 Atlanta, Georgia 30332

11/30/85
 3. CONTRACT NO.
 a. COSTS

\$ 136

\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE

Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-16357

4. FUND LIMITATION

\$ 136

\$ - 0 -

c. SCOPE OF WORK

ERBS/SAGE

d. AUTH. CONTR. REP. (Signature)

DATE

1/8/85

e. INVOICE AMTS BILLED

\$ 132

f. TOTAL PYTS REC'D

\$ 119

5. BILLING

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.	e.	b.	c.	e.	b.	
DIRECT LABOR HOURS*	-	-	6.8	6.8			-	6.8	6.8	
DIRECT LABOR DOLLARS	-	-	68	68			-	68	68	
OVERHEAD	1	1	48	48			-	48	48	
FRINGE BENEFITS	-	-	8	8			1	9	9	
OTHER DIRECT COSTS	-	-	8	8			3	11	11	
TOTAL COSTS	1	1	132	132			4	136	136	
*Disclaimer: For purposes of the this report it was assumed that the professor worked a 40 hour week. Many work more than this.										



April 17, 1985

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the months ended January 31, 1985, February 28, 1985 and March 31, 1985.

If you have questions or require additional information, please contact this office.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

Enclosures

cc: Dr. C. S. Kiang
Dr. D. M. Cunnold
Mr. D. Farmer
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-2 Copies
File: R5380-0A0

NASA Langley Research Center
 Attn: Mr. C. L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM:
 Georgia Tech Research Corporation
 Atlanta, Georgia 30332

03/31/85 21
 3. CONTRACT VALUE
 a. COSTS \$ 182
 b. FEE \$ - 0 -

1. DESCRIPTION OF CONTRACT
 a. TYPE Cost Reimbursable
 c. SCOPE OF WORK ERBS/SAGE
 b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO. NAS1-16357
 d. AUTH/CONTR. REP. (Signature) | DATE 04/15/85
 4. FUND LIMITATION \$ 182
 5. BILLING
 6. INVOICE AMTS BILLED \$ 160
 7. TOTAL PYTS REC'D \$ 133

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED						
Direct Labor Hours *	1.3	1.3	8.2	8.2			--	9.3	9.3	
Direct Labor Dollars	13	13	82	82			11	93	93	
Overhead	9	9	58	58			6	64	64	
Fringe Benefits	4	4	12	12			2	14	14	
Other Direct Costs	--	--	8	8			3	11	11	
Total Costs	26	26	160	160			22	182	182	

* Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.

NASA-Langley Research Center
 Attn: Mr. C. L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM:
 Georgia Tech Research Corporation
 Atlanta, Georgia 30332.

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 182	\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE

Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-16357

4. FUND LIMITATION

\$ 182	\$ - 0 -
--------	----------

c. SCOPE OF WORK

ERBS/SAGE

d. AUTH. CONTR. REP. (Signature) DATE

04/17/85

5. INVOICE AMTS BILLED

\$ 134

b. TOTAL PYTS REC'D

\$ 131

8. BILLING

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CON-TRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED						
Direct Labor Hours *	--	--	6.9	6.9			--	9.3	9.3	
Direct Labor Dollars	--	--	69	69			24	93	93	
Overhead	1	1	49	49			15	64	64	
Fringe Benefits	--	--	8	8			6	14	14	
Other Direct Costs	--	--	8	8			3	11	11	
Total Costs	1	1	134	134			48	182	182	
* Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.										

Attn: Mr. C. L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

Georgia Tech Research Corporation
 Atlanta, Georgia 30332

3. CONTRACT VALUE	
a. COSTS	b. FEE
\$ 182	\$ - 0 -
4. FUND LIMITATION	
\$ 182	\$ - 0 -
5. BILLING	
b. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 133	\$ 130

1. DESCRIPTION OF CONTRACT	a. TYPE	b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.	c. SCOPE OF WORK	d. AUTH. CONTR. REP. (Signature)	DATE
	Cost Reimbursable				

8. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.	e.	f.	g.	h.		
Direct Labor Hours *	--	--	6.9	6.9			--	9.3	9.3	
Direct Labor Dollars	--	--	69	69			24	93	93	
Overhead	--	--	48	48			16	64	64	
Fringe Benefits	--	--	8	8			6	14	14	
Other Direct Costs	--	--	8	8			3	11	11	
Total Costs	--	--	133	133			49	182	182	

* Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.

035-675

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



May 30, 1985

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended April 30, 1985.

If you have questions or require additional information, please contact this office.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

Enclosure

cc: Dr. C. S. Kiang
Dr. D. M. Cunnold
Mr. D. Farmer ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-2 Copies
File: R5380-OA0

NASA-Langley Research Center
 Attn: Mr. C. L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM:
 Georgia Tech Research Corporation
 Atlanta, Georgia 30332

3. CONTRACT VALUE

a. COSTS

b. FEE

\$ 182

\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE

Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-16357

4. FUND LIMITATION

\$ 182

\$ - 0 -

c. SCOPE OF WORK

ERBS/SAGE

d. AUTH. CONTR. REP. (Signature)

DATE

05/30/85

e. INVOICE AMTS BILLED

\$ 166

f. BILLING

g. TOTAL PYTS REC'D

\$ 133

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED						
Direct Labor Hours *	.3	.3	8.5	8.5			8	9.3	9.3	
Direct Labor Dollars	3	3	85	85			8	93	93	
Overhead	2	2	60	60			4	64	64	
Fringe Benefits	1	1	13	13			1	14	14	
Other Direct Costs	0	0	8	8			3	11	11	
Total Costs	6	6	166	166			15	182	182	

* Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.

G35 1615

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

ASSOCIATE VICE PRESIDENT
(FINANCE)

GRANTS AND CONTRACTS
ACCOUNTING DEPT.

(404) 894-4624 OR 2629



June 17, 1985

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended May 31, 1985.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

Enclosure

- cc: Dr. C. S. Kiang
- Dr. D. M. Cunnold
- Mr. D. Farmer ✓
- Ms. Suzanne Zimmerman
- Tech. Rep. M/S 234
- NASA Expt. Scientist
- Cost Accounting M/S 135-2 copies
- File: R5380-OAO

TO: NASA-Langley Research Center Attn: Mr. C. L. Crowder Financial Management, M/S 126 Hampton, VA 23665		FROM: Georgia Tech Research Corporation Atlanta, Georgia 30332.		3. CONTRACT VALUE	
1. DESCRIPTION OF CONTRACT		b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.		a. COSTS	b. FEE
a. TYPE Cost Reimbursable		NAS1-16357		\$ 182	\$ - 0 -
c. SCOPE OF WORK ERBS/SAGE		d. AUTH. CONTR. REP. (Signature) DATE 06/18/85		4. FUND LIMITATION \$ 182 \$ - 0 -	
				5. BILLING	
				a. INVOICE AMTS BILLED \$ 171	b. TOTAL PYTS REC'D \$ 133

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT c.	CON-TRACTOR ESTIMATE a.	CONTRACT VALUE b.	
	ACTUAL a.	PLANNED b.	ACTUAL c.	PLANNED d.	a.	b.				
Direct Labor Hours *	.3	.3	8.8	8.8			.5	9.3	9.3	
Direct Labor Dollars	3	3	88	88			5	93	93	
Overhead	2	2	62	62			2	64	64	
Fringe Benefits	0	0	13	13			1	14	14	
Other Direct Costs	--	--	8	8			3	11	11	
Total Costs	5	5	171	171			11	182	182	

*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.



GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

6735-675

Georgia Institute of Technology
Grants and Contracts Accounting Dept.
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

August 14, 1985

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended June 30, 1985.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/vdh

Enclosure

cc: Dr. C. S. Kiang
Dr. D. M. Cunnold
Mr. D. Farmer ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-2 copies
File: R5380-OA0



GEORGIA TECH 1985-1985

DESIGNING TOMORROW TODAY

635-045

Georgia Institute of Technology

Grants and Contracts Accounting Dept.

Lyman Hall/Emerson Building

Atlanta, Georgia 30332-0259

Telephone: (404) 894-4624; 2629

September 20, 1985

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended August 31, 1985.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/vdh

Enclosure

cc: Dr. C. S. Kiang
Dr. D. M. Cunnold
Mr. D. Farmer ✓
Ms. Suzanne Zimmerman
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-2 copies
File: R5380-OA0

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

06/31/85

22

TO:

NASA-Langley Research Center
Attn: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM:

Georgia Tech Research Corp
Atlanta, Georgia 30332

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 185	\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE

Cost Reimbursable

c. SCOPE OF WORK

ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-16357

d. AUTH. CONTR. REP. (Signature)

DATE
09/20/85

4. FUND LIMITATION

\$ 185	\$ - 0 -
--------	----------

5. BILLING

a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 180	\$ 168

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED						
	a.	b.	c.	d.	e.	f.	g.	h.		
Direct Labor Hours *	.1	.1	9.2	9.2			.2	9.4	9.4	
Direct Labor Dollars	1	1	92	92			2	94	94	
Overhead	1	1	65	65			1	66	66	
Fringe Benefits	0	0	14	14			0	14	14	
Other Direct Costs	0	0	9	9			2	11	11	
Total Costs	2	2	180	180			5	185	185	
*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week, Many work more than this.										
NOTE: No Expenditures During July, 1985										



GEORGIA TECH 1885-1985

Georgia Institute of Technology
Grants and Contracts Accounting Dept.
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

DESIGNING TOMORROW TODAY

October 24, 1985

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended September 30, 1985.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420 ✓
Ms. Suzanne Zimmerman 0340
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OA0

Enclosure

TO: NASA-Langley Research Center
 Attn: Mr. C. L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM:
 Georgia Tech Research Corp.
 Atlanta, Georgia 30332

3. CONTRACT VALUE	
a. COSTS	b. FEE
\$ 185	\$ - 0 -

1. DESCRIPTION OF CONTRACT

h. TYPE
 Cost Reimbursable

c. SCOPE OF WORK
 ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
 NAS1-16357

d. AUTH/CONTR REP. (Signature) _____

DATE
 10/24/85

4. FUND LIMITATION	
\$ 185	\$ - 0 -
B. BILLING	
a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 181	\$ 175

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
Direct Labor Hours *	.1	.1	9.3	9.3			.1	9.4	9.4	
Direct Labor Dollars	1	1	93	93			1	94	94	
Overhead	0	0	65	65			1	66	66	
Fringe Benefits	0	0	14	14			0	14	14	
Other Direct Costs	0	0	9	9			2	11	11	
Total Costs	1	1	181	181			4	185	185	
*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.										



GEORGIA TECH 1885-1985

Georgia Institute of Technology

Grants and Contracts Accounting Dept.

Lyman Hall/Emerson Building

Atlanta, Georgia 30332-0259

Telephone: (404) 894-4624; 2629

DESIGNING TOMORROW TODAY

November 21, 1985

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended October 31, 1985.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420 ✓
Ms. Suzanne Zimmerman 0340
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OA0

Enclosure

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Form Approved
Budget Bureau No. 104-R0011

2. REPORT FOR MONTH ENDING AND NUMBER OF OPERATING DAYS
10/31/85 23

TO: NASA-LANGLEY RESEARCH CENTER
ATTN: MR. C. L. CROWDER
FINANCIAL MANAGEMENT, M/S 126
HAMPTON, VA 23665

FROM:
GEORGIA TECH RESEARCH CORP.
ATLANTA, GEORGIA 30332

3. CONTRACT VALUE
a. COSTS \$ 185
b. FEE \$ - 0 -

1. DESCRIPTION OF CONTRACT
a. TYPE COST REIMBURSABLE
c. SCOPE OF WORK ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
NAS1-16357
d. AUTH. CONTR. REF. (Signature), DATE 11/21/85

4. FUND LIMITATION \$ 185
5. BILLING
a. INVOICE AMTS BILLED \$ 183
b. TOTAL PYTS REC'D \$ 175

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT c.	CON-TRACTOR ESTIMATE a.	CONTRACT VALUE b.	
	ACTUAL a.	PLANNED b.	ACTUAL c.	PLANNED d.	a.	b.				
Direct Labor Hours*	.1	.1	9.4	9.4			-0-	9.4	9.4	
Direct Labor Dollars	1	1	94	94			-0-	94	94	
Overhead	1	1	66	66			-0-	66	66	
Fringe Benefits	-0-	-0-	14	14			-0-	14	14	
Other Direct Costs	-0-	-0-	9	9			2	11	11	
Total Costs	2	2	183	83			2	185	185	

*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week.
Many work more than this.



GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

G-35-675
Georgia Institute of Technology
Grants and Contracts Accounting Dept.
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

December 16, 1985

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended November 30, 1985.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420 ✓
Ms. Suzanne Zimmerman 0340
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OA0

Enclosure

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

11/30/85

18

TO: NASA-LANGLEY RESEARCH CENTER
ATTN: MR. C. L. CROWDER
FINANCIAL MANAGEMENT, M/S 126
HAMPTON, VA 23665

FROM: GEORGIA TECH RESEARCH CORP.
ATLANTA, GEORGIA 30332

3. CONTRACT VALUE	
a. COSTS	b. FEE
\$ 185	\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE
Cost Reimbursable

c. SCOPE OF WORK
ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
NAS1-16357

d. AUTH. CONTR. REP. (Signature) | DATE
12/16/85

4. FUND LIMITATION	
\$ 185	\$ - 0 -
5. BILLING	
b. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 183	\$ 176

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE		9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED					
	a.	b.	c.	d.	e.	f.	c.	a.	b.
Direct Labor Hours *	- 0 -	- 0 -	9.4	9.4			- 0 -	9.4	9.4
Direct Labor Dollars	- 0 -	- 0 -	94	94			- 0 -	94	94
Overhead	- 0 -	- 0 -	66	66			- 0 -	66	66
Fringe Benefits	- 0 -	- 0 -	14	14			- 0 -	14	14
Other Direct Costs	- 0 -	- 0 -	9	9			2	11	11
Total Costs	- 0 -	- 0 -	183	183			2	185	185

*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week.
Many work more than this.

G-35-675/R5380-0A0



G-35-610

GEORGIA TECH 1885-1985

DESIGNING TOMORROW TODAY

Georgia Institute of Technology
Grants and Contracts Accounting Dept
Lyman Hall-Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

January 21, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended December 31, 1985.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

✓
Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0307 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-0A0

Enclosure

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Form Approved
Budget Bureau No. 104-R0011

2. REPORT FOR MONTH ENDING AND NUMBER OF OPERATING DAYS

12/31/85 17

1. NASA-Langley Research Center
Attn: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM:
Georgia Tech Research Corp.
P. O. Box 100117
Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 185	\$ - 0 -

1. DESCRIPTION OF CONTRACT
a. TYPE
Cost Reimbursable

d. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
NAS1-16357

4. FUND LIMITATION
\$ 185 \$ - 0 -

c. SCOPE OF WORK
ERBS/SAGE

d. AUTH. CONTR. REP. (Signature) DATE
[Signature] 01/21/86

5. BILLING
a. INVOICE AMTS BILLED b. TOTAL PYTS REC'D
\$ 183 \$ 179

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CON-TRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.			c.			
Direct Labor Hours*	0	0	9.4	9.4			0	9.4	9.4	
Direct Labor Dollars	0	0	94	94			0	94	94	
Overhead	0	0	66	66			0	66	66	
Fringe Benefits	0	0	14	14			0	14	14	
Other Direct Costs	0	0	9	9			2	11	11	
Total Costs	0	0	183	183			2	185	185	

*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week.
Many work more than this.

G-35-675/R5380-0A0



GEORGIA TECH 1885-1985

Georgia Institute of Technology
Grants and Contracts Accounting Dept.
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

DESIGNING TOMORROW TODAY

February 18, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended January 31, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0307 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-0A0

Enclosure

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

01/31/86

21

TO: NASA-Langley Research Center
Attn: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM: Georgia Tech Research Corporation
P O Box 100117
Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS

b. FEE

\$ 185

\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE

Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-16357

4. FUND LIMITATION

\$ 185

\$ - 0 -

c. SCOPE OF WORK

ERBS/SAGE

d. AUTH. CONTR. REG. (Signature)

DATE

02/18/86

5. BILLING

a. INVOICE AMTS BILLED

\$ 183

b. TOTAL PYTS REC'D

\$ 180

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				B. ESTIMATED COSTS/HRS. TO COMPLETE		BALANCE OF CONTRACT	9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL			CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.			c.	e.	b.	
Direct Labor Hours*	0	0	9.4	9.4			0	9.4	9.4	
Direct Labor Dollars	0	0	94	94			0	94	94	
Overhead	0	0	66	66			0	66	66	
Fringe Benefits	0	0	14	14			0	14	14	
Other Direct Costs	0	0	9	9			2	11	11	
Total Costs	0	0	183	183			2	185	185	
*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this										
G-35-675/R5380-OA0										



GEORGIA TECH 1885-1985

Georgia Institute of Technology
Grants and Contracts Accounting Dept.
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

DESIGNING TOMORROW TODAY

March 14, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended February 28, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0307
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OAO

Enclosure

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

02/28/86

20

TO: NASA-LANGLEY RESEARCH CENTER
 ATTN: MR. C. L. CROWDER
 FINANCIAL MANAGEMENT, M/S 126
 HAMPTON, VA 23665

FROM: Georgia Tech Research Corporation
 P. O. Box 100117
 Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 185	\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE
 Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
 NAS1-16357

4. FUND LIMITATION
 \$ 185 \$ - 0 -

c. SCOPE OF WORK
 ERBS/SAGE

d. AUTH. CONTR. REP. (Signature) | DATE
 | 03/14/86

B. BILLING
 a. INVOICE AMTS BILLED | b. TOTAL PYTS REC'D
 \$ 183 | \$ 180

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CONTRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED						
	a.	b.	c.	d.	e.	b.	c.	a.	b.	
Direct Labor Hours*	0	0	9.4	9.4			0	9.4	9.4	
Direct Labor Dollars	0	0	94	94			0	94	94	
Overhead	0	0	66	66			0	66	66	
Fringe Benefits	0	0	14	14			0	14	14	
Other Direct Costs	0	0	9	9			2	11	11	
Total Costs	0	0	183	183			2	185	185	

*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.

G-35-675/R5380-0A0



GEORGIA TECH 1885-1985

Georgia Institute of Technology

Grants and Contracts Accounting Dept.

Lyman Hall/Emerson Building

Atlanta, Georgia 30332-0259

Telephone: (404) 894-4624; 2629

DESIGNING TOMORROW TODAY

April 11, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended March 31, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0307/0420
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OA0

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Georgia Institute of Technology

Grants and Contracts Accounting Dept.

Lyman Hall/Emerson Building

Atlanta, Georgia 30332-0259

Telephone: (404) 894-4624; 2629

May 12, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended April 30, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
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Enclosure



MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

03/31/86

21

TO: NASA-Langley Research Center
Attn: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM:
Georgia Tech Research Corporation
P. O. Box 100117
Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS

b. FEE

\$ 185

\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE

Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-16357

4. FUND LIMITATION

\$ 185

\$ - 0 -

c. SCOPE OF WORK
ERBS/SAGE

d. AUTH/ CONTR. REP. (Signature)

DATE

04/11/86

a. INVOICE AMTS BILLED

\$ 183

b. TOTAL PYTS REC'D

\$ 180

B. BILLING

6. REPORTING CATEGORY

7. COSTS INCURRED/HOURS WORKED

8. ESTIMATED COSTS/HRS. TO COMPLETE

9. ESTIMATED FINAL COSTS/HOURS

10. UN-FILLED ORDERS OUT-STANDING

DURING MONTH

CUM. TO DATE

DETAIL

BALANCE OF CONTRACT

CONTRACTOR ESTIMATE

CONTRACT VALUE

ACTUAL

PLANNED

ACTUAL

PLANNED

a.

b.

c.

d.

e.

f.

Direct Labor Hours*

0

0

9.4

9.4

0

9.4

9.4

Direct Labor Dollars

0

0

94

94

0

94

94

Overhead

0

0

66

66

0

66

66

Fringe Benefits

0

0

14

14

0

14

14

Other Direct Costs

0

0

9

9

2

11

11

Total Costs

0

0

183

183

2

185

185

Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than the

G-35-675/R5380-OA0

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

04/30/86

22

TO: NASA-Langley Research Center
Attn: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM:
Georgia Tech Research Corporation
P. O. Box 100117
Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 237	\$ - 0 -

1. DESCRIPTION OF CONTRACT

a. TYPE

Cost Reimbursable

c. SCOPE OF WORK

ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-16357

d. AUTH. CONTR. REP. (Signature)

DATE

05-12-86

4. FUND LIMITATION

\$ 237	\$ - 0 -
--------	----------

5. BILLING

a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 193	\$ 180

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CON-TRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.			c.	a.	b.	
Direct Labor Hours*	.5	.5	9.9	9.9			1.6	11.5	11.5	
Direct Labor Dollars	5	5	99	99			16	115	115	
Overhead	4	4	70	70			16	86	86	
Fringe Benefits	1	1	15	15			2	17	17	
Other Direct Costs	0	0	9	9			10	19	19	
Total Costs	10	10	193	193			44	237	237	
Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this										
G-33-675/R5380-0A0										

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

04/30/86

22

TO: NASA-Langley Research Center Attn: Mr. C. L. Crowder Financial Management, M/S 126 Hampton, VA 23665		FROM: Georgia Tech Research Corporation P. O. Box 100117 Atlanta, Georgia 30384		9. CONTRACT VALUE	
a. TYPE Cost Reimbursable		b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO. NAS1-16357		a. COSTS \$ 237	b. FEE \$ - 0 -
1. DESCRIPTION OF CONTRACT		d. AUTH. CONTR. REP. (Signature) DATE 05-12-86		4. FUND LIMITATION \$ 237 \$ - 0 -	
c. SCOPE OF WORK ERBS/SAGE				8. BILLING	
				a. INVOICE AMTS BILLED \$ 193	b. TOTAL PYTS REC'D \$ 180

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE		9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING	
	DURING MONTH		CUM. TO DATE		DETAIL		CONTRACTOR ESTIMATE a.	CONTRACT VALUE b.		
	ACTUAL a.	PLANNED b.	ACTUAL c.	PLANNED d.						BALANCE OF CONTRACT c.
Direct Labor Hours*	.5	.5	9.9	9.9			1.6	11.5	11.5	
Direct Labor Dollars	5	5	99	99			16	115	115	
Overhead	4	4	70	70			16	86	86	
Fringe Benefits	1	1	15	15			2	17	17	
Other Direct Costs	0	0	9	9			10	19	19	
Total Costs	10	10	193	193			44	237	237	

Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.



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Grants and Contracts Accounting Dept.
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

DESIGNING TOMORROW TODAY

June 20, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended May 31, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OA0

Enclosure

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

05/31/86

22

TO: NASA-Langley Research Center
Attn: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM: Georgia Tech Research Corp.
P. O. Box 100117
Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 237	\$ - 0 -

I. DESCRIPTION OF CONTRACT

II. TYPE
Cost Reimbursable

III. SCOPE OF WORK
ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
NAS1-16357

d. AUTH. CONTR. REP. (Signature) DATE
Virginia H. ... 06/20/86

4. FUND LIMITATION

\$ 237 \$ - 0 -

5. BILLING

a. INVOICE AMTS BILLED b. TOTAL PYTS REC'D

\$ 227 \$ 181

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE			9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CON-TRACTOR ESTIMATE	CONTRACT VALUE	
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.						
Direct Labor Hours*	1.8	1.8	11.7	11.7			(.2)	11.5	11.5	
Direct Labor Dollars	18	18	117	117			(2)	115	115	
Overhead	13	13	83	83			3	86	86	
Fringe Benefits	3	3	18	18			(1)	17	17	
Other Direct Costs	0	0	9	9			10	19	19	
Total Costs	34	34	227	227			10	237	237	

*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.

G-33-675/R5380-0A0

July 31, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23685

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended June 30, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Crowlold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmüller 0420
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/RS380-0A0

Enclosure

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

06/30/86

21

TO: NASA-Langley Research Center
 Attn: Mr. C. L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM: Georgia Tech Research Corporation
 P. O. Box 100117
 Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 237	\$ - 0 -

I. DESCRIPTION OF CONTRACT

II. TYPE
 Cost Reimbursable

III. SCOPE OF WORK
 ERBS/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
 NAS1-16357

4. FUND LIMITATION
 \$ 237 \$ - 0 -

d. AUTH. CONTR. REP. (Signature) DATE
 _____ 07/31/86

5. BILLING

a. INVOICE AMTS BILLED b. TOTAL PYTS REC'D
 \$ 233 \$ 181

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE		9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING	
	DURING MONTH		CUM. TO DATE		DETAIL		BALANCE OF CONTRACT	CON-TRACTOR ESTIMATE		CONTRACT VALUE
	ACTUAL	PLANNED	ACTUAL	PLANNED	a.	b.				
	a.	b.	c.	d.			c.	a.	b.	
Direct Labor Hours*	.3	.3	12.0	12.0			(.5)	11.5	11.5	
Direct Labor Dollars	3	3	120	120			(5)	115	115	
Overhead	2	2	85	85			1	86	86	
Fringe Benefits	1	1	19	19			(2)	17	17	
Other Direct Costs	0	0	9	9			10	19	19	
Total Costs	6	6	233	233			4	237	237	
*Disclaimer: For purposes of this report it was assumed that the professor worked a 40 hour week. Many work more than this.										
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Georgia Institute of Technology
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Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

September 17, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended August 31, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-0A0

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Georgia Institute of Technology
Grants and Contracts Accounting Dept
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

October 13, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended September 30, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Mr. D. Farmer 0420
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-0A0

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GEORGIA TECH 1885-1985

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8-35-675
Georgia Institute of Technology
Grants and Contracts Accounting Dept
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624, 2629

November 12, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended October 31, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OA0

Enclosure



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Georgia Institute of Technology
Grants and Contracts Accounting Dept.
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
Telephone: (404) 894-4624; 2629

December 9, 1986

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended November 30, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-0A0

Enclosure

Georgia Institute of Technology
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
404 • 894 • 4624; 2629

January 13, 1987

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended December 31, 1986.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Linda A. Gill
Linda A. Gill, Accountant III
Grants and Contracts Accounting

LAG/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OAO

Enclosure

Georgia Institute of Technology
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
404-894-4624; 2629

February 12, 1987

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended January 31, 1987.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Randall Bailey, Financial Mgmt Associate
Grants and Contracts Accounting

RB/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-OAO ✓

Enclosure

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

01/31/87

18

TO: NASA - Langley Research Center
 Attn: Mr. C. L. Crowder
 Financial Management, M/S 126
 Hampton, VA 23665

FROM:
 Georgia Tech Research Corporation
 P. O. Box 100117
 Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 237	\$ - 0 ⁰⁰

1. DESCRIPTION OF CONTRACT

h. TYPE

Cost Reimbursable

i. SCOPE OF WORK

ERB/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-16357

d. AUTH. CONTR. REP. (Signature)

DATE

02/12/87

4. FUND LIMITATION

\$ 237 \$ - 0 -

5. BILLING

a. INVOICE AMTS BILLED

\$ 237

b. TOTAL PYTS REC'D

\$ 235

6. REPORTING CATEGORY

7. COSTS INCURRED/HOURS WORKED

DURING MONTH

CUM. TO DATE

8. ESTIMATED COSTS/HRS. TO COMPLETE

DETAIL

9. ESTIMATED FINAL COSTS/HOURS

10. UN-FILLED ORDERS OUT-STANDING

ACTUAL

PLANNED

ACTUAL

PLANNED

a.

b.

BALANCE OF CONTRACT

c.

CON-TRACTOR ESTIMATE

d.

CONTRACT VALUE

e.

Direct Labor Hours*

0

0

12.0

12.0

(.5)

11.5

11.5

Direct Labor Dollars

0

0

120

120

(5)

115

115

Overhead

0

0

87

87

(1)

86

86

Fringe Benefits

0

0

19

19

(2)

17

17

Other Direct Costs

0

0

11

11

8

19

19

Total Costs

0

0

237

237

0

237

237

G-35-675/R5380-0A0

Georgia Institute of Technology
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
404-894-4624; 2629

March 19, 1987

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended February 28, 1987.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Randall Bailey, Financial Mgmt Associate
Grants and Contracts Accounting

RB/djt

cc: Dr. C. S. Kiang 0340
Dr. D. M. Cunnold 0340
Ms. Suzanne Zimmerman 0340
Ms. Pat Heitmuller 0420 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135-(2 copies)
File G-35-675/R5380-0A0

Enclosure

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Budget Bureau No. 104-R0011

02-28-87

20

TO: Langley Research Center
Attn: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM:
Georgia Tech Research Corporation
P. O. Box 100117
Atlanta, Georgia 30384

3. CONTRACT VALUE

a. COSTS	b. FEE
\$ 237	\$ - 0 -

1. DESCRIPTION OF CONTRACT

ii. TYPE
Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
NAS1-16357

4. FUND LIMITATION
\$ 237

c. SCOPE OF WORK
ERB/SAGE

d. AUTH. CONTR. REP. (Signature) | **DATE**
03/19/87

5. BILLING

a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 237	\$ 235

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE		9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING	
	DURING MONTH		CUM. TO DATE		DETAIL		CONTRACTOR ESTIMATE	CONTRACT VALUE		
	ACTUAL a.	PLANNED b.	ACTUAL c.	PLANNED d.	e.	b.				BALANCE OF CONTRACT c.
Director Labor Hours*	0	0	12.0	12.0			(.5)	11.5	11.5	
Direct Labor Dollars	0	0	120	120			(5)	115	115	
Overhead	0	0	87	87			(1)	86	86	
Fringe Benefits	0	0	19	19			(2)	17	17	
Other Direct Costs	0	0	11	11			8	19	19	
Total Costs	0	0	237	237			0	237	237	

Georgia Tech

G-35-675

Office of Grants and Contract Accounting

Georgia Institute of Technology
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
404-894-4624; 2629

April 21, 1987

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended March 31, 1987.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

✓ Randall Bailey, Financial Mgmt. Associate
Grants and Contracts Accounting

RB/djt

cc: Dr. C. S. Kiang, Geophysical Sci. - 0340
Dr. D. M. Cunnold, Geophysical Sci. - 0340
Ms. Suzanne Zimmerman, Geophysical Sci. - 0340
Ms. Pat Heitmuller, OCA - 0420 ✓
Tech. Rep. M/S 234
NASA Expt. Scientist
Cost Accounting M/S 135 - (2 copies)
OCA/CSD - 0420
File G-35-675/R5380-OAO

Enclosure

MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Form Approved
Budget Bureau No. 104-R0011

OPERATING DAYS
03/31/87 22

TO: Langley Research Center
Attn: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM: Georgia Tech Research Corporation
P. O. Box 100117
Atlanta, Georgia 30384

3. CONTRACT VALUE	
a. COSTS	b. FEE
\$ 237	\$ - 0--
4. FUND LIMITATION	
\$ 237	\$ - 0 -
5. BILLING	
a. INVOICE AMTS BILLED	b. TOTAL PYTS REC'D
\$ 237	\$ 235

1. DESCRIPTION OF CONTRACT
2. TYPE
Cost Reimbursable
3. SCOPE OF WORK
ERB/SAGE

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.
NAS1-16357
d. AUTH. CONTR. REP. (Signature) DATE
4/21/87

6. REPORTING CATEGORY	7. COSTS INCURRED/HOURS WORKED				8. ESTIMATED COSTS/HRS. TO COMPLETE		9. ESTIMATED FINAL COSTS/HOURS		10. UN-FILLED ORDERS OUT-STANDING	
	DURING MONTH		CUM. TO DATE		DETAIL		CONTRACTOR ESTIMATE	CONTRACT VALUE		
	ACTUAL	PLANNED	ACTUAL	PLANNED						BALANCE OF CONTRACT
a.	b.	c.	d.	e.	f.	g.	h.			
Direct Labor Hours*	0	0	12.0	12.0			(.5)	11.5	11.5	
Direct Labor Dollars	0	0	120	120			(5)	115	115	
Overhead	0	0	87	87			(1)	86	86	
Fringe Benefits	0	0	19	19			(2)	17	17	
Other Direct Costs	0	0	11	11			8	19	19	
Total Costs	0	0	237	237			0	237	237	

Georgia Institute of Technology
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
404-894-4624; 2629

May 20, 1987

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended April 30, 1987.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Randall Bailey, Financial Mgmt Associate
Grants and Contracts Accounting

RB/djt

cc: Dr. C. S. Kiang, Geophysical Sci. 0340
Dr. D. M. Cunnold, Geophysical Sci. 0340
Ms. Suzanne Zimmerman, Geophysical Sci. 0340
OCA/CSD 0420 (2 copies)
Tech. Rep. M/S 234
Cost Accounting M/S 135 (2 copies)
NASA Expt. Scientist
File G-35-675/R5380-OAO

Enclosure

Georgia Institute of Technology
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
404-894-4624; 2629

June 19, 1987

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended May 31, 1987.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

✓ Randall Bailey, Financial Mgmt Associate
Grants and Contracts Accounting

RB/djt

cc: Dr. C. S. Kiang, Geophysical Sci. 0340
Dr. D. M. Cunnold, Geophysical Sci. 0340
Ms. Suzanne Zimmerman, Geophysical Sci. 0340
OCA/CSD 0420 (2 copies) ✓
Tech. Rep. M/S 234
Cost Accounting M/S 135 (2 copies)
NASA Expt. Scientist
File G-35-675/R5380-OAO

Enclosure

Georgia Institute of Technology
Lyman Hall/Emerson Building
Atlanta, Georgia 30332-0259
404-894-4624; 2629

August 12, 1987

Mr. C. L. Crowder, Contracting Officer
NASA - Langley Research Center
Financial Management Division M/S 126
Hampton, VA 23665

Mr. Crowder:

Enclosed is the Monthly Contractor Financial Management Report for Contract No. NAS1-16357 for the month ended July 31, 1987.

If you have questions or require additional information, please contact me at (404) 894-6759.

Sincerely,

Randall Bailey, Financial Mgmt Associate
Grants and Contracts Accounting

RB/djt

cc: Dr. C. S. Kiang, Geophysical Sci. 0340
Dr. D. M. Cunnold, Geophysical Sci. 0340
Ms. Suzanne Zimmerman, Geophysical Sci. 0340
Ms. Luch Blunski, Geophysical Sci. 0340
OCA/CSD 0420 (2 copies)
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NASA Expt. Scientist
File G-35-675/R5380-OAO

Enclosure

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MONTHLY CONTRACTOR FINANCIAL MANAGEMENT REPORT

Form Approved
Budget Bureau No. 104-R0011

2. REPORT FOR MONTH ENDING AND NUMBER OF OPERATING DAYS

07/31/87 22

TO: Langley Research Center
ATTN: Mr. C. L. Crowder
Financial Management, M/S 126
Hampton, VA 23665

FROM: Georgia Tech Research Corporation
P.O. BOX 100117
Atlanta, Georgia 30084

3. CONTRACT VALUE

a. COSTS

b. FEE

\$ -0-

\$ -0-

1. DESCRIPTION OF CONTRACT

m. TYPE

Cost Reimbursable

b. CONTRACT NO. AND LATEST DEFINITIZED AMENDMENT NO.

NAS1-18447

4. FUND LIMITATION

\$ 15

\$ -0-

5. BILLING

c. SCOPE OF WORK

ERBS/SAGE II

d. AUTH. CONTR. REP. (Signature)

DATE

6/12/87

6. INVOICE AMTS BILLED

\$ 6

b. TOTAL PYTS REC'D

\$ 1

6. REPORTING CATEGORY

7. COSTS INCURRED/HOURS WORKED

8. ESTIMATED COSTS/HRS. TO COMPLETE

9. ESTIMATED FINAL COSTS/HOURS

10. UN-FILLED ORDERS OUT-STANDING

DURING MONTH

CUM. TO DATE

DETAIL

BALANCE OF CONTRACT

CONTRACTOR ESTIMATE

CONTRACT VALUE

ACTUAL

PLANNED

ACTUAL

PLANNED

a.

b.

c.

a.

b.

Direct Labor Dollars

1

1

1

1

3

4

4

Fringe Benefits

0

0

0

0

1

1

1

Other Direct Costs

.7

.7

3.2

3.2

.8

4

4

Overhead

1

1

2.1

2.1

3.9

6

6

Total Costs

2.7

2.7

6.3

6.3

8.7

15

15

G-35-675

Georgia Institute of Technology

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ATLANTA, GEORGIA 30332

SCHOOL OF GEOPHYSICAL SCIENCES

404/894-3893

June 3, 1985

Mr. J. Y. Taylor
Contracting Officer
NASA/Langley Research Center
Contract Center
Mail Stop 126
Hampton, Virginia 23665

Re: NASA Contract No. NAS1-16357
Georgia Tech No. G-35-675

Dear Mr. Taylor:

Enclosed please find one copy of my Progress Report from the May 1985 team meeting at NASA Ames, California.

Sincerely,

Derek M. Cunnold

DMC/spz

Science Team Progress Report
for May, 1985 Meeting
NASA Ames, California

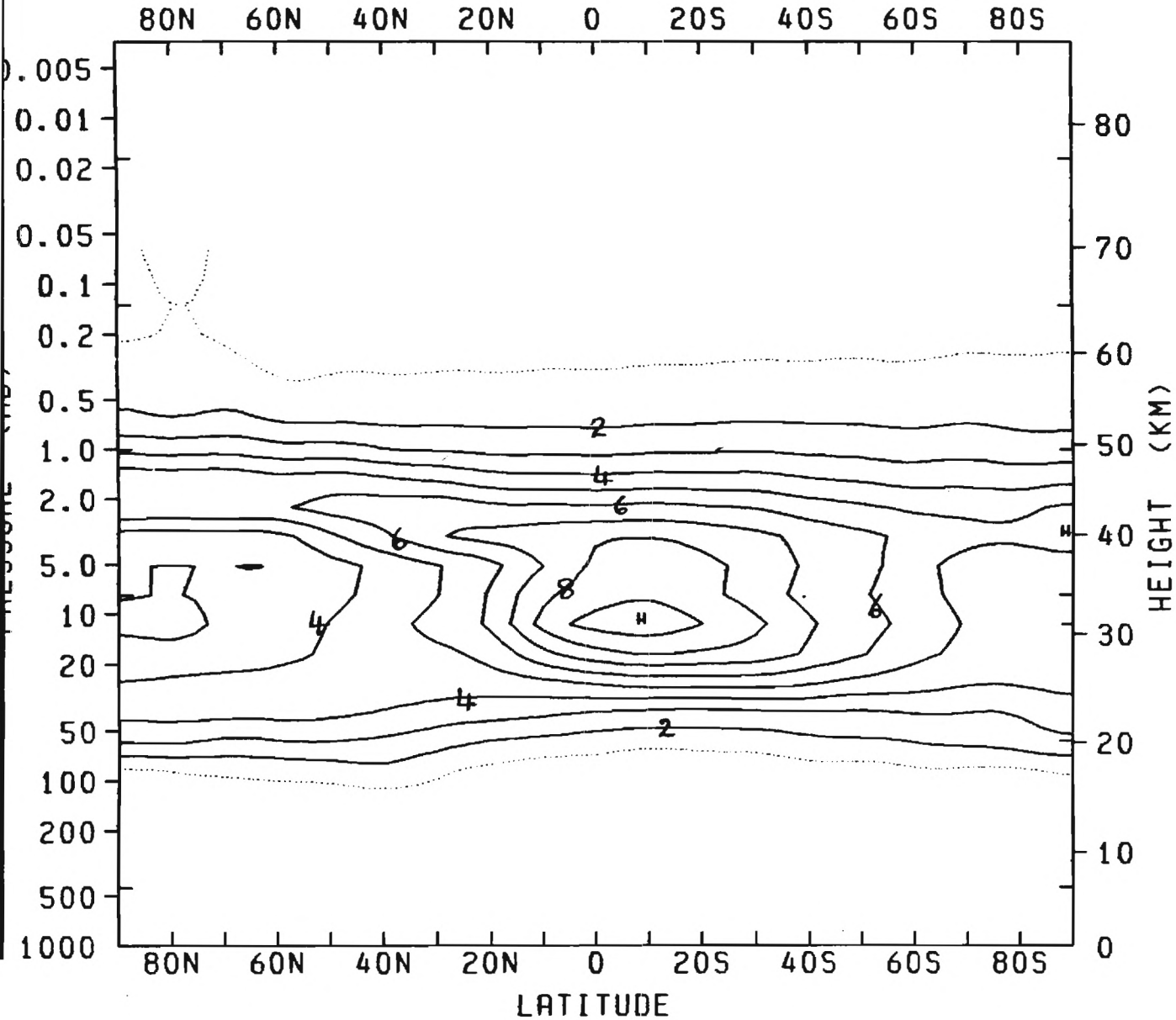
Science Support for Earth Radiation Budget
Satellite (ERBS)/Stratospheric Aerosol and
Gas Experiment (SAGE)

Dr. Derek M. Cunnold
School of Geophysical Sciences
Georgia Institute of Technology

The reprocessed SAGE I data has been decoded and collated for processing on our Data General computer by our graduate student, Mike Newchurch. This data is now being processed into Fourier coefficients in order to compare the revised SAGE data against the SBUV data (which also is now being revised). Results should be available within one month.

The principal activity during this period was the analysis of results from our new three-dimensional model of the atmosphere. A paper discussing the longitudinal variations of ozone in the model was presented at the AMS meeting on stratospheric dynamics held in Boulder in April. These first results from the 18 wave version of the model were encouraging in that the January zonal mean dynamics looked quite realistic. The stationary waves at mid-latitudes in winter also looked realistic. Thus the ozone distribution shown in Figure (i) and the distribution of longitudinal variability shown in Figure (ii) could be interpreted in terms of transport and chemistry. The interaction of these physical phenomena has a substantial effect on the ozone budget at mid-latitudes in winter. In the stratosphere this is a region which can be studied using SAGE (and SBUV) satellite data. We are, therefore, emphasizing this region in our studies and plan to compare model results and satellite observations of this region.

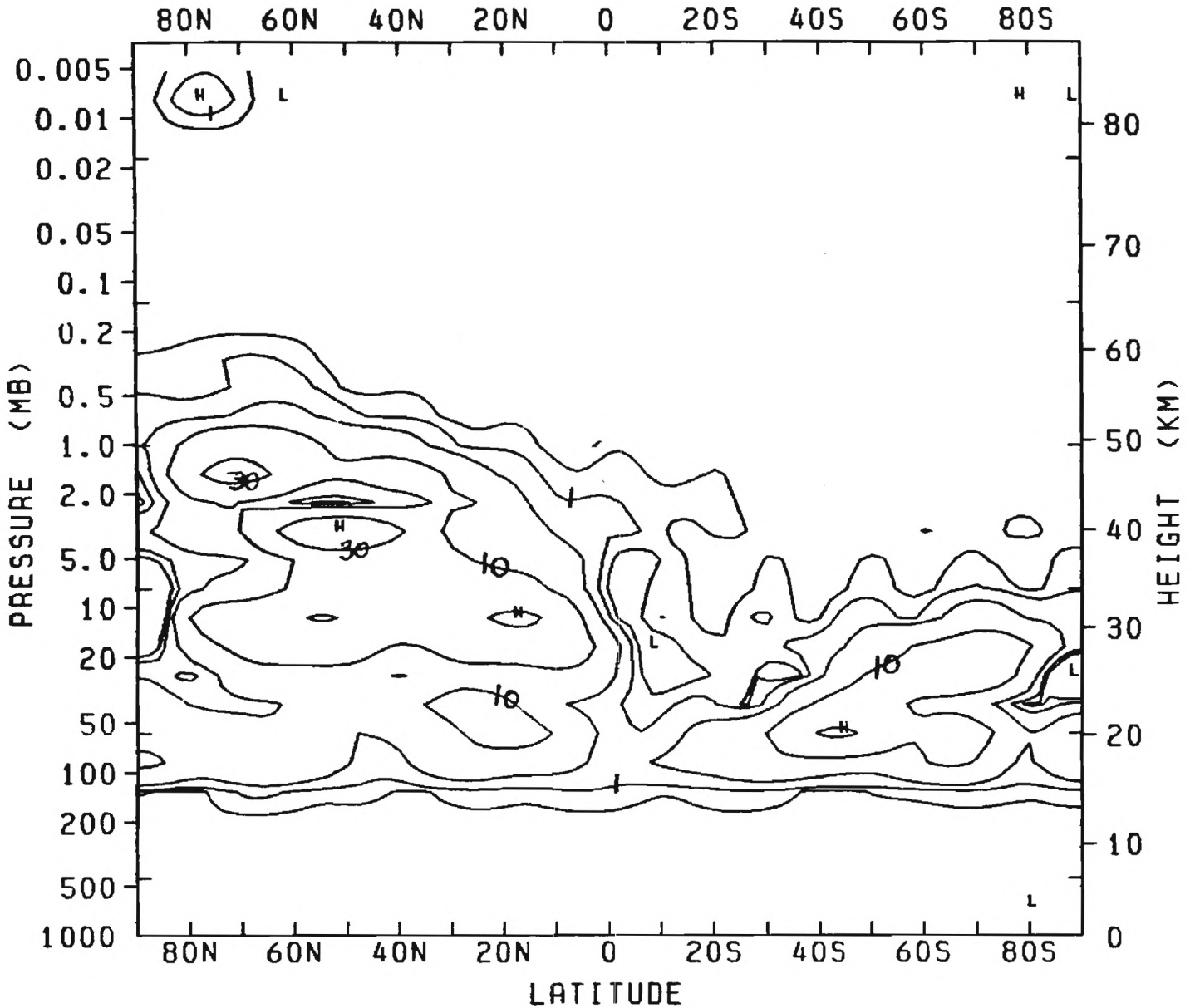
RUN 242 JANUARY 03BAR MIXING RATIO



LOW=1.68 E -8 HIGH=9.61 E -6 STANDARD= 0.0 INTERVAL= 10.0E -7

Figure (i): Zonal mean mixing ratio (ppmv) of ozone for January. Note the maximum at 2 mb at mid-latitude in winter.

XX03



LOW = -6.6E -14 HIGH = 5.94 E -13 STANDARD = NONE INTERVAL = 0.00 E -20

Figure (ii): Mean square longitudinal variability of ozone in January. Units are $(10^{-1} \text{ ppmv})^2$. Note the complex structure near 2 mb at mid-latitude in winter.

G-35-675

Science Team Progress Report
for October, 1985 Meeting
Georgia Institute of Technology
Atlanta, Georgia

Science Support for Earth Radiation Budget
Satellite (ERBS)/Stratospheric Aerosol and
Gas Experiment (SAGE)

Dr. Derek M. Cunnold
School of Geophysical Sciences
Georgia Institute of Technology

1. SAGE I Zonal Mean Ozone

The comparison of ozone observations from SAGE I (retrieval version 1) with SAGE I (retrieval version 2) has been completed. Retrieval version 2 differs from version 1 in that a correction has been made for perceived biases in tropical stratospheric temperatures determined by NOAA and species mixing ratios have been corrected for differences between geometric and geopotential altitude (which was used for inferring neutral density). The latter effect would be expected to result in differences of approximately 5% between the two retrievals at 2 mb and only a few percent at 10 mb. Figure 1 shows a comparison of the two retrieval results as a function of latitude at these pressure levels. For this comparison days on which both SAGE and SBUV ozone observations existed were selected. It should be noted that our processing of the two sets of SAGE results was not identical and minor differences may be produced by this. In general, however, we see that version 2 ozone results are approximately 5% larger at mid-latitudes at 2 mb but the differences are $\leq 2\%$ at 10 mb (and of the opposite sign). In the tropics, at 2 mb the version 2 results are approximately 5% smaller. This difference is presumably produced by the adjustment for tropical temperature biases. The differences are larger than the 2 mb results at 1 mb and smaller at 5 mb.

Recalling our comparison of version 1 results with SBUV ozone observations, we inferred that SAGE was overestimating ozone by approximately 20% at tropical latitudes at pressures below 5 mb. Thus, the version 2 results produce latitudinal gradients which

although in better agreement with the SBUV results are approximately only half as large in magnitude. The discrepancy remains primarily at tropical latitudes and although the differences between SBUV and the version 2 results are less than for version 1, they remain substantial.

2. Longitudinal ozone variability

In the processing of version 2 we chose to average vertically over 5 km instead of over 8 km as we did for version 1 processing. This meant that above approximately 38 km where the ozone retrieval already employed 5 km smoothing, no additional smoothing was used. The reason for using 5 km smoothing instead of 8 km was that it is difficult to replicate the SBUV smoothing (except via a full SBUV retrieval) which is in the 5-10 km range but is scale size dependent. It has been pointed out that our smoothing procedure does not preserve layer ozone amounts and it was, therefore, decided that it is best to use the minimum smoothing consistent with the SBUV procedure.

Figure 2 shows sample effects of vertical smoothing on mid-latitude SAGE ozone profiles. At most heights, 5 km smoothing results in larger ozone variance than 8 km smoothing. This is particularly true at higher altitudes where SAGE is known to produce fairly low signal/noise ozone observations. At 1 mb, for example, where the comparison of SAGE and SBUV ozone observations suggest a SAGE signal to noise ratio of approximately unity, 8 km smoothing reduces the variance by approximately 40%. Figure 2 also shows that vertical smoothing can introduce variance to

altitudes such as 2 mb where the variance is low.

Of particular physical significance in Figure 2 is the minimum in ozone variance at approximately 2 mb. This minimum remains even if the unity signal to noise level at 1 mb is allowed for. As is well known, the correlation between ozone and temperature changes from positive to negative with increasing altitude near 2 mb. Based on these SAGE observations, this transition occurs between 2 and 5 mb (at these latitudes and this season of the year). Recent calculations of our three-dimensional model exhibit this transition under these conditions at approximately 2 mb. Moreover, the model indicates a minimum in ozone variability associated with this transition (actually 1 km above the transition height) with the normalized ozone variance being up to an order of magnitude lower than at neighboring model levels. This minimum is associated with the substantial change in the phase of an "ozone wave" with increasing height. As a result, at this level, horizontal planetary wave fluxes of ozone are up-gradient (and the gradient is weak) and the altitude is below the height at which ozone responds rapidly through chemistry to temperature perturbations. There is thus little tendency for local generation of ozone perturbations.

It is interesting to study not only the correlation between ozone and temperature but also the relative amplitudes of ozone and temperature variations. From the SAGE observations after normalizing the ozone and temperature variations by the local zonal mean values of ozone and temperature, the ratio of the normalized standard deviation of ozone to that of temperature at

1 mb at mid-latitudes is approximately 4 in spring and 3 in fall. At 10 mb, this ratio is also approximately 3. Since SAGE data at 1 mb, for example, contains noise, these ratios were calculated by retaining only that part of the ozone variance which is correlated with temperature (or correlated with temperature variations shifted 90° in phase). The latter part of the variance is significant (~ 10%) at altitudes below 2 mb where ozone and temperature variations are approximately in phase.

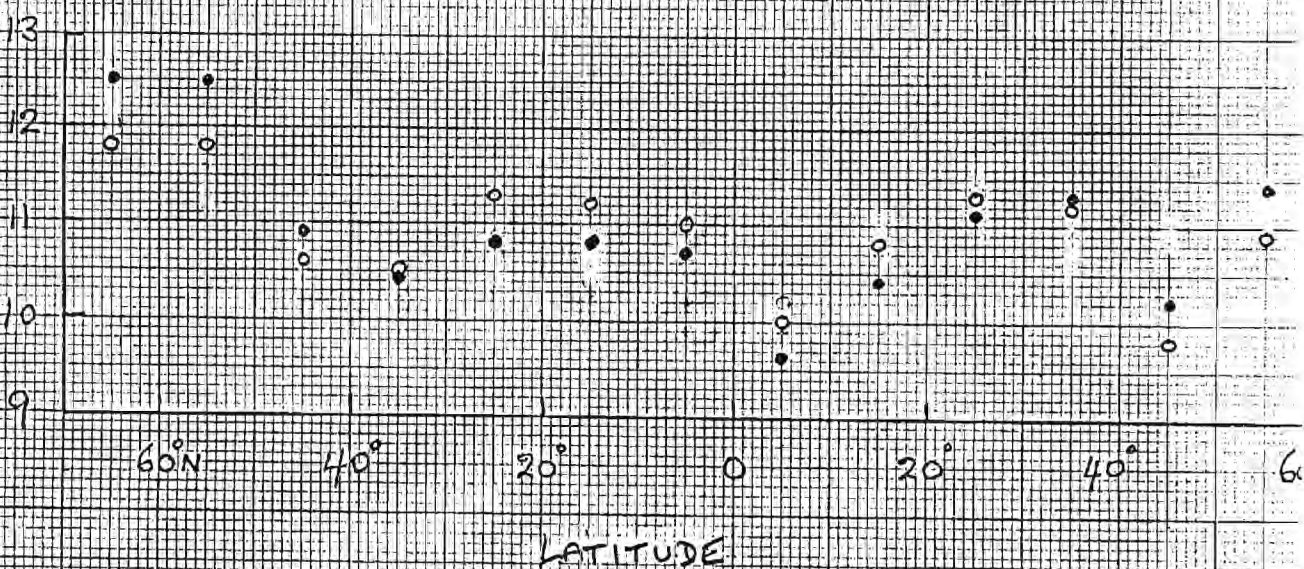
Table 1 shows the ratio of the ozone to temperature standard deviation determined in the model for January. The ratios are similar to those derived from the SAGE data. A more detailed comparison would require model results for March/April and additional discussion of the noise content of both the temperature and ozone observations. At 1 mb, the ratio is controlled by the temperature sensitivity of the ozone photochemistry and the similarity of the results suggests that the model and the atmosphere may possess similar chemistries. It is worth noting that version 2 SAGE results possess a slightly higher correlation with temperature than the version 1 results.

TABLE 1: Ratio of ozone standard deviation, normalized by its zonal-mean, to temperature standard deviation, normalized by its zonal-mean, for model January at 50°N.

Pressure (mb)	Model Level	Ratio
0.2	11	1.7
0.4	13	2.4
1.0	15	3.5
1.5	16	2.2
2.3	17	0.8
3.4	18	4.7
7.7	20	4.0
17.3	22	2.9
39.0	24	1.7

OZONE MIXING RATIOS ($\mu\text{gm/gm}$)

2 mb



10 mb



1. Zonal mean ozone mixing ratios from version 1 (open circle) and version 2 (black circles) of the SAGE I March/April results. Only days with simultaneous SBUV observations were selected.

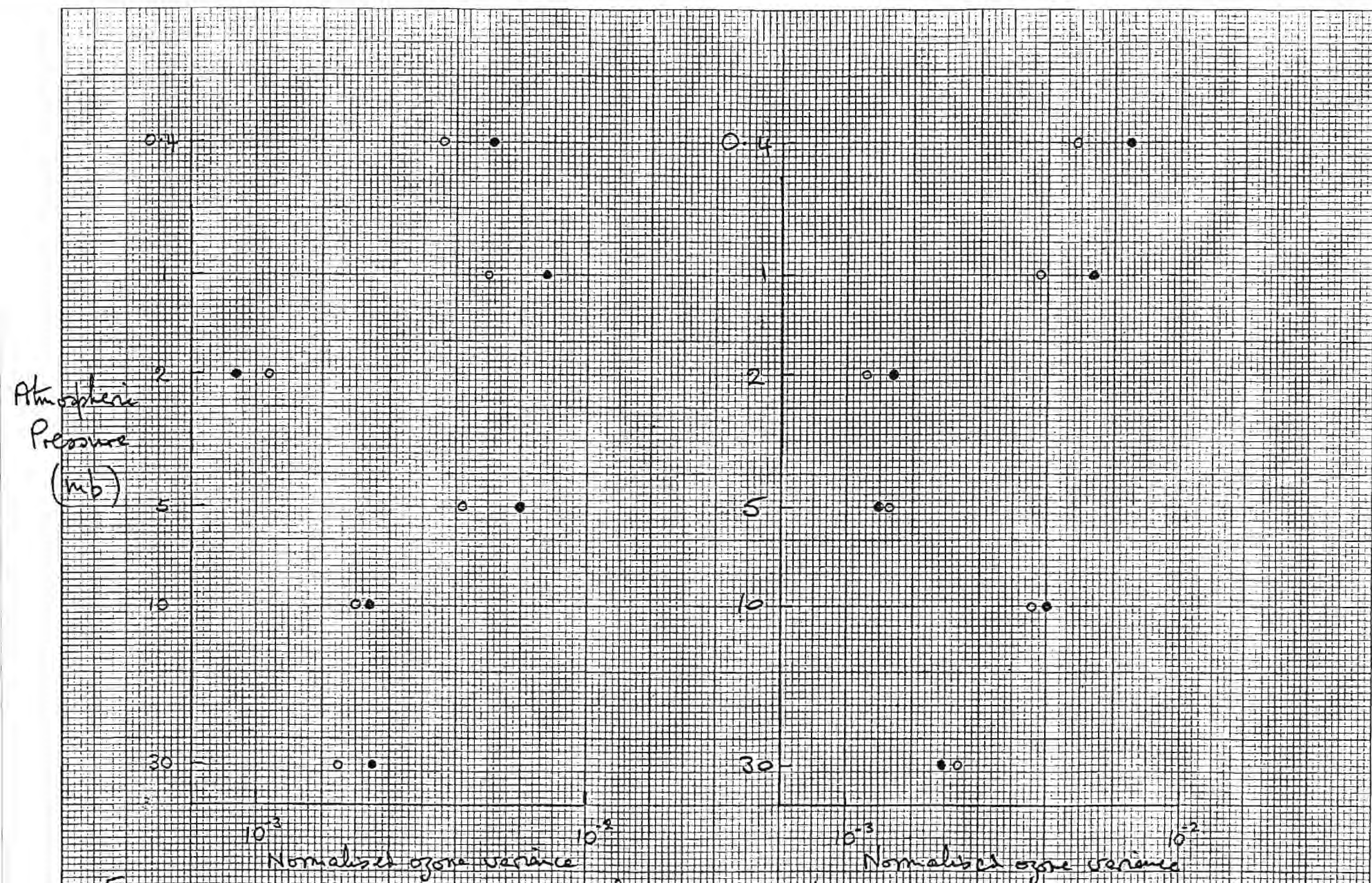


Fig 2: Ozone variances at (a) 60 to 70°N and (b) 50 to 60°S from 10 and 18 days of SAGE-1 observations respectively during March and April 1979. The open circles are from retrieval version 1 with vertical smoothing over 8 km and the blackened circles are from retrieval version 2 with smoothing over 5 km.

Georgia Institute of Technology

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ATLANTA, GEORGIA 30332

SCHOOL OF GEOPHYSICAL SCIENCES

404/894-3893

September 22, 1986

Dr. Len McMaster
Technical Officer
NASA Langley Research Center
Mail Stop 275
Hampton, Virginia 23665

Re: NASA Contract No. 1-16357
Georgia Tech No. G-35-675

Dear Len:

Enclosed please find two copies of a paper that relates my progress on this contract through July 1986.

Sincerely,

Derek M. Cunnoid

DMC/spw

AN ANALYSIS OF PRELIMINARY SAGE II DATA ON OZONE AND NO₂

D. M. Cunnold and D. A. Chu

School of Geophysical Sciences, Georgia Institute of Technology, Atlanta, Georgia
30332

ABSTRACT

Zonal mean mixing ratios of ozone and NO₂ measured by SAGE II on several days in March and April, 1985 are compared against zonal means for this time of year previously measured by SAGE I, SBUV, and LIMS. After allowing for calculated diurnal variations of these gases, agreement within 15% is found for ozone and 20% for NO₂. It is noted that the profile error bars given on the SAGE II data tapes need to be carefully interpreted and that the measured tropical variances suggest that these error bars are being somewhat overestimated. Planetary waves in both ozone and NO₂ in the middle stratosphere should be derivable from the SAGE II measurements.

INTRODUCTION

SAGE II observations began in October 1984. A preliminary data set covering the period November 1984 to May 1985 has been distributed to the SAGE Science Team. From this data set the months of March and April 1985 have been selected because we previously analyzed SAGE I observations for March and April, 1979 /5/. Both the SAGE I and II ozone measurements are based on measurements of the earth's limb at 0.6 μm /6,2/. However, whereas the SAGE I NO₂ measurements were based on measurements at 0.45 μm, the SAGE II NO₂ measurements are based on the differential absorption between two neighboring wavelengths close to 0.45 μm. This is expected to create a more accurate measurement of NO₂.

During the data retrieval vertical profiles have been smoothed over 5 km at heights where the extinction is less than 2×10^{-5} /km. This produces smoothing of all the NO₂ profiles and of ozone profiles above approximately 37 km altitude. In our analysis we have smoothed the ozone profiles below 37 km altitude in both SAGE I and SAGE II using

$$\bar{x}(z_1) = \exp \left\{ \frac{1}{h} \int_{z_1 - h/2}^{z_1 + h/2} I_{\text{O}_3} dz \right\}$$

where $x(z)$ is the ozone mixing ratio at altitude Z and $h = 5$ km. The data has then been analyzed on the standard meteorological levels which are roughly 5 km apart.

The temperature data analyzed here is that accompanying each SAGE constituent profile. It is provided to the SAGE team by the Upper Air Branch of NOAA from the mapped data which is routinely derived from the TIROS satellites and radiosondes. These temperature profiles have generally been smoothed horizontally and vertically somewhat more than the SAGE constituent profiles. These profiles provide a reference height for each constituent profile and are used to relate geometric altitudes to pressure levels in the SAGE I data and in this version of the SAGE II data.

Horizontal variations in the SAGE data are analyzed as described in Cunnold /5/. Thus, each day of data (defined by Universal Time) is analyzed separately in terms of longitudinal Fourier components using generalized least squares estimation by which each measurement is inversely weighted according to the variance of the measurement. The components are assigned to the average latitude of the measurements on that day. Except at the extreme latitudes of the SAGE observations, a single day of observations typically traverses approximately 5° latitude. The observations are then grouped into 10° latitude bins. Because our interest is in longitudinal variations, we have selected only those days which contain no more than one orbit of missing data.

OZONE ZONAL MEANS

Figures 1 and 2 show a comparison of ozone zonal means for March and April at mid-latitudes and in the tropics. The preliminary SAGE II data for 1985 is being compared against two retrievals of SAGE I data for 1979 and SBUV data for 1979. Note that SAGE I version 1 is now officially non-existent and has been removed from the archives; the currently archived version (version 2), however, contains mixing ratio errors such that the correct ozone mixing ratios lie between those of versions 1 and 2 (but closer to 2). Note also that the SBUV data set is the original data which has not been adjusted for the Bass and Paur /1/ ozone cross section measurements. Although there are several versions of each satellite data set (including a new version of SAGE II now being produced) these adjustments typically change the concentrations by a factor of less than 10% in a way which is only weakly dependent on latitude and height. Thus, in particular, longitudinal variances normalized by the zonal mean concentrations do not differ significantly from one version to another.

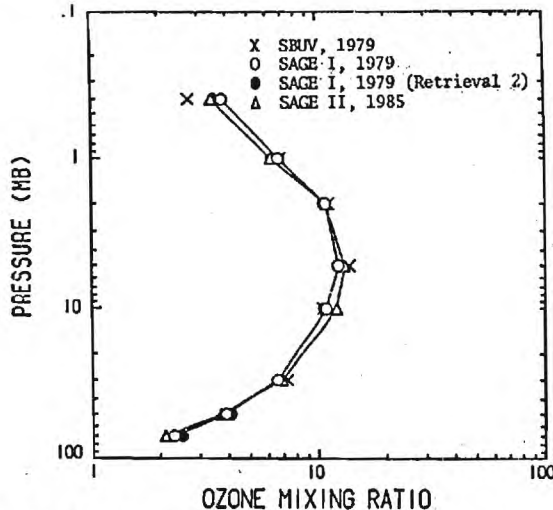


Fig. 1. Zonally-averaged ozone mixing ratios ($\mu\text{g/g}$) at $40\text{-}50^{\circ}\text{S}$ for several days in March and April.

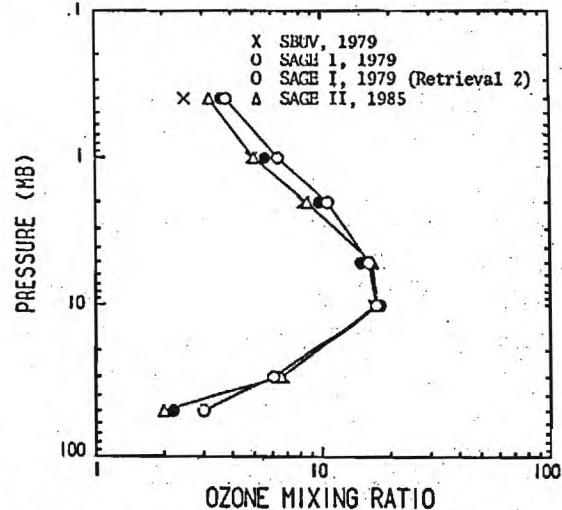


Fig. 2. Zonally-averaged ozone mixing ratios ($\mu\text{g/g}$) for $20^{\circ}\text{N}\text{-}20^{\circ}\text{S}$ for several days in March and April.

Figure 1 exhibits excellent agreement between the four data sets with 15% being the range of the zonal means except at 0.4 mb. At this level the smaller SBUV values almost certainly reflect the diurnal variation of ozone which should be negligible at altitudes below 1 mb but which should have a magnitude of roughly 25% at 0.4 mb (e.g., /7/). In the tropics there exists a wider spread in the measurements at 2, 1 and 0.4 mb. This difference between the SBUV and SAGE I measurements was previously noted by Cunnold /5/. Note, however, the excellent agreement between SAGE II and SBUV and the closer agreement with SAGE I version 2 than with version 1. Assuming that version 2 is more correct than version 1, the spread between the data sets in both tropics and mid-latitudes (excluding SBUV measurements at 0.4 mb) is 15%.

We thus consider the SAGE II ozone data for this time period to have been validated to 15%. Using simultaneous SBUV II measurements and improved SAGE II retrievals, we hope to be able to validate the SAGE II data at all heights and latitudes to better than 10%. The projected accuracy of the SAGE II measurements is similar to that of the SAGE I measurements and is approximately 5%. If percentage differences at 1, 2, 5, 10 and 30 mb are averaged for both the tropics and mid-latitudes (including 50°N , not shown), there is less than 1% difference between the SAGE II and the SBUV ozone measurements on average and the SAGE II measurements are approximately 2% smaller than those for SAGE I version 2.

TROPICAL VARIANCES OF OZONE

An estimate of the precision of the SAGE measurements is obtained by examining the longitudinal variances of ozone in waves 1 through 4 in the tropics where we should expect that physically-generated variations are small. Figure 3 shows these values for both SAGE I and SAGE II. The noise in SAGE ozone measurements consists of an uncertainty of approximately 0.25 km in the reference height for the profile and measurement noise which dominates the uncertainties above 2 mb (there are about equal contributions at 2 mb; see /5/). SAGE II evidently contains a slightly smaller (10-20%) uncertainty in the reference height than SAGE I, and at altitudes above 2 mb, measurement noise is less for SAGE II (by roughly a factor of 5 in variance at 0.4 mb).

These uncertainties may be compared against the profile error bars supplied on the data tapes. Those error bars, however, refer to 1 km vertical resolution. In comparing the results in Figure 3, the "theoretical" profile error variances need to be reduced by a factor of 2 because we are retaining only 4 waves (8 out of 15 degrees of freedom) and, at heights above 2 mb, they should also be reduced by a factor of 5 to reflect the vertical averaging over 5 km. Note that at lower altitudes, where the reference height uncertainty dominates, vertical averaging should not affect the error bars. The smaller measurement noise for SAGE II is reflected in the error variances at 0.4 mb and after a reduction by a factor of ten these error variances are slightly larger than the measured tropical variances. Since the error bars are derived assuming a vertical correlation between measurements of 1 km, this suggests that this correlation distance is being over-estimated. At lower altitudes, the reference height uncertainty in the tropics is evidently less than 0.25 km (perhaps only 0.15 km). It is not obvious how to extrapolate this uncertainty to middle latitudes because of the more intense large scale wave activity at mid-latitudes which might increase the reference height uncertainty there. Overall, the error variances provide a conservative estimate of the observed ozone uncertainties. Note that at 50 and 70 mb the reference height uncertainty results in large variances because of the large vertical ozone gradient in the tropics.

Between 0.4 and 30 mb, the combined variability in the 4 waves is 20×10^{-4} . A wavenumber breakdown, given in Table 1, shows that, where the reference height uncertainty dominates, much of this variability is in wave 1 and in the zonal mean. This is probably associated with the dominance of wave 1 variations in temperature and geopotential height which are mapped into reference height uncertainties also in wave 1. In contrast, at 0.4 mb, where measurement errors dominate, the spectrum is fairly white but the substantial variance in the zonal mean may be noted, which suggests that there may be longer term (> 1 day) variations in noise level. Table 1 suggests that ozone wave amplitudes need to exceed 3% in wave 1 and 2% in wave 1-4 to be observable (i.e., the longitudinal variance must exceed approximately 20×10^{-4}).

TABLE 1 Wavenumber breakdown of tropical variances (20°N-20°S)

(a) Ozone (Ratio to zonal mean ²) (SAGE II March/April 1985)						
mb	Wave 1	Wave 2	Wave 3	Wave 4	Variance of zonal mean	
30.0	11.0	2.0	1.0	1.0	13.0	
5.0	6.0	4.0	2.0	1.0	3.0	
0.4	8.0	5.0	3.0	4.0	37.0	
(b) Temperature (°K ²) (Coincident with SAGE II, April 1985)						
mb	Wave 1	Wave 2	Wave 3	Wave 4	Variance of zonal mean	
30.0	0.14	0.14	0.09	0.09	0.18	
5.0	0.61	0.24	0.08	0.17	0.01	
0.4	0.90	0.41	0.13	0.29	0.71	

MID-LATITUDE OZONE VARIATIONS

Table 2 shows considerable ozone activity in excess of the measurement noise levels at mid-latitudes in March and April. A significant minimum in ozone activity is found at 30 mb, a tendency which is also found in our 6 wave numerical model of the atmosphere /4/. Similar levels of activity are found in the 2 SAGE observations and in the model. Note, however, that the model exhibits a minimum of activity at 5 mb but is absent in the observations. In the model this is associated with different irregularity production mechanisms operating at 2 and 10 mb and is related to a correlation between ozone and temperature of approximately zero at 5 mb. If this correlation is examined in the SAGE observations (see Table 3), the transition between heights at which ozone variations are in phase with temperature variations and heights where the variations are out of phase seems to vary in the atmosphere. Note that if variations between latitude bins are included (see Table 3), the SAGE I and SAGE II results are not significantly different at most levels. The brackets at 0.4 mb for SAGE II (in Table 3) reflect the lack of activity there in April 1985 and thus the probable dominance of measurement noise at that time.

Apart from the variability from day to day in the real atmosphere which could be smoothing out the ozone variance minimum at approximately 5 mb, the correspondence between observed and modeled ozone-temperature covariances is acceptable. Additional studies should indicate whether it is possible to use measured factors similar to those given in Table 3 to derive conclusions about atmospheric chemistry and transport.

TABLE 2 Variances of ozone at mid-latitudes (40-70°N) expressed as a ratio to the zonal mean squared $\times 10^4$.

Pressure level (mb)	SAGE II March/April 1985	SAGE I March/April 1979	6 wave model
50	227	126	1000
30	34	31	120
10	66	44	155
5	115	58	55
2	190	79	170
1	70	166	190

TABLE 3 Ratio of amplitudes of longitudinal ozone variations to the amplitudes of correlated temperature variations ($= r\sigma_{O_3}/\sigma_T$) at mid-latitudes of the Northern Hemisphere.

Pressure level (mb)	SAGE II (April, 1985)	SAGE I (March/April, 1979)	3D (6 wave) model (April)
50.0	6.8 \pm 4.4	3.6 \pm 0.5	4.2
30.0	4.0 \pm 0.5	2.5 \pm 0.2	2.6
10.0	0.5 \pm 1.7	2.8 \pm 0.4	2.1
5.0	-2.0 \pm 1.6	2.6 \pm 1.3	-0.3
2.0	-3.8 \pm 0.9	-1.8 \pm 2.5	-3.7
1.0	-2.4 \pm 0.3	-4.3 \pm 1.5	-5.6
0.4	(-0.3 \pm 1.1)	-4.5 \pm 0.2	-3.6

ZONAL MEANS OF NO₂

Figures 4 and 5 show the zonal means for SAGE II NO₂ versus those for SAGE I (version 2). One way to discuss the differing sunrise and sunset comparisons is to consider the mean of sunrise and sunset values together with the sunset/sunrise ratio. Figure 4 shows that at mid-latitudes at 5 and 10 mb (the mixing ratio peak where NO₂ concentrations are measured most precisely), SAGE II measurements are 40% larger than those for SAGE I; however, in the tropics there is excellent agreement between the SAGE I and SAGE II measurements (Figure 5). Furthermore, at mid-latitudes the SAGE II measurements lie within the range of balloon measurements and, more particularly, are in excellent agreement with the LIMS measurements at 32°N at 1:30 pm for May 1979. Based on Chu and McCormick /3/, NO₂ mixing ratios in May should be similar to those in March and April except at 5 mb where they are expected to be approximately 10% larger. The discussion of the diurnal variation of NO₂ by Roscoe /8/ indicates that mixing ratios at 1:30 pm should be approximately a factor of 2 smaller than this average at 2 mb but equal to the average at 5, 10 and 30 mb. Given that all these measurement techniques have an accuracy of approximately 20%, we consider that Figures 4 and 5 constitute validation of the SAGE II NO₂ measurements to this accuracy.

The sunset/sunrise ratios shown in Table 4, on the other hand, are not in such good agreement. The SAGE I ratios have been found to be in good agreement with theory /3/ but the SAGE II ratios are considerably smaller. Part of this problem in the SAGE II measurements has already been identified as an error in the reference altitudes for sunrise measurements (sunrise ozone measurements, for example, are 4-7% larger than sunset measurements at all levels). Correction of this problem may produce agreement with Sage I values at 30, 10 and 5 mb leaving a problem at 2 mb only.

TABLE 4 NO₂ Sunset to Sunrise Ratios

Pressure level mb	SAGE II		SAGE I	
	30-40°N Mar/Apr 1985	50°N Mar 31, 1985	30-40°N Mar/Apr 1979	35°N Mar 12, 1979
30	1.00	1.04	1.19	1.03
10	1.24	1.31	1.62	1.66
5	1.33	1.28	1.67	1.80
2	0.44	0.54	0.91	1.25

TROPICAL VARIANCES OF NO₂

SAGE measurements of NO₂ are expected to be both less accurate and less Precise than SAGE O₃ measurements. Figure 6 contains a comparison of the tropical NO₂ variances with the profile error variances given on the data tapes. The tropical variances indicate that the SAGE II measurements of NO₂ are 3 or 4 times more precise than those of SAGE I. The error variances suggest that they are just twice as precise at 5 and 10 mb but we are currently

unsure how to relate these error variances to the measured variances. Figure 6 suggests that it is unlikely that longitudinal variations in NO₂ could have been observed by SAGE I but that such variations should be observable between 1 and 10 mb in the SAGE II measurements. In contrast to the ozone measurements, the tropical variance appears to be roughly independent of wavenumber. We conclude that 0.3 ppbv variations (3% of the zonal mean) should be observable at 5 mb (and 10 mb) and 2 ppbv fluctuations (4% of the zonal mean) should be observable at 2 mb. This suggests that the precision of the SAGE II NO₂ measurements is excellent.

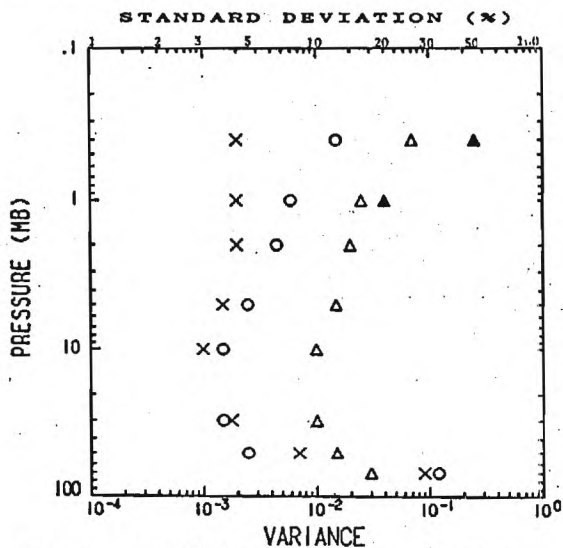


Fig. 3. Longitudinal variances of ozone (normalized by the zonal-mean squared) and standard deviations (as % of the zonal mean) in the tropics for several days in March and April. SAGE I values are denoted by O's, SAGE II values by X's. Also shown are the measurement error bars given on the data tapes for SAGE II (Δ) and, where different, for SAGE I (Δ).

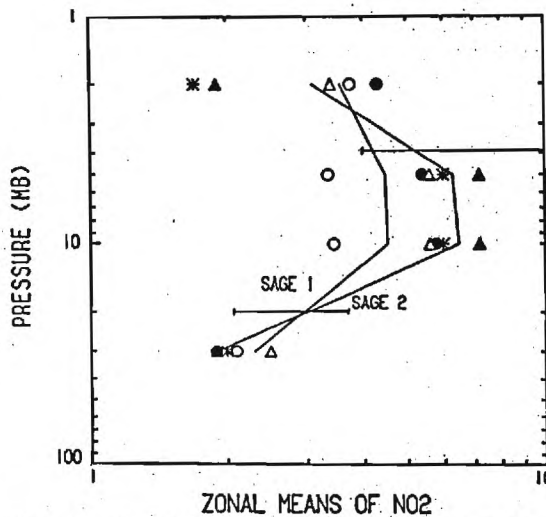


Fig. 4. Zonally-averaged NO₂ mixing ratios (ppbv) at 30-40°N for several days in March and April. The horizontal lines indicate the range of climatological measurements by balloons in this latitude range. LIMS measurements in May 1979 at 32°N at 1:30 pm (local time) are denoted by an "*" (from /9/).

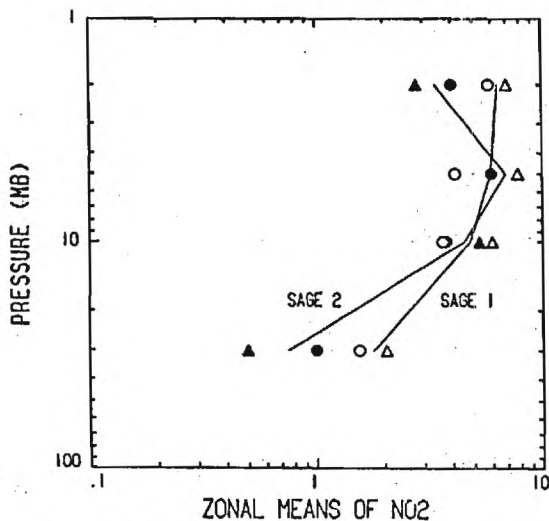


Fig. 5. Zonally-averaged NO₂ mixing ratios (ppbv) in the tropics for several days in March and April. The continuous profiles join the averages of the sunset and sunrise values.

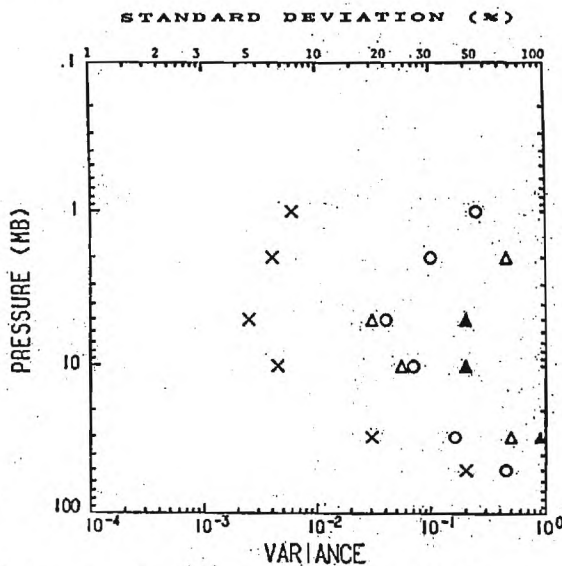


Fig. 6. Longitudinal variances of NO₂ (normalized by the zonal-mean squared) and standard deviations (as % of the zonal mean) in the tropics for several days in March and April. SAGE I values are denoted by O's, SAGE II values by X's. Also shown are the measurement error bars given on the data tapes for SAGE II (Δ) and, where different, for SAGE I (Δ).

CONCLUSIONS

The preliminary version of the SAGE II ozone data has been compared against SAGE I data and SBUV data for the same months in 1979. The comparison shows agreement within 15% for all three data sets except at two locations. At 0.4 mb the SBUV measurements are approximately 25% smaller corresponding presumably to the diurnal variation of ozone there. In the tropics above 5 mb, the SAGE I (version 2) results which have been corrected for temperature biases in the NOAA data are in significantly better agreement with the SBUV and SAGE II data than was true for the SAGE I (version 1) results.

The longitudinal variations in the SAGE II measurements in the tropics indicate that the SAGE II ozone measurements are more precise than the SAGE I ozone measurements. This feature is reflected in the profile error bars provided with the data. These error bars are nominally for 1 km resolution and need to be adjusted above 2 mb by \sqrt{n} for a resolution of n km. The tropical variances indicate that the precision of the measurements is being somewhat underestimated and is dependent on the planetary wavenumber. Between 0.4 and 30 mb, variations having a magnitude of 3% of the zonal mean in wave 1 and 2% in waves 2-4 should be observable in the SAGE II ozone data. Mid-latitude variations exceeding these magnitudes roughly exhibit the expected (i.e., modeled) variation with altitude and covariances with temperature.

The preliminary SAGE II NO₂ sunset-sunrise average measurements exhibit agreement with SAGE I NO₂ measurements at tropical and mid-latitudes for the same months in 1979 to better than 20%. Even better agreement is found with the May, 1979 mid-latitude LIMS measurements for 1:30 pm local time at 30, 10, and 5 mb. SAGE II NO₂ sunset-sunrise ratios are found to be too small but these may be corrected when the sunrise retrievals are adjusted for reference altitude errors. The tropical variances of NO₂ indicate that the SAGE II NO₂ measurements are substantially more precise than those of SAGE I and that planetary wave activity exceeding 3% of the zonal mean may be observable at the NO₂ mixing ratio peak (5-10 mb).

ACKNOWLEDGEMENT

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Final Report

for

Science Support for Earth Radiation Budget
Satellite (ERBS)/Stratospheric Aerosol and
Gas Experiment (SAGE)

Contract No. 1-16357

February, 1987

Derek M. Cunnold
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Research Activities

Our contributions to the SAGE II (and SAGE I) science team activities have focused on the validation of the ozone and NO₂ measurements. The objective has been to validate both the constituent concentrations and mixing ratios and the assigned error estimates. Here it should be noted that the sun-scanning capability, which is an integral part of the SAGE measurements, permits a profile by profile assessment of measurement precision. Our contributions to date have emphasized the comparison of ozone zonal mean and longitudinal variations between SAGE I and the Nimbus 7 SBUV (Cunnold, 1984; Cunnold et al, 1984), the comparison of SAGE I and ozone against umkehr ozone (Newchurch et al, 1986) and the study of preliminary SAGE II ozone and NO₂ data (Cunnold and Chu, 1986; copy attached).

During these validation activities some comparisons against three-dimensional numerical model results have also been made. Relationships between measured parameters, such as between ozone and temperature, have been studied. In these studies it is most important to separate variances having a natural origin from variances associated with measurement errors. In view of the roughly 10% precision of the SAGE measurements, the validation activities have taken precedence, and the scientific results regarding correlations between the measured parameters have so far been interpreted cautiously.

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AN ANALYSIS OF PRELIMINARY SAGE II DATA ON OZONE AND NO₂

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ABSTRACT

Zonal mean mixing ratios of ozone and NO₂ measured by SAGE II on several days in March and April, 1985 are compared against zonal means for this time of year previously measured by SAGE I, SBUV, and LIMS. After allowing for calculated diurnal variations of these gases, agreement within 15% is found for ozone and 20% for NO₂. It is noted that the profile error bars given on the SAGE II data tapes need to be carefully interpreted and that the measured tropical variances suggest that these error bars are being somewhat overestimated. Planetary waves in both ozone and NO₂ in the middle stratosphere should be derivable from the SAGE II measurements.

INTRODUCTION

SAGE II observations began in October 1984. A preliminary data set covering the period November 1984 to May 1985 has been distributed to the SAGE Science Team. From this data set the months of March and April 1985 have been selected because we previously analyzed SAGE I observations for March and April, 1979 /5/. Both the SAGE I and II ozone measurements are based on measurements of the earth's limb at 0.6 μm /6,2/. However, whereas the SAGE I NO₂ measurements were based on measurements at 0.45 μm, the SAGE II NO₂ measurements are based on the differential absorption between two neighboring wavelengths close to 0.45 μm. This is expected to create a more accurate measurement of NO₂.

During the data retrieval vertical profiles have been smoothed over 5 km at heights where the extinction is less than 2×10^{-5} /km. This produces smoothing of all the NO₂ profiles and of ozone profiles above approximately 37 km altitude. In our analysis we have smoothed the ozone profiles below 37 km altitude in both SAGE I and SAGE II using

$$\bar{x}(Z_1) = \exp \left\{ \frac{1}{h} \int_{Z_1 - h/2}^{Z_1 + h/2} I(x) dz \right\}$$

where $x(Z)$ is the ozone mixing ratio at altitude Z and $h = 5$ km. The data has then been analyzed on the standard meteorological levels which are roughly 5 km apart.

The temperature data analyzed here is that accompanying each SAGE constituent profile. It is provided to the SAGE team by the Upper Air Branch of NOAA from the mapped data which is routinely derived from the TIROS satellites and radiosondes. These temperature profiles have generally been smoothed horizontally and vertically somewhat more than the SAGE constituent profiles. These profiles provide a reference height for each constituent profile and are used to relate geometric altitudes to pressure levels in the SAGE I data and in this version of the SAGE II data.

Horizontal variations in the SAGE data are analyzed as described in Cunnold /5/. Thus, each day of data (defined by Universal Time) is analyzed separately in terms of longitudinal Fourier components using generalized least squares estimation by which each measurement is inversely weighted according to the variance of the measurement. The components are assigned to the average latitude of the measurements on that day. Except at the extreme latitudes of the SAGE observations, a single day of observations typically traverses approximately 5° latitude. The observations are then grouped into 10° latitude bins. Because our interest is in longitudinal variations, we have selected only those days which contain no more than one orbit of missing data.

OZONE ZONAL MEANS

Figures 1 and 2 show a comparison of ozone zonal means for March and April at mid-latitudes and in the tropics. The preliminary SAGE II data for 1985 is being compared against two retrievals of SAGE I data for 1979 and SBUV data for 1979. Note that SAGE I version 1 is now officially non-existent and has been removed from the archives; the currently archived version (version 2), however, contains mixing ratio errors such that the correct ozone mixing ratios lie between those of versions 1 and 2 (but closer to 2). Note also that the SBUV data set is the original data which has not been adjusted for the Bass and Paur /1/ ozone cross section measurements. Although there are several versions of each satellite data set (including a new version of SAGE II now being produced) these adjustments typically change the concentrations by a factor of less than 10% in a way which is only weakly dependent on latitude and height. Thus, in particular, longitudinal variances normalized by the zonal mean concentrations do not differ significantly from one version to another.

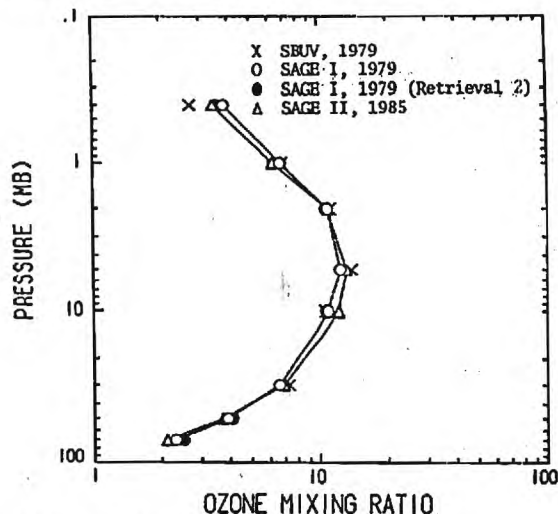


Fig. 1. Zonally-averaged ozone mixing ratios ($\mu\text{g/g}$) at $40\text{--}50^\circ\text{S}$ for several days in March and April.

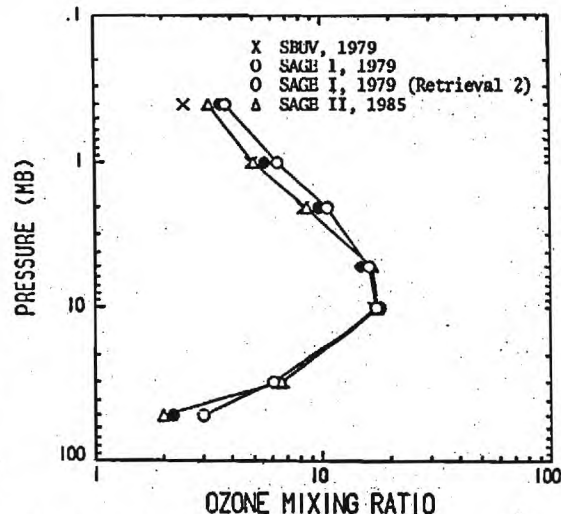


Fig. 2. Zonally-averaged ozone mixing ratios ($\mu\text{g/g}$) for $20^\circ\text{N}\text{--}20^\circ\text{S}$ for several days in March and April.

Figure 1 exhibits excellent agreement between the four data sets with 15% being the range of the zonal means except at 0.4 mb. At this level the smaller SBUV values almost certainly reflect the diurnal variation of ozone which should be negligible at altitudes below 1 mb but which should have a magnitude of roughly 25% at 0.4 mb (e.g., /7/). In the tropics there exists a wider spread in the measurements at 2, 1 and 0.4 mb. This difference between the SBUV and SAGE I measurements was previously noted by Cunnold /5/. Note, however, the excellent agreement between SAGE II and SBUV and the closer agreement with SAGE I version 2 than with version 1. Assuming that version 2 is more correct than version 1, the spread between the data sets in both tropics and mid-latitudes (excluding SBUV measurements at 0.4 mb) is 15%.

We thus consider the SAGE II ozone data for this time period to have been validated to 15%. Using simultaneous SBUV II measurements and improved SAGE II retrievals, we hope to be able to validate the SAGE II data at all heights and latitudes to better than 10%. The projected accuracy of the SAGE II measurements is similar to that of the SAGE I measurements and is approximately 5%. If percentage differences at 1, 2, 5, 10 and 30 mb are averaged for both the tropics and mid-latitudes (including 50°N , not shown), there is less than 1% difference between the SAGE II and the SBUV ozone measurements on average and the SAGE II measurements are approximately 2% smaller than those for SAGE I version 2.

TROPICAL VARIANCES OF OZONE

An estimate of the precision of the SAGE measurements is obtained by examining the longitudinal variances of ozone in waves 1 through 4 in the tropics where we should expect that physically-generated variations are small. Figure 3 shows these values for both SAGE I and SAGE II. The noise in SAGE ozone measurements consists of an uncertainty of approximately 0.25 km in the reference height for the profile and measurement noise which dominates the uncertainties above 2 mb (there are about equal contributions at 2 mb; see /5/). SAGE II evidently contains a slightly smaller (10-20%) uncertainty in the reference height than SAGE I, and at altitudes above 2 mb, measurement noise is less for SAGE II (by roughly a factor of 5 in variance at 0.4 mb).

These uncertainties may be compared against the profile error bars supplied on the data tapes. Those error bars, however, refer to 1 km vertical resolution. In comparing the results in Figure 3, the "theoretical" profile error variances need to be reduced by a factor of 2 because we are retaining only 4 waves (8 out of 15 degrees of freedom) and, at heights above 2 mb, they should also be reduced by a factor of 5 to reflect the vertical averaging over 5 km. Note that at lower altitudes, where the reference height uncertainty dominates, vertical averaging should not affect the error bars. The smaller measurement noise for SAGE II is reflected in the error variances at 0.4 mb and after a reduction by a factor of ten these error variances are slightly larger than the measured tropical variances. Since the error bars are derived assuming a vertical correlation between measurements of 1 km, this suggests that this correlation distance is being over-estimated. At lower altitudes, the reference height uncertainty in the tropics is evidently less than 0.25 km (perhaps only 0.15 km). It is not obvious how to extrapolate this uncertainty to middle latitudes because of the more intense large scale wave activity at mid-latitudes which might increase the reference height uncertainty there. Overall, the error variances provide a conservative estimate of the observed ozone uncertainties. Note that at 50 and 70 mb the reference height uncertainty results in large variances because of the large vertical ozone gradient in the tropics.

Between 0.4 and 30 mb, the combined variability in the 4 waves is 20×10^{-4} . A wavenumber breakdown, given in Table 1, shows that, where the reference height uncertainty dominates, much of this variability is in wave 1 and in the zonal mean. This is probably associated with the dominance of wave 1 variations in temperature and geopotential height which are mapped into reference height uncertainties also in wave 1. In contrast, at 0.4 mb, where measurement errors dominate, the spectrum is fairly white but the substantial variance in the zonal mean may be noted, which suggests that there may be longer term (> 1 day) variations in noise level. Table 1 suggests that ozone wave amplitudes need to exceed 3% in wave 1 and 2% in wave 1-4 to be observable (i.e., the longitudinal variance must exceed approximately 20×10^{-4}).

TABLE 1 Wavenumber breakdown of tropical variances (20°N-20°S)

(a) Ozone (ratio to zonal mean ²) (SAGE II March/April 1985)						
mb	Wave 1	Wave 2	Wave 3	Wave 4	Variance of zonal mean	
30.0	11.0	2.0	1.0	1.0	13.0	
5.0	6.0	4.0	2.0	1.0	3.0	
0.4	8.0	5.0	3.0	4.0	37.0	
(b) Temperature ($^{\circ}\text{K}^2$) (Coincident with SAGE II, April 1985)						
mb	Wave 1	Wave 2	Wave 3	Wave 4	Variance of zonal mean	
30.0	0.14	0.14	0.09	0.09	0.18	
5.0	0.61	0.24	0.08	0.17	0.01	
0.4	0.90	0.41	0.13	0.29	0.71	

MID-LATITUDE OZONE VARIATIONS

Table 2 shows considerable ozone activity in excess of the measurement noise levels at mid-latitudes in March and April. A significant minimum in ozone activity is found at 30 mb, a tendency which is also found in our 6 wave numerical model of the atmosphere /4/. Similar levels of activity are found in the 2 SAGE observations and in the model. Note, however, that the model exhibits a minimum of activity at 5 mb but is absent in the observations. In the model this is associated with different irregularity production mechanisms operating at 2 and 10 mb and is related to a correlation between ozone and temperature of approximately zero at 5 mb. If this correlation is examined in the SAGE observations (see Table 3), the transition between heights at which ozone variations are in phase with temperature variations and heights where the variations are out of phase seems to vary in the atmosphere. Note that if variations between latitude bins are included (see Table 3), the SAGE I and SAGE II results are not significantly different at most levels. The brackets at 0.4 mb for SAGE II (in Table 3) reflect the lack of activity there in April 1985 and thus the probable dominance of measurement noise at that time.

Apart from the variability from day to day in the real atmosphere which could be smoothing out the ozone variance minimum at approximately 5 mb, the correspondence between observed and modeled ozone-temperature covariances is acceptable. Additional studies should indicate whether it is possible to use measured factors similar to those given in Table 3 to derive conclusions about atmospheric chemistry and transport.

TABLE 2 Variances of ozone at mid-latitudes (40-70°N) expressed as a ratio to the zonal mean squared $\times 10^4$.

Pressure level (mb)	SAGE II March/April 1985	SAGE I March/April 1979	6 wave model
50	227	126	1000
30	34	31	120
10	66	44	155
5	115	58	55
2	190	79	170
1	70	166	190

TABLE 3 Ratio of amplitudes of longitudinal ozone variations to the amplitudes of correlated temperature variations ($= r\sigma_{O_3}/\sigma_T$) at mid-latitudes of the Northern Hemisphere.

Pressure level (mb)	SAGE II (April, 1985)	SAGE I (March/April, 1979)	3D (6 wave) model (April)
50.0	6.8 \pm 4.4	3.6 \pm 0.5	4.2
30.0	4.0 \pm 0.5	2.5 \pm 0.2	2.6
10.0	0.5 \pm 1.7	2.8 \pm 0.4	2.1
5.0	-2.0 \pm 1.6	2.6 \pm 1.3	-0.3
2.0	-3.8 \pm 0.9	-1.8 \pm 2.5	-3.7
1.0	-2.4 \pm 0.3	-4.3 \pm 1.5	-5.6
0.4	(-0.3 \pm 1.1)	-4.5 \pm 0.2	-3.6

ZONAL MEANS OF NO₂

Figures 4 and 5 show the zonal means for SAGE II NO₂ versus those for SAGE I (version 2). One way to discuss the differing sunrise and sunset comparisons is to consider the mean of sunrise and sunset values together with the sunset/sunrise ratio. Figure 4 shows that at mid-latitudes at 5 and 10 mb (the mixing ratio peak where NO₂ concentrations are measured most precisely), SAGE II measurements are 40% larger than those for SAGE I; however, in the tropics there is excellent agreement between the SAGE I and SAGE II measurements (Figure 5). Furthermore, at mid-latitudes the SAGE II measurements lie within the range of balloon measurements and, more particularly, are in excellent agreement with the LIMS measurements at 32°N at 1:30 pm for May 1979. Based on Chu and McCormick /3/, NO₂ mixing ratios in May should be similar to those in March and April except at 5 mb where they are expected to be approximately 10% larger. The discussion of the diurnal variation of NO₂ by Roscoe /8/ indicates that mixing ratios at 1:30 pm should be approximately a factor of 2 smaller than this average at 2 mb but equal to the average at 5, 10 and 30 mb. Given that all these measurement techniques have an accuracy of approximately 20%, we consider that Figures 4 and 5 constitute validation of the SAGE II NO₂ measurements to this accuracy.

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	30-40°N Mar/Apr 1985	50°N Mar 31, 1985	30-40°N Mar/Apr 1979	35°N Mar 12, 1979
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unsure how to relate these error variances to the measured variances. Figure 6 suggests that it is unlikely that longitudinal variations in NO_2 could have been observed by SAGE I but that such variations should be observable between 1 and 10 mb in the SAGE II measurements. In contrast to the ozone measurements, the tropical variance appears to be roughly independent of wavenumber. We conclude that 0.3 ppbv variations (3% of the zonal mean) should be observable at 5 mb (and 10 mb) and 2 ppbv fluctuations (4% of the zonal mean) should be observable at 2 mb. This suggests that the precision of the SAGE II NO_2 measurements is excellent.

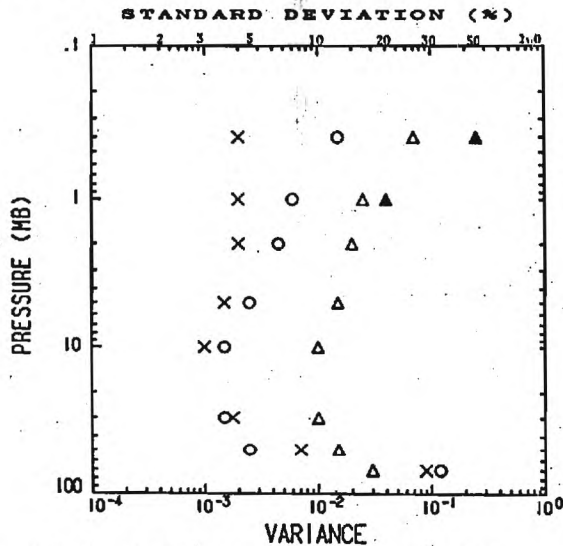


Fig. 3. Longitudinal variances of ozone (normalized by the zonal-mean squared) and standard deviations (as % of the zonal mean) in the tropics for several days in March and April. SAGE I values are denoted by O's, SAGE II values by X's. Also shown are the measurement error bars given on the data tapes for SAGE II (Δ) and, where different, for SAGE I (Δ).

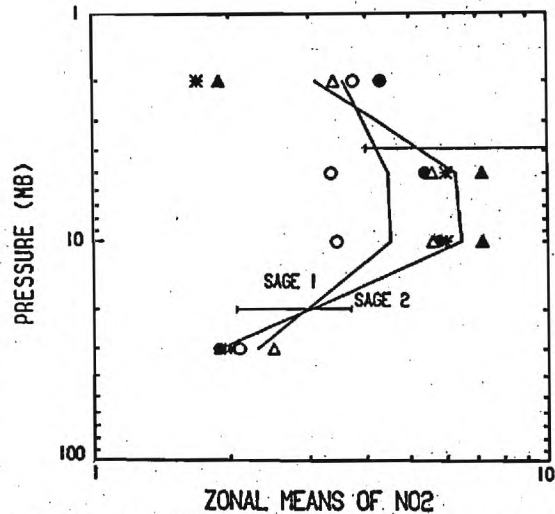


Fig. 4. Zonally-averaged NO_2 mixing ratios (ppbv) at $30\text{-}40^\circ\text{N}$ for several days in March and April. The horizontal lines indicate the range of climatological measurements by balloons in this latitude range. LIMS measurements in May 1979 at 32°N at 1:30 pm (local time) are denoted by an "*" (from 9/).

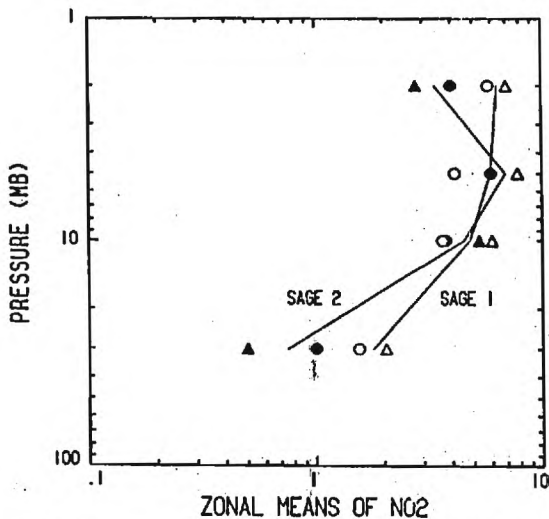


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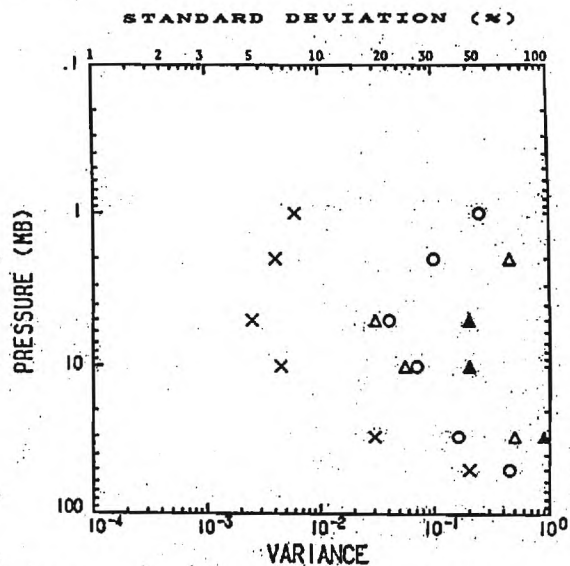


Fig. 6. Longitudinal variances of NO_2 (normalized by the zonal-mean squared) and standard deviations (as % of the zonal mean) in the tropics for several days in March and April. SAGE I values are denoted by O's, SAGE II values by X's. Also shown are the measurement error bars given on the data tapes for SAGE II (Δ) and, where different, for SAGE I (Δ).

CONCLUSIONS

The preliminary version of the SAGE II ozone data has been compared against SAGE I data and SBUV data for the same months in 1979. The comparison shows agreement within 15% for all three data sets except at two locations. At 0.4 mb the SBUV measurements are approximately 25% smaller corresponding presumably to the diurnal variation of ozone there. In the tropics above 5 mb, the SAGE I (version 2) results which have been corrected for temperature biases in the NOAA data are in significantly better agreement with the SBUV and SAGE II data than was true for the SAGE I (version 1) results.

The longitudinal variations in the SAGE II measurements in the tropics indicate that the SAGE II ozone measurements are more precise than the SAGE I ozone measurements. This feature is reflected in the profile error bars provided with the data. These error bars are nominally for 1 km resolution and need to be adjusted above 2 mb by \sqrt{n} for a resolution of n km. The tropical variances indicate that the precision of the measurements is being somewhat underestimated and is dependent on the planetary wavenumber. Between 0.4 and 30 mb, variations having a magnitude of 3% of the zonal mean in wave 1 and 2% in waves 2-4 should be observable in the SAGE II ozone data. Mid-latitude variations exceeding these magnitudes roughly exhibit the expected (i.e., modeled) variation with altitude and covariances with temperature.

The preliminary SAGE II NO₂ sunset-sunrise average measurements exhibit agreement with SAGE I NO₂ measurements at tropical and mid-latitudes for the same months in 1979 to better than 20%. Even better agreement is found with the May, 1979 mid-latitude LIMS measurements for 1:30 pm local time at 30, 10, and 5 mb. SAGE II NO₂ sunset-sunrise ratios are found to be too small but these may be corrected when the sunrise retrievals are adjusted for reference altitude errors. The tropical variances of NO₂ indicate that the SAGE II NO₂ measurements are substantially more precise than those of SAGE I and that planetary wave activity exceeding 3% of the zonal mean may be observable at the NO₂ mixing ratio peak (5-10 mb).

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