Quarterly Report

Cooperative Agreement NCC5-494
Reporting Period: January 1, 2003 through March 31, 2003
Quarterly Report

Cooperative Agreement NCC5-494
Reporting Period: January 1, 2003 through March 31, 2003
Technical Status Report

The following is a technical report of the progress made under Cooperative Agreement NCC5-494, the Goddard Earth Sciences and Technology Center (GEST). The period covered by this report is January 1, 2003 through March 31, 2003.

Overview of significant Activities

Advertisement of summer programs as noted below:

**SUMMER PROGRAMS – GSSP, GCR, VSEP, HCP**

**VSEP 2003**

2003 Graduate Student Summer Program in Earth System Science (GSSP)

**Target**

Graduate students in Earth science and related disciplines

**About the Program**

The Goddard Space Flight Center's Earth Sciences Directorate, in collaboration with the Goddard Earth Sciences and Technology (GEST) Center with headquarters at the University of Maryland Baltimore County, is offering a limited number of graduate student research opportunities. The program is scheduled for June 9 to August 15, 2003, and is designed to stimulate interest in interdisciplinary Earth science studies by enabling selected students to pursue specially tailored research projects in conjunction with Goddard scientific mentors. This year's theme and introductory seminar series will be Radiation Effects of Aerosols and Clouds on Climate.

**Introduction**

The Goddard Space Flight Center (GSFC) is recognized as a world leader in the application of remote sensing and modeling aimed at improving knowledge of the Earth system. The Goddard Earth Sciences Directorate is playing a central role in NASA's Earth Observing System (EOS) and the U.S. Global Change Research Program. GEST is a consortium of universities and corporations (University of Maryland Baltimore County, Howard University, Hampton University, Caelum Research Corporation and Northrop Grumman Corporation) organized as a cooperative agreement with the GSFC to promote excellence in the Earth sciences. The program's goal is to attract and introduce promising students to Earth system science career options through hands-on educational research experiences in the Earth sciences at NASA.
Program Activities

Research Projects: Each student will be teamed with a NASA scientist mentor with parallel scientific interests to jointly develop and carry out an intensive research project at GSFC over the ten-week period. NASA mentors will be drawn from within the four participating Earth Science laboratories at Goddard: The Laboratory for Atmospheres, The Goddard Institute for Space Studies (in New York City), The Laboratory for Hydrospheric Processes, and The Laboratory for Terrestrial Physics. Students will be expected to produce final oral and written reports on their summer research activities.

Examples of past summer research projects include: Applying the Mesoscale Model 5 for a regional climate study; Adaptation of the Global Circulation Model for use on Jupiter; Assimilation of satellite surface temperature data into a land surface model; Characterization of aerosol relative humidity with their radiative properties; Characterization of forest canopy structure with a high-resolution imaging laser; Assimilation of TRMM lightning and radar data in regional numerical prediction models; Analysis of TOMS aerosol data with model based predictions; Cloud screening procedures to improve radiometric data sets from Saharan desert dust over Puerto Rico; and Coupling a planetary boundary layer model to the Global Land Data Assimilation System.

In addition, students are required to participate in an introductory lecture series and in informal weekly lunch discussions with GSFC researchers. Students may also have the opportunity to tour key NASA facilities and meet with NASA and industry scientific leaders.

Eligibility and Selection Criteria

The program is open to students enrolled in or accepted to accredited U.S. graduate programs in the Earth, physical or biological sciences, mathematics, or engineering disciplines. Students will be selected on the basis of academic record, demonstrated motivation and qualification to pursue multidisciplinary research in the Earth sciences, clarity and relevance of stated research proposal to NASA programs, and letters of recommendation. Preference will be given to students who have completed at least one year of graduate study. Minorities, women, and those with disabilities are encouraged to apply. GEST is an Affirmative Action/Equal Opportunity Employer.

Students must commit for the full ten-week period (June 9 - August 15, 2003). Participants must be either U.S. citizens or foreign nationals in U.S. schools who are either permanent residents or who possess a valid F1 visa. All selected students will be subject to a pre-employment security background check under the current security guidelines.

Application Material

A formal application may be obtained by contacting Anathea Brooks by mail or email (see information below). The application package should include:

1. Completed application form
2. Updated Curriculum Vitae
3. At least two letters of reference
4. Undergraduate/graduate transcripts

Compensation and Support

Students will be paid the equivalent of $10/hour for forty hours per week over the ten-week period. In addition, GEST will reimburse reasonable domestic travel expenses for participants needing to relocate to the Greenbelt, MD area. Housing for the program participants only will be provided at program expense (alternate or additional accommodations cannot be supported). Transportation to and from NASA’s GSFC will be provided daily.

Deadline

Applications must be received no later than March 7, 2003. Selection announcements will be made before April 4, 2003.

Contact Information

All application materials should be directed to:

L. Anathea Brooks, Assistant Director
GEST Center, Mail Code 900.1
NASA Goddard Space Flight Center
Greenbelt, MD 20771

Email: abrooks@pop900.gsfc.nasa.gov
Telephone: 301 286 4403

2003 Goddard Coastal Research Graduate Fellowship Program (GCR)

Target

Graduate students in physical and biological oceanography and related disciplines

About the Program

The Goddard Space Flight Center’s Earth Sciences Directorate and Wallops Flight Facility, in collaboration with the Goddard Earth Sciences and Technology (GEST) Center, led by the University of Maryland Baltimore County, is offering a limited number of graduate student research opportunities. This new program is scheduled for June 2 to August 8, 2003. It is designed to stimulate interest in interdisciplinary Earth science studies by enabling selected students to pursue specially tailored research projects on coastal processes in conjunction with Goddard scientific mentors during the program period.
Introduction

The Goddard Space Flight Center (GSFC) is recognized as a world leader in the application of remote sensing and modeling aimed at improving knowledge of the Earth system. The Goddard Earth Sciences Directorate plays a central role in NASA’s Earth Observing System and the U.S. Global Change Research Program. GEST is organized as a cooperative agreement with the GSFC to promote excellence in the Earth sciences, and is a consortium of universities and corporations (University of Maryland Baltimore County, Howard University, Hampton University, Caelum Research Corporation and Northrop Grumman Corporation).

The aim of this new program is to attract and introduce promising students in their first or second year of graduate studies to Oceanography and Earth system science career options through hands-on instrumentation research experiences on coastal processes at NASA’s Wallops Flight Facility on the Eastern Shore of Virginia.

Program Activities

Research Projects: Each student will be teamed with a NASA scientist mentor with parallel scientific interests to jointly develop and carry out an intensive research project over the ten-week period. Most research will be done at GSFC’s Wallops Flight Facility, however there is the possibility that students will have the opportunity to participate in field programs at other locations as well. NASA mentors can include any Goddard Earth Scientist, but most will be drawn from within the Observational Sciences Branch (http://osb.wff.nasa.gov/). Students will be expected to produce final oral and written reports on their summer research activities. The experience will likely help students to enrich their thesis or dissertation topic choices, and broaden their scope of research tools.

Instrumentation Available: Some of the instruments available for students to learn and use are listed below.

- **Airborne Oceanographic LIDAR** - Retrieval of oceanic inherent optical properties by use of laser-induced fluorescence of phytoplankton and chromophoric dissolved organic matter (CDOM) concurrently with water Raman emission. Recent applications include satellite algorithm development for the global retrieval of the absorption coefficients of phytoplankton and CDOM together with the total backscattering coefficient.

- **Shipboard Laser Fluorometer (SLF)** - Flow-through system used to measure high spectral resolution dual wavelength laser-induced fluorescence of phytoplankton and CDOM concurrently with water Raman emission.

- **Airborne Topographic Mapper**: A laser altimeter used to measure beach erosion or deposition, and changes in Arctic ice sheets.

- **Experimental Advanced Airborne Research LIDAR** - A laser altimeter used for bathymetry in mapping coral reefs as well as measuring the height of vegetative growth.

- **Instrumentation used for Air-Sea Interaction Studies** - Participation in ongoing experiments and research in all aspects of ocean surface processes and interactions. Please visit [http://airsea.wff.nasa.gov](http://airsea.wff.nasa.gov) for more information.
- Polarimetric Research Weather Radar - New state-of-the-art portable multi-parameter S band radar used to study microphysical processes in convective storms as well as supporting validation studies for the NASA TRMM satellite.

- Instrumentation for Bio-Optical/Photophysiological Research for understanding taxonomic and physiological indicators of the phytoplankton community, examples include studying harmful algal blooms.

- Instrumentation for Upper Air Research including ozon sondes, radiosondes, aerosol LIDAR, temperature, pressure and humidity sensors.

Potential Mentors at NASA’s Wallops Flight Facility

Dr. Larry F. Bliven (http://rsif.wff.nasa.gov/bliven_cv.htm)
Dr. John Gerlach
Dr. Frank E. Hoge (http://modarch.gsfc.nasa.gov/MODIS/OCEANS/HogeBio.html)
Mr. William B. Krabill
Dr. Steve Long
Dr. John R. Moisan
Dr. Tiffany A. Moisan
Mr. Frank Schmidlin (http://www.spacedata.net/explorer/company/advisors/schmidlin.htm)
Mr. Doug Vandemark
Mr. Wayne Wright

Eligibility and Selection Criteria

The program is open to students enrolled in or accepted to accredited U.S. graduate programs in the Earth sciences, physical or biological oceanography, and biological or environmental sciences disciplines. Students will be selected on the basis of academic record, demonstrated motivation and qualification to pursue multidisciplinary research in the Earth or Oceanographic sciences, clarity and relevance of stated research interests to NASA programs, and letters of recommendation. Minorities, women, and individuals with disabilities are encouraged to apply. GEST is an Affirmative Action/Equal Opportunity Employer.

Students must commit for the specific full ten-week period (June 2 - August 8, 2003). Participants must be either U.S. citizens or foreign nationals in U.S. schools who are either permanent residents or who possess a valid F1 visa. All selected students will be subject to a pre-employment security background check under the current security guidelines.

Application Material

A formal application may be obtained by contacting Anathea Brooks by mail or email (see information below). The application package should include:

1. Completed application form

2. Updated Curriculum Vitae
3. At least two letters of reference
4. Undergraduate/graduate transcripts

**Compensation and Support**

Students will be paid the equivalent of $12/hour for forty hours per week over the ten-week period. In addition, GEST will reimburse reasonable domestic travel expenses for participants needing to relocate to Wallops Flight Facility, located near Chincoteague, Virginia on the Eastern Shore. Housing will be provided only for the program participants.

**Deadline**

Applications must be received by March 7, 2003 (flexible beyond then). Selection announcements will be made before April 4, 2003.

**Contact Information**

All application materials should be directed to:

L. Anathea Brooks, Assistant Director
GEST Center, Mail Code 900.1
NASA Goddard Space Flight Center
Greenbelt, MD 20771

Email: abrooks@pop900.gsfc.nasa.gov
Telephone: 301 286 4403

**2003 Visiting Student Enrichment Program (VSEP)**

**Target:**

High school, undergraduate and graduate students interested in computer science, mathematics, physics or Earth science

**About the Program:**

The Visiting Student Enrichment Program (VSEP) offers students summer employment with the Goddard Earth Sciences and Technology Center (GEST), working with scientists at NASA's Goddard Space Flight Center (GSFC). Student projects have included simulating neural
networks, preparing image analysis algorithms on supercomputers, developing computational science applications, and creating interactive World Wide Web sites.

Project experiences are available from June 9 to August 15 (high school students may start/stop 1-2 weeks later subject to housing availability), at GSFC in Greenbelt, MD. Students are provided opportunities to work with scientists and professionals at a world-class facility while experiencing meaningful work through a project primarily focused on computer science or the application of computers to solve problems in other sciences. VSEP also offers field trips and lectures to broaden appreciation for GSFC's mission and activities.

Possible Placements:
The following Divisions and Branches have hosted participants in previous years:

- The Scientific Computing Facility provides access to advanced computers, (i.e. a Cray T3E, Cray SV1's, SGI ORIGIN 2K and ORIGIN 3K, SUN E10000 and E6500, an IBM RS 6000 SP), the world's largest UniTree mass storage system, as well as a visualization studio. In addition, a new, even larger and more powerful supercomputer tailored to the needs of the GSFC scientific community has been purchased and will be available the first quarter of 2002. Researchers model Earth's weather, climate, and crustal dynamics, as well as space plasma and astrophysical systems.

- The National Space Science Data Center is a central repository for the large data bases generated from NASA spacecraft. Using these facilities, scientists develop space physics and astrophysics data systems, intelligent data systems, data visualization techniques, distributed data bases, and advanced technologies for mass storage. The Flight Dynamics Analysis Facility uses computers to perform mission design and determine spacecraft attitude and orbit parameters. Research is in advanced techniques for mission support and systems engineering including state-of-the-art graphics techniques and advanced software engineering.

- The Data Systems Technology Division provides a full spectrum of hardware and software environments to support applied research and development of advanced solutions to operational problems. Domains include mission operations for near-Earth unmanned scientific satellites and administrative support systems.

- Laboratory for Atmospheres researches areas such as atmospheric modeling and climate analysis in support of Earth observing systems.

- Laboratory for Hydrospheric Processes researches the oceanic, cryospheric, and hydrologic sciences.

Eligibility and Selection Criteria:

The Program is open to full-time students in computer science, the physical sciences, and mathematics. Participants must be either U.S. citizens or foreign nationals in U.S. schools who are either permanent residents or who possess a valid F-1 work visa. All selected students will be subject to a pre-employment security background check under current security guidelines.
College: Undergraduate and graduate students must have taken courses in physical and
computer sciences directly related to their areas of study.

High School: Students will be evaluated with emphasis on their potential and related
extracurricular experiences, as well as on coursework. The number of positions available
will be limited.

All students will be evaluated relative to their school-level peers. Participants will be selected
after a competitive review. Selection criteria will be academic record, letters of reference,
experience, and career goals/interest in VSEP. Funding is available for approximately 20
positions.

Application Material:

There are no formal application forms. To be considered for VSEP, please send
the following application materials to GEST (see contact information below):

1. Full name and both current and permanent addresses with telephone
   numbers and email address, if available.
2. Social security number and proof of U.S. citizenship. Foreign students will
   need proof of residency and/or visa.
3. Grade level, GPA, and intended major.
4. Well-written statement of career goals and reasons for interest in VSEP.
5. Description of relevant experience.
7. Formal academic transcripts for at least the past 2 full academic years.

Compensation and Support:

Students will be made full-time temporary employees of GEST, a nonprofit research consortium.
Compensation is lower for high school students than for undergraduate and graduate students
and is set before students are chosen. For those students not within normal commuting distance
to GSFC, the program will provide limited round-trip travel expenses and local housing.

Deadline:

Materials must be received by January 28, 2003. Selection announcements will be made on or
around April 10, 2003. Transcripts and reference letters must be sent directly from the academic
institution to the address below.
Contact Information:

Send the application package to:

Visiting Student Enrichment Program
GEST/Mail Code 930
NASA/Goddard Space Flight Center
Greenbelt, MD 20771

Web: http://esdcd.gsfc.nasa.gov/VSEP/
Email: VSEP@gsfc.nasa.gov

2003 NASA Summer School for High Performance Computational Earth and Space Sciences (HPC)

Target:

Doctoral candidates interested in using high performance computing in their research

About the Program:

The NASA Goddard Space Flight Center’s (GSFC) Earth and Space Data Computing Division (ESDCD) and the Goddard Earth Sciences and Technology Center (GEST) are soliciting applications from qualified graduate students to participate in an intensive lecture series in computational earth and space sciences during the three-week period July 7 to 25, 2003. The ESDCD provides comprehensive research and development support in data handling and computing for NASA Earth and space science research programs. Resident facilities include a 416-processor Compaq (current acquisition), a 1360-processor Cray T3E, a 512-processor SGI Origin 3000, numerous middle-sized supercomputing platforms, and several Beowulf-class systems (Beowulf is a class of inexpensive massively-parallel systems designed as a cluster of commodity PC’s using LINUX, first conceived at GSFC in the 90s). The GEST Center is a consortium of the University of Maryland Baltimore County; Howard University; Hampton University; Caelum Research Corporation; and Northrop Grumman Corporation, dedicated to excellence in the earth sciences. The consortium works under a cooperative agreement with GSFC. This summer program stems from NASA’s ongoing commitment to provide educational opportunities for the next generation of Earth and space scientists in the development of computational techniques and algorithms for scalable parallel computers in support of the Federal High-End Computing Program.

Approximately 15 students will be selected to participate in the three-week program. Students will be given hands-on computer training and small group interaction experience. Staff and invited computational scientists will present a series of lectures on advanced topics in computational Earth and space sciences, with emphasis on computational fluid dynamics and particle methods. Lectures will be presented on developing software for massively parallel
architectures. Students are encouraged to give a presentation of their thesis research interests during the course of the summer school.

The program aims to attract Ph.D. students in the Earth and space science disciplines whose present or future research requires large-scale numerical modeling on massively parallel architectures.

Eligibility:

Eligibility is limited to those Earth and space science students who are U.S. citizens, and are enrolled in U.S. universities.

Application Material:

There is no formal application form, but the application package should include:

1. A cover letter explaining your interest in the program and how your research will benefit from your participation
2. Your area of research and thesis title
3. A statement of your career objectives and goals
4. A description of your relevant work experience
5. Your curriculum vitae or resume with publication list
6. Your current G.P.A.
7. Two letters of reference
8. Academic transcripts showing two full years of work
9. A statement of U.S. citizenship

Compensation and Support:

Students will receive a stipend of $1,440 ($12 per hour) and will be reimbursed for domestic transportation to and from Greenbelt, MD. Students will be housed within commuting distance of the GSFC, and transportation to and from NASA's GSFC each day will be provided.

Deadline:

Application materials received by March 7, 2003 will receive full consideration. Selection announcements are planned by March 21, 2003.

Contact Information:

All application materials should be directed to:

Dr. Anil Deane
Email: deane@ipst.umd.edu
For more information, please visit the Earth and Space Data Computing Division (ESDCD) Web site at http://esdcd.gsfc.nasa.gov/ESS/summer_school.html

**GEST Administrative Staff**

One administrative staff member was hired during this reporting period, Marci Delaney, Education Program Coordinator.

Contact information of each of the GEST administrative staff members are given in Appendix T-2 following this technical report.

Position advertisements appeared in *EOS* and *Science*. Information concerning these advertisements is provided in Table T-2.

**Table T-2** Position advertisements published during this reporting period

<table>
<thead>
<tr>
<th>Advertisement</th>
<th>No. of Positions</th>
<th>Publication Date</th>
<th>Closing Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOS</td>
<td>1</td>
<td>2/4/03</td>
<td>2/15/03</td>
</tr>
<tr>
<td>The Chronicle of Higher Education Earthworks web site</td>
<td>1</td>
<td></td>
<td>2/15/03</td>
</tr>
<tr>
<td>American Meteorological Society web site</td>
<td>1</td>
<td></td>
<td>2/15/03</td>
</tr>
</tbody>
</table>

Changes in the GEST technical staff during this reporting period are provided in the following two tables, Table T-3 and Table T-4.

**Table T-3** GEST technical and administrative staff hired during the reporting period

<table>
<thead>
<tr>
<th>Name</th>
<th>Sponsor</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare, Craig</td>
<td>Hanson</td>
<td>920</td>
</tr>
<tr>
<td>Chandra, Sushel</td>
<td>Bhartia</td>
<td>916</td>
</tr>
<tr>
<td>Chandrasekar, Candra</td>
<td>Smith</td>
<td>912</td>
</tr>
<tr>
<td>Delaney, Marci</td>
<td>GEST Administrative Office</td>
<td>900.1</td>
</tr>
<tr>
<td>Gleason, Brendan</td>
<td>Houser</td>
<td>974</td>
</tr>
<tr>
<td>Kealy, Peter</td>
<td>Murphy</td>
<td>923</td>
</tr>
<tr>
<td>Lee, Myong-Lin</td>
<td>Rienecker</td>
<td>971</td>
</tr>
<tr>
<td>Olsen, Mark</td>
<td>Douglass</td>
<td>916</td>
</tr>
<tr>
<td>Wang, Halan</td>
<td>Lau</td>
<td>913</td>
</tr>
<tr>
<td>Whaler, Kathy</td>
<td>Goddard Visiting Fellow</td>
<td>900</td>
</tr>
<tr>
<td>Yang, Fanglin</td>
<td>Lau</td>
<td>913</td>
</tr>
</tbody>
</table>
Table T-4  GEST technical and administrative staff who have left during the present reporting period

<table>
<thead>
<tr>
<th>Name</th>
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</thead>
<tbody>
<tr>
<td>Boy, Jean Paul</td>
<td>Ben Choi</td>
<td>926</td>
</tr>
<tr>
<td>Choi, Wookap</td>
<td>Goddard Visiting Fellow</td>
<td>916</td>
</tr>
<tr>
<td>Wang, Guiling</td>
<td>Bosilovich/Houser</td>
<td>910</td>
</tr>
</tbody>
</table>

At the end of the reporting period GEST had approximately 123 research staff on board.

Submitted or Published Papers by GEST Researchers During this Reporting Period

The articles submitted or published during this reporting period are listed in the Appendix T-2 at the end this section of the report.

GEST Related Seminars for this Reporting Period

Several GEST related seminars are listed in Appendix T-3 at the end of this section of the report.

Proposals Submitted by GEST Researchers During this Reporting Period

Proposals submitted by UMBC GEST research faculty are listed in Appendix T-4 at the end of this section of the report.
Appendix T-1. GEST Administrative Staff

GEST Administrative Staff as of March 31, 2003

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Location</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert J. Curran</td>
<td>Director</td>
<td>UMBC/GSFC</td>
<td>410-455-8813</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>301-286-4403</td>
</tr>
<tr>
<td>Tom Low</td>
<td>Associate Director</td>
<td>UMBC/GSFC</td>
<td>410-455-8814</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>301-286-7992</td>
</tr>
<tr>
<td>L. Anathëa Brooks</td>
<td>Assistant Director</td>
<td>GSFC</td>
<td>301-286-4226</td>
</tr>
<tr>
<td>Robert Schiffer</td>
<td>Chief Scientist</td>
<td>GSFC</td>
<td>410-455-8810</td>
</tr>
<tr>
<td>Debbie Hicks</td>
<td>Business Manager</td>
<td>UMBC</td>
<td>410-455-8815</td>
</tr>
<tr>
<td>Marci Delaney</td>
<td>Ed. Program Coordinator</td>
<td>GSFC</td>
<td>301-286-4403</td>
</tr>
<tr>
<td>Grace Roscoe</td>
<td>Executive Assistant</td>
<td>UMBC</td>
<td>410-455-8808</td>
</tr>
<tr>
<td>Nancy Flowers</td>
<td>Administrative Assistant II</td>
<td>UMBC</td>
<td>410-455-8812</td>
</tr>
<tr>
<td>Camilla Hyman</td>
<td>Administrative Assistant II</td>
<td>UMBC</td>
<td>410-455-8899</td>
</tr>
</tbody>
</table>

Locations:

UMBC
UMBC Technology Center, South Campus
1450 S. Rolling Road, Suite 3.002
Baltimore, MD 21227

GSFC
NASA Goddard Space Flight Center
Mail Code 900.1
Bldg, 28, Room W223
Greenbelt, MD 20771

gr - 3/03
Appendix T-2. PUBLICATIONS, January 1, 2003 –March 31, 2003

Refereed

K.R. Arsenault


J.J. Wang


**Julio Bacmeister**

Bacmeister, J., Rain re-evaporation and the creation of double ITCZs, paper presented at Atmospheric Model Working Group Meeting, National Center for Atmospheric Research (NCAR), Boulder Col., March, 2003.

**Peter Colarco**

Colarco, P. R., Dynamical and microphysical analysis of transnational pollutant transport over the Eastern United States from Canadian forest fires, seminars presented at the U. of Maryland, College Park, and the GSFC Aerocenter Seminar Series, January/February, 2003.


**Mircea Grecu**


**Daniel Johnson**


**David Lary**


Lary, D., Future objectively optimized Earth observation, invited presentation given at NASA HQ, 22 January 2003. Silver Spring, MD

Ruei Fong Lin


Alexei Lyapustin


Sarith Mahnama


Jesse Meng


Steven Pawson


**Rolf Reichle**


**C. A. Schlosser**


**Chun-Lin Shie**


**Gregory Solvar**


**Illya Zavorin**

## Appendix T-4.

<table>
<thead>
<tr>
<th>P.I.</th>
<th>Title</th>
<th>Sponsoring Agency</th>
<th>Budget/Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koratkar, Anuradha</td>
<td>The Far UV Spectral Energy Distribution of Quasars – FUSE</td>
<td>NASA Office of Earth Sciences (Code Y)</td>
<td>$52,139</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>P.I.</th>
<th>Title</th>
<th>Sponsoring Agency</th>
<th>Budget/Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koratkar, Anuradha</td>
<td>Sea Simulation Pipeline</td>
<td>NASA Office of Earth Sciences (Code Y)</td>
<td>$148,436</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P.I.</th>
<th>Title</th>
<th>Sponsoring Agency</th>
<th>Budget/Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koratkar, Anuradha</td>
<td>Idea to Observations: User Support Tools for the Next Decade</td>
<td>NASA</td>
<td>$58,707</td>
</tr>
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<table>
<thead>
<tr>
<th>P.I.</th>
<th>Title</th>
<th>Sponsoring Agency</th>
<th>Budget/Commitment</th>
</tr>
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<tbody>
<tr>
<td>Lary, David</td>
<td>Objectivity Optimized EOS</td>
<td>NASA ESE AIST NRA</td>
<td>$777,570</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P.I.</th>
<th>Title</th>
<th>Sponsoring Agency</th>
<th>Budget/Commitment</th>
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</thead>
<tbody>
<tr>
<td>Lyapustin, Alexei</td>
<td>Analysis and Validation of Aerosols and Land Surface EDRs from VIIRS</td>
<td>NASA</td>
<td>$425,780</td>
</tr>
</tbody>
</table>
PI: Pap, Judit
Title: Study of EUV and UV Irradiance Variations and Their Atmospheric Effects Using Full Disk and Spatially Resolved Measurements
Sponsoring Agency: NASA
Budget/Commitment: $187,778

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PI: Wu, Yihua
Title: Numerical Investigation of Soil Moisture and Temperature Effects on the Spatial Pattern of Biogenic Emissions
Sponsoring Agency: U.S. Environmental Protection Agency
Budget/Commitment: $266,681
Business Status Report

Amendments Received During this Reporting Period

Four amendments to the Cooperative Agreement were received during the present reporting period. At the start of the reporting period a total of $21,276,649 was obligated to the Cooperative Agreement. As of 3/31/03 the total financial obligation was $24,327,763. Table B.1 gives an overview of these amendments.

Table B.1. Amendments to NCC5-494, received between 1/1/03 and 3/31/03.

<table>
<thead>
<tr>
<th>Amendment Number</th>
<th>Date</th>
<th>Amount</th>
<th>Activities Added/Augmented</th>
<th>Activities Deleted</th>
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The attached Table B.2 gives a detailed breakdown of the new or augmented activities in amendments 44, 45, and 46.

Summary of Account Activity

The most recent cost analysis for GEST, giving actual costs accrued during the reporting period was dated 3/31/03. Table B.3 gives a detailed breakdown, by task number of the costs incurred, the approved budget and remaining balance, during the reporting period.
| Date     | Description | Total | Direct Cost | Indirect Cost | Fixed | Variable | Total Expenses | Average Expense | Standard Deviation | Percentage of Direct Cost | Predicted Profit | Actual Profit |
|----------|-------------|-------|-------------|--------------|--------|----------|----------------|----------------|------------------|---------------------|---------------------|----------------|--------------|
| 1/1/23   | Sales       | 123  | 456         | 789          | 0.5    | 0.4      | 1234           | 123            | 456              | 789                | 567              | 890          |
| 2/1/23   | Marketing   | 98   | 321         | 678          | 0.3    | 0.2      | 345            | 345            | 345              | 345                | 345              | 345          |
| 3/1/23   | Operations  | 45   | 789         | 321          | 0.2    | 0.1      | 456            | 456            | 456              | 456                | 456              | 456          |

*Note: The table above represents a simplified version of a cost breakdown report.*
### TABLE B.3: DETAILED COST BREAKDOWN FOR THE LAST THREE MONTHS OF THE REPORTING PERIOD

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<th>GEST Task # and Sponsor</th>
<th>A</th>
<th>C</th>
<th>T</th>
<th>U</th>
<th>L</th>
<th>Total Direct Costs</th>
<th>Indirect Costs</th>
<th>Total Costs</th>
<th>Committed</th>
<th>Transferred</th>
<th>Remaining</th>
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<td><strong>Fringe</strong></td>
<td><strong>Travel</strong></td>
<td><strong>Subcontract</strong></td>
<td><strong>Supplies</strong></td>
<td><strong>Publications</strong></td>
<td><strong>Construction</strong></td>
<td><strong>Equipment</strong></td>
<td><strong>ODC</strong></td>
<td><strong>BDR</strong></td>
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<td>280,682</td>
<td>272,776</td>
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<td>9,290</td>
<td>0</td>
<td>5,450</td>
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<td>1,839,245</td>
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