SCIENTIFIC COORDINATION OF ACTIVITIES FOR UNIVERSITY PARTICIPATION IN MISSION TO PLANET EARTH

Contract Number:
NAS8-38782

Report Number: 13

FINAL ACTIVITIES REPORT

Reporting Period:
November 30, 1990 - February 28, 1994

Program Director:
Michael W. Kalb, Ph.D.

Submitted to:
THE GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER
ALABAMA 35812

By:
UNIVERSITIES SPACE RESEARCH ASSOCIATION
4950 CORPORATE DRIVE, SUITE 100
HUNTSVILLE, ALABAMA 35806

February 28, 1994
FINAL ACTIVITIES REPORT

SCIENTIFIC COORDINATION OF ACTIVITIES FOR UNIVERSITY PARTICIPATION IN MISSION TO PLANET EARTH

NAS8-38782

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OBJECTIVE

USRA provided management, clerical and organizational support to perform the following specific activities:

- Establish and administer (and serve as logistical interface for) a program supporting University Visiting Scientists at MSFC. The program involved Short-term Visiting Scientists, USRA Senior University Scientists, and Affiliated University Scientists;

- Establish and administer a program to increase the interaction, understanding and cooperation between MSFC earth scientists and the university earth science research community. This program included an education effort (to educate the university and NASA researchers as to the needs and goals of each other's activities), student fellowships and awards (to promote and stimulate student and faculty interest in NASA research) and production of a quarterly newsletter on behalf of the MSFC Earth Science and Applications Division (to keep MSFC affiliates and other interested scientists apprised of NASA/MSFC research programs and missions);

- Provide computer user consulting and assistance to university users to promote efficient usage and access to MSFC computers as part of approved research activities;

- Support, coordinate and provide oversight for scientific meetings and working groups required as part of MSFC's Mission to Planet Earth activities;

- Provide meeting logistical and information distribution support for scientific research, sensor development and science community interaction;

- Co-sponsor and serve as coordinator of annual MSFC scientific workshops in a topic of special interest and relevance to MSFC Earth science missions.

SPECIAL PROJECTS

PROGRAM - University-Based Cooperative Program in Earth Systems Science Education (ESSE)

ELIGIBLE PARTICIPANTS - The program targeted universities throughout the United States with a commitment to developing an interdisciplinary earth science program and curricula at their institution with an audience consisting of undergraduate students.

PROGRAM DESCRIPTION - Under this pilot program, selected universities participated cooperatively with other universities and NASA in two inter-related activities: curriculum development and scientific exchange. Each university was required to develop and offer an introductory survey course in earth systems science and senior-level interdisciplinary course. The
introductory course presents an overview of earth systems science to a broad segment of the student body, including both science and non-science majors. The purpose of the senior level course is to attract those undergraduate science majors with solid foundations in relevant sciences for future studies and work in earth systems science. The senior level course is taught jointly by faculty members from at least two academic departments with supplemental lectures from other in-house faculty, advanced graduate students, postdoctoral students, as well as visiting faculty and researchers from other universities or NASA laboratories. In addition to the curriculum development portion of the program, each university participated in an effort involving short-term visiting scientists from other participating universities and NASA Field Centers. These visitors provide additional technical insight and foster interdisciplinary education and research through their special expertise from a NASA Center which serves as a sponsor for their academic program. The NASA-sponsoring scientist may join in the identification and formulation of course work and relevant projects, facilitate access to NASA data, technical material, and other resources, and locate other NASA-based scientists to serve in a resource lecture pool from which universities may draw visiting lecturers.

Each participating university and its principal investigator were required to report on courses taught during the year and provide travel records for the visiting faculty. Previous reports outline the class participation, schedule, and topics. Tables that show participation and courses taught are attached at Appendix 1.

Curriculum development by universities is central to the ESSE program effort, especially in the areas of applying computer and visual aids technology to classroom instruction in global change.

VISITING SCIENTIST

Dr. Robert Thomas served as a Visiting Scientist at NASA Headquarters from January 1, 1991, through February 8, 1992, to manage the Polar Research Program in the Earth Science & Applications Division to act as coordinating investigator for ice-sheet research using data from ERS-1 and to serve as a team member for the EOS/GLRS instrument. Dr. Thomas produced a review entitled, "Polar Research From Satellites," while working under this contract. The review is on file at the USRA Corporate Drive office in Huntsville, Alabama.

WORKSHOPS AND CONSULTING

The following workshops/meetings were held during the course of this contract to promote Earth System Science and Education (ESSE):

- Planning Meeting in Washington, DC, October 1-3, 1991;
- Program Meeting in New Carrollton, MD, May 31, 1992, through June 2, 1992;
- Program Meeting in Stanford, CA, December 2-4, 1992;

The following consultants were retained by USRA to develop Earth System Science courses and other ESSE related issues at their institution. The program had two inter-related objectives of (1) promoting ESS undergraduate curricula development and (2) encouraging interdisciplinary collaboration between scientists both within the same university and between universities. The participants and their institutions are listed below in alphabetical order.

Ms. Susan Alexander from the Stanford University;
Dr. Raymond E. Arvidson from the Washington University;
Dr. Eric Barron from the Pennsylvania State University;
Dr. Patrick Bartlein from the University of Oregon;
Dr. Robert Bartlett from the Purdue University;
Mr. Richard Becker from the Washington University;
Mr. Ben Boyle Rice from the University Boulder;
Dr. Francis Bretherton from the University of Wisconsin;
Dr. Jim Buttle from the Trent University;
Dr. Mark Chandler from the NASA/GISS;
Mr. Peter Czepiel from the University of New Hampshire;
Robert Dickerson from the University of Arizona;
Dr. W. G. Ernst from the Stanford University;
Mr. Bruce Fegley and Ms. Laura Griffith from the Washington University;
Dr. Arthur Few from the Rice University;
Dr. George W. Fisher from the Johns Hopkins University;
Mr. Paul Forward from the Northwestern University;
Mr. Steve Frolkong from the University of New Hampshire;
Dr. Catherine Gautier from the University of California-Santa Barbara;
Dr. Barbara Grandin from the Rutgers University;
Dr. Lisa Graumlich from the University of Arizona;
Ms. Laura Griffith from the Washington University;
Mr. Jay Gulledge from the University of Alaska-Fairbanks;
Dr. David Halpern from the Jet Propulsion Laboratory;
Dr. Patrick Halpin from the University of Virginia;
Dr. Paul Harcombe from the Rice University;
Mr. David Harris from the Utah State University;
Dr. Robert C. Harris from the University of New Hampshire;
Dr. Brian Haskell from the University of Minnesota;
Dr. Harold Helgeson from the University of California-Berkeley;
Dr. Katherine Hirschboeck from the University of Arizona;
Dr. David Hodell from the University of Florida;
Mr. Martin Hoffert from the New York University;
Dr. Henry Horn from the Princeton University;
Mr. John Jirikowic from the University of Arizona;
Dr. Donald R. Johnson from the University of Wisconsin;
Ms. Joyce Johnson from the University of Iowa;
Dr. Kerry Kelts from the University Minnesota;
Dr. Carol Kendall from the U. S. Geological Survey;
Dr. Stan Kidder from the University of Alabama in Huntsville;
Me. Paul J. Kinder, Jr. from the Romney, West Virginia;
Dr. Lee Kump from the Penn State University;
Ms. Lisa Leffler from the Northwestern University;
Dr. James K. Luers from the University of Dayton;
Dr. Jeffrey McDonnell from the Utah State University;
Dr. Richard McNider from the University of Alabama in Huntsville;
Dr. Gregory Mead from the University of Florida;
Dr. Carlos Mechoso from the University of California-Los Angeles;
Dr. James R. Miller from the Cook College, Rutgers University;
Dr. Jon Nese from the Penn State Beaver Campus;
Dr. Greg Norris from the University of New Hampshire;
Dr. Bradley Opdyke from the University of Michigan;
Dr. Daniel Orange from the Stanford University;
Mr. Leigh Orf from the University of Wisconsin;
Mr. Patrick Parker from the University of Arizona;
Mr. Kurtis Paterson from the University of Iowa;
Dr. Donald Perkey from the Drexel University;
Dr. Mario Picazo from the University of California in Los Angeles;
Dr. Jorge Ramirez from the Colorado State University;  
Dr. Michael Rampino from the New York University;  
Mr. Ron Resmini from the Johns Hopkins University;  
Mr. Dave Roberts from the Utah State University;  
Dr. Jonathan Roughgarden from the Stanford University;  
Dr. Nigel Roulet from the York University;  
Dr. Jorge L. Sarmiento from the Princeton University;  
Dr. Ron Sass from the Rice University;  
Dr. Joshua Schimel from the University of Alaska Fairbanks;  
Dr. Stephen H. Schneider from the Stanford University;  
Dr. Jerald Schnoor from the University of Iowa;  
Ms. Diane Schweizer from the University of California-Santa Barbara;  
Dr. Douglas Sherman from the University of Southern California;  
Dr. Everette Shock from the Washington University;  
Dr. Raymond C. Smith from the University of California-Santa Barbara;  
Dr. John Snow from the Purdue University;  
Dr. Anne Spacie from the Purdue University;  
Mr. Parvada Suntharalingam from the Princeton University;  
Ms. Tracy Totten from the Rice University;  
Dr. Lonnie Thompson from the Ohio State University;  
Dr. Ellen Mosley-Thompson from the Ohio State University;  
Dr. Richard P. Turco from the University of California-Los Angeles;  
Mr. Daniel Vietor from the Purdue University;  
Mr. Mitch Wagener from the University of Alaska-Fairbanks;  
Dr. John Walther from the Northwestern University;  
Dr. Paul Weiblen from the University of Minnesota;  
Dr. Frank Weirich from the University of Iowa;  
Dr. Ed Wright from the University of Arizona;  

Detailed program descriptions and status reports for each institution were submitted in previous quarterly reports. They remain on file in the USRA Corporate Drive office.

**SUBCONTRACTS**

USRA entered into a subcontract agreement with the University of Oklahoma effective August 15, 1991, for a period of twelve months to perform the research entitled, "Theory and Application of Remote Sensing to Understanding Land-Atmosphere Interactions and Surface Hydrology." The subcontract supported Dr. Claude Duchon, Professor of Meteorology, to use SSM/I data to provide estimates of precipitation, vegetation, land surface temperatures, and soil moisture and to determine the feasibility of employing SSM/I data as input to a hydrological model, for example SWRRB. The research directly supported the CaPE field program at Marshall Space Flight Center.

**FINANCIAL**

Total Contract Value: $990,961  
Total Cumulative Costs and Fee: $990,961  
Estimated Residual: $0  

The period of performance was extended through February 28, 1994, at no additional cost to the government to allow additional time for the participating institutions to invoice final billing.
APPENDIX 1
<table>
<thead>
<tr>
<th>SCHOOL NAME</th>
<th>TITLE—SURVEY COURSE</th>
<th>DATE OFFERED</th>
<th>ENROLL</th>
<th>TITLE—SENIOR COURSE</th>
<th>DATE OFFERED</th>
<th>ENROLL</th>
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<td>Univ. of Alaska—Fairbanks</td>
<td>Humans in the Earth System</td>
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<tr>
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<td>The Earth from Space</td>
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<td>Atmos. Chemistry &amp; Physics</td>
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<td>Johns Hopkins University</td>
<td>Global Environmental Change</td>
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<td>Energy for a Sustainable Future</td>
<td>Fall '92</td>
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<td>Unv. of New Hampshire</td>
<td>Geology &amp; the Environment</td>
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<td>Earth As A System</td>
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<td>Numerous Earth Systems related Courses</td>
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<td>Rice University</td>
<td>Atmosphere, Weather &amp; Climate</td>
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<td>Washington University</td>
<td>Global Change: Atmospheric Issues and Problems</td>
<td>Fall '92</td>
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<td>Earth System Modeling</td>
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<p>| Totals                |                                           |              | 1584    |                                           |              | 525     |</p>
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<th>SCHOOL NAME</th>
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<th>TITLE—SENIOR COURSE</th>
<th>DATE</th>
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<td>Univ. of Ala. – HSV</td>
<td>Humans In the Earth System</td>
<td>Spring '94</td>
<td>10P</td>
<td>The Earth as a System</td>
<td>Spring '94</td>
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<td>Univ. of CA—Los Angeles</td>
<td>The Earth As A System</td>
<td>Fall '93/Spring '94</td>
<td>55P</td>
<td>1) Global Biogeochem. Cycles</td>
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<td>University of Florida</td>
<td>Intro. to Earth Sys. Science</td>
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<td>Earth System Science</td>
<td>Summer '94</td>
<td>70P</td>
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<td>Summer '93/Spring '94</td>
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<td>New York University</td>
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<td>Geology &amp; the Environment</td>
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<td>70P</td>
<td>Integrated Earth Systems</td>
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<td>780P</td>
<td>Numerous Earth Systems related Courses</td>
<td>Fall '93/Spring '94</td>
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<td>Princeton University</td>
<td>Perspectives on Env. Issues</td>
<td>'92/93</td>
<td>90P</td>
<td>Biogeochemistry of</td>
<td>'92/93</td>
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### Table B Cont.

SCHOOLS TO TEACH ACADEMIC YEAR 1993–94 WITH ESSE SUPPORT

<table>
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<tr>
<th>SCHOOL NAME</th>
<th>TITLE—SURVEY COURSE</th>
<th>DATE OFFERED</th>
<th>ENROLL.</th>
<th>TITLE—SENIOR COURSE</th>
<th>DATE OFFERED</th>
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<tr>
<td>Purdue University</td>
<td>Survey of Earth Sys. Sci.</td>
<td>Fall '93</td>
<td>50P</td>
<td>Global Change</td>
<td>Spring '94</td>
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<td>117P</td>
<td>Earth System Dynamics</td>
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<td>Winter '94</td>
<td>61P</td>
<td>Senior Sem. in Earth Systems</td>
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<td>Perspectives In Agrl. &amp; Environ.</td>
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<td>Washington University</td>
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<td>University of Wisconsin</td>
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<td>Global Change: Atmospheric Issues and Problems</td>
<td>Fall '93</td>
<td>44P</td>
<td>Earth System Modeling</td>
<td>Spring '94</td>
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<td>TEACHING ASSISTANT</td>
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<td>Ohio State</td>
<td>Integrated Earth Systems</td>
<td>Ellen Thompson, Carolyn Merry</td>
<td>Geography &amp; Polar Resources</td>
<td>Paul Kinder</td>
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<td>Earth Systems</td>
<td>Brent Yarnal, Nels Shirer, Alistair Fraser, &amp; Others</td>
<td>Civil Engineering</td>
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<td>Rice</td>
<td>Earth System Dynamics</td>
<td>Arthur Few, Ron Sass, Tamarz Ledley</td>
<td>Geosciences</td>
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<td>Senior Seminar in Earth Sys.</td>
<td>Mark Johnsson</td>
<td>Space Physics &amp; Astronomy</td>
<td>Susan Alexander</td>
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<td>Utah State</td>
<td>Climate—Hydrologic Inter.</td>
<td>Jeff McDonnell</td>
<td>Ecol. &amp; Evolutionary Biology</td>
<td>Dave Harriss</td>
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<td>Washington</td>
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<td>Ray Arvidson</td>
<td>Space Physics &amp; Astronomy</td>
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<td>Earth System Modelling</td>
<td>Francis Bretherton, John Kutzbach</td>
<td>Earth Systems Program</td>
<td>Jahander Ramezari</td>
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<td>Atmos. &amp; Ocean. Sci.</td>
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<tr>
<td>Alaska—Fairbanks</td>
<td>The Earth as a System</td>
<td>Glenn Shaw, Dave Musgrave</td>
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<td>Gregory Carmichael, Frank Welrich, Jerald Schnoor, G. Edgar Folk, Other members of the Ctr.Glob.&amp; Reg. Env. Res.</td>
<td>Chemical &amp; Biochemical Eng, Geography, Civil &amp; Environmental Eng, Physiology &amp; Biophysics</td>
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<td>Michael R. Rampino</td>
<td>Applied Science</td>
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This report describes USRA activities in support of the University Participation in Mission to Planet Earth. Specifically it addresses the following areas:

a) personnel assigned to the effort
b) travel
c) consultant participants
d) technical progress
e) contract spending