

Final Report

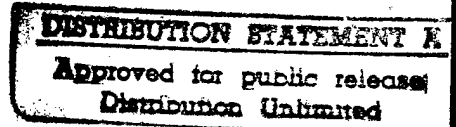
Strategic Environmental Research and Development Program (SERDP)

prepared by

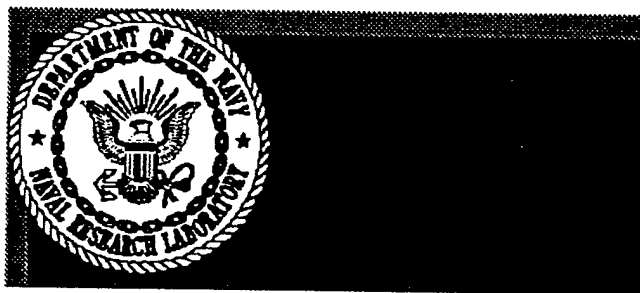
National Supercomputing Center for
Energy and the Environment (NSCEE)



for



Naval Research Laboratory (NRL)



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ONR Seattle

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6. AUTHOR(S) Joseph Lombardo, Director NSCEE				
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13. ABSTRACT (Maximum 200 words) The purposes of the (SERDP) program are as follows: 1. To address environmental matters of concern to the Department of Defense and the Department of Energy through support for basic and applied research and development of technologies that can enhance the capabilities of the departments to meet their environmental obligations. 2. To identify research, technologies, and other information developed by the Department of Energy for national defense purposes that would be useful to governmental and private organizations involved in the development of energy technologies and of technologies to address environmental restoration, waste minimization, hazardous waste substitution, and other environmental concerns, and to share such research, technologies with such governmental and private organizations. 3. To furnish other governmental organizations and private organizations with continued				
14. SUBJECT TERMS Environmental Research, Energy Technologies, Climate Modeling, Atmospheric Modeling		15. NUMBER OF PAGES		
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data, enhanced data collection capabilities, and enhanced analytical capabilities for use by such organizations in the conduct of environmental research, including research concerning global environmental change.

4. To identify technologies developed by the private sector that are useful for Department of Defense and Department of Energy defense activities concerning environmental restoration, hazardous and solid waste minimization and prevention, hazardous material substitution, and provide for the use of such technologies in the conduct of such activities.



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SERDP Proposals Funded

Proposal Number	PI Name(s)	Institution	Title	Awarded SBU's	Awarded Duration
Phase I Awards					
92-01	Robert L. Lee and Jinwon Kim	Lawrence Livermore National Laboratory	Climatology of Gravity Wave Forcing on the Atmospheric Motion	350	2
92-04	Jeffery Lienau	University of California, Davis	Numerical Simulation of Particle Dispersion in Round Turbulent Jets	250	1
92-05	R. V. Madala	Naval Research Laboratory	High Resolution Regional and Mesoscale Model	500	2
92-06	Rose C. McCallen	Lawrence Livermore National Laboratory	Large Eddy Simulation of Turbulent Flow Around Buildings Using the Finite Element Method	700	2
92-07	J. Alan Ross	Lawrence Livermore National Laboratory	An Algebraic Stress Model for Turbulent Flow Using the Finite Element Method	200	2
92-11	Joseph P. Pinto	Environmental Protection Agency	Photochemical Modeling Studies Related to Global Change	250	2
92-12	Joyce E. Penner	Lawrence Livermore National Laboratory	Climate Studies of the Direct and Indirect Effects of Sulfate Aerosols	1700	2
Total				3950	
Phase II Awards					
93-1	Liang Xu	North Carolina State University	Mesoscale Processes Important for Understanding Global Climate	1000	2
93-2	Martin J. Lesch	North Carolina State University	Physical Processes Important for Understanding the Hydrologic Cycle	400	2
93-3	Richard M. Hodur	Naval Research Laboratory	Development of a Coupled Ocean/Atmospheric Model to Determine Environmental Conditions for US Navy Operations	500	2
93-4	James D. Doyle	Naval Research Laboratory	Air-Sea Interaction during Explosive Cyclogenesis	600	2
93-5	Jeffery Lienau	University of California, Davis	Numerical Simulation of Round Turbulent Jets	250	1
93-6	John W. Glendening	Naval Research Laboratory	Large-Eddy Simulation of Vertical Transport by Coherent Roll Structures in the Atmospheric Boundary Layer	800	2
93-8	Gail P. Anderson	Hanscom AFB	SAMME Global Sensitivity Studies	500	1
Total				4050	

Proposal Number	PI Name(s)	Institution	Title	Awarded SBU's	Duration (years)
93-16	Robert E. Dickinson	University of Arizona	Development of the State of the Art Interactive Land Model for Greenhouse Projections	2500	2
93-17	Wei-Chyung Wang	University of New York at Albany	Model Assessment of the Enhanced Greenhouse Effect, Phase 2	2250 ^a	2
93-18	Julio T. Bacmeister & Simon Chang	Naval Research Laboratory	A Proposal to Examine Mountain Wave Generation over Complex Terrain	500	1
93-20	Robert L. Lee John C. Pace Jinwon Kim Su-Tzai Soong	Lawrence Livermore National Laboratory	Modeling Regional Scale Climate Change	500	1
93-21	Jeffery Lienau	University of California, Davis	Numerical Simulation of Round Turbulent Jets	250	1
93-22	Suman Rao	North Carolina State University	Effect of Land Use Patterns on Regional Climate	250	1
93-23	Kiran Alapathy	North Carolina State University	Sensitivity of Monsoon Rainfall Predictions to Cumulus Parameterization Schemes: Implications for Climate Modeling	250	1
93-25	J. Alan Ross	Lawrence Livermore National Laboratory	Modeling Turbulent Flow Around Buildings Using the Finite Element Method with an Algebraic Stress Model	250	1
93-27	Melani Wetzel Gary T. Bates	Desert Research Institute National Center for Atmospheric Research	Regional Climate Modeling with Satellite Derived Initialization and Validation	240	2
93-28	Martin J. Leach	North Carolina State University	Physical Processes Important for Understanding the Hydrologic Cyclone	600	1
93-29	Lawrence A. Mysak	McGill University	International Variability of Arctic Sea Ice	700	1
Total				6040	

^a Unfunded Account.

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GRANT # CA-N000014-92-2-2001

January 7, 1993 - September 27, 1997

Description	12/18-3/192												Total
	Jan-93	Feb-93	Mar-93	Apr-93	May-93	Jun-93	Jul-93	Aug-93	Sep-93	Oct-93	Nov-93	Dec-93	
Cray Charges	23,019.91	39,515.46	37,779.98	15,737.49	34,688.03	37,088.41	57,714.39	143,698.14	65,681.81	49,999.10	119,455.43	54,961.44	\$609,600.50
Sun Charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.02	0.02	0.00	
Coaxes Charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	
Total Amount	23,019.91	39,526.36	37,779.98	15,737.49	34,688.03	37,088.41	57,714.39	143,698.14	65,681.86	49,999.12	119,455.47	54,961.44	
Cost Sharing at (14.17%)	-3,261.92	-5,599.34	-5,353.42	-2,230.00	-4,915.29	-5,255.43	-8,178.13	-20,362.03	-9,307.12	-7,084.88	-16,926.84	-7,788.04	
Net Amount	\$19,757.99	\$33,916.12	\$32,426.56	\$12,113.36	\$29,772.74	\$31,832.98	\$49,536.26	\$123,336.11	\$56,374.74	\$42,914.24	\$102,528.63	\$47,173.40	
Description	Jan-94	Feb-94	Mar-94	Apr-94	May-94	Jun-94	Jul-94	Aug-94	Sep-94	Oct-94	Nov-94	Dec-94	Total
Cray Charges	64,348.27	100,971.71	64,212.68	139,976.90	116,178.05	70,903.70	93,609.08	87,843.38	99,592.68	69,054.70	110,581.90	83,649.72	\$976,386.99
Sun Charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	
Coaxes Charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	
Total Amount	64,348.27	100,971.71	64,212.68	139,976.90	116,178.05	70,903.70	93,609.08						
Cost Sharing at (14.17%)	-9,118.15	-14,307.69	-9,098.94	-19,834.73	-16,462.43	-10,047.05	-13,264.41	-12,447.44	-14,112.28	-9,785.05	-15,669.46	-11,853.17	
Net Amount	\$55,230.12	\$86,664.02	\$55,113.74	\$120,142.17	\$99,715.62	\$60,856.65	\$80,344.67	75,396.14	85,480.40	59,269.65	94,912.44	71,796.55	
Storage Fee								<u>5,286.25</u>	<u>5,084.35</u>	<u>5,244.82</u>	<u>9,686.13</u>	<u>6,163.17</u>	
Net Amount \$94 on								\$80,682.39	\$90,564.75	\$64,514.47	\$104,598.67	\$77,959.72	
Description	Jan-95	Feb-95	Mar-95	Apr-95	May-95	Jun-95	Jul-95	Aug-95	Sep-95	Oct-95	Nov-95	Dec-95	Total
Cray Charges	17,358.66	67,249.38	38,916.02	43,949.62	70,760.80	37,398.68	73,693.84	67,597.86	80,578.74	43,417.22	31,341.42	3,535.62	\$573,592.75
Cost Sharing @ 14.17%	-2,459.72	-9,529.24	-5,514.40	-6,227.66	-10,026.81	-5,299.39	-10,442.42	-9,578.62	-11,418.01	-6,152.22	-4,441.08	-501	
Total Amount	14,898.94	57,720.14	33,401.62	37,721.96	60,733.99	32,099.29	63,251.42	58,019.24	69,160.73	37,265.00	26,900.34	3,034.62	
Storage Fee	5,200.02	0.00	4,967.41	5,286.17	5,997.27	6,393.16	6,214.05	7,144.65	8,457.52	10,195.78	9,065.99	10,463.41	
Sun Charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	
Net Amount	\$20,098.96	\$57,720.14	\$38,369.03	\$43,008.13	\$66,731.26	\$38,492.45	\$69,465.47	\$65,163.89	\$77,618.25	\$47,460.78	\$35,966.36	\$13,498.03	
Description	Jan-96	Mar-96	Apr-96	May-96	Jun-96	Jul-96	Aug-96	Sep-96	Oct-96	Nov-96	Dec-96	Jan-97	Total
Cray Charges	2,412.74	1,672.22	14,006.96	57,308.02	32,699.04	968.00	55.66	3,603.38	2,352.24	89,757.80	126,036.02	47,652.22	\$586,083.42
C. Shrg @ 14.17%	-341.89	-236.95	-1,984.79	-8,120.55	-4,633.45	-137.17	-7.89	-510.6	-333.31	-12,718.68	-17,859.30	-6752.32	
Total Amount	2,070.85	1,435.27	12,022.17	49,187.47	28,065.59	830.83	47.77	3,092.78	2,018.93	77,039.12	108,176.72	40,899.90	
Storage Fee	11,016.97	15,008.41	12,791.01	13,050.17	12,953.64	12,927.23	12,905.13	17,810.48	17,029.27	17,083.72	16,768.68	17,762.35	
Sun Charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Coaxes Charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Net Amount	\$13,087.82	\$16,490.69	\$24,813.18	\$62,237.64	\$41,019.23	\$13,758.06	\$12,952.90	\$20,956.61	\$20,939.50	\$94,340.67	\$125,083.81	58,794.34	
Total Usage													
										</			

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Introduction

Public Law 101-510 established the Strategic Environmental Research and Development Program (SERDP) in Fiscal Year 1990. The Naval Research Laboratory (NRL) and the National Supercomputing Center for Energy and the Environment (NSCEE) signed a three-year cooperative agreement in September 1992 to provide supercomputing support to the SERDP program.

This cooperative program supports research and development projects in atmospheric modelling and analysis in support of global environmental change which has been identified as a key component of the SERDP.

"The purposes of the (SERDP) program are as follows:

1. To address environmental matters of concern to the Department of Defense and the Department of Energy through support for basic and applied research and development of technologies that can enhance the capabilities of the departments to meet their environmental obligations.
2. To identify research, technologies, and other information developed by the Department of Defense and the Department of Energy for national defense purposes that would be useful to governmental and private organizations involved in the development of energy technologies and of technologies to address environmental restoration, waste minimization, hazardous waste substitution, and other environmental concerns, and to share such research, technologies, and other information with such governmental and private organizations.
3. To furnish other governmental organizations and private organizations with data, enhanced data collection capabilities, and enhanced analytical capabilities for use by such organizations in the conduct of environmental research, including research concerning global environmental change.
4. To identify technologies developed by the private sector that are useful for Department of Defense and Department of Energy defense activities concerning environmental restoration, hazardous and solid waste minimization and prevention, hazardous material substitution, and provide for the use of such technologies in the conduct of such activities."

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Objectives

The objectives of this program are to:

- Provide a numerical laboratory for SERDP related research projects.
- Support advancement of modelling capability and understanding of climate change and predict potential human impacts on climate for the future.
- Support modelling experiments to quantify uncertainties associated with predicting climate change caused by human impacts on the environment.

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Computing Resource Requirements Questionnaire

Please specify your project requirements.

PI Name: _____
 Project Title: _____
 Affiliation: _____
 E-mail address: _____

Resource Required	Quantity/ Method
Cray YMP CPU hours	
Cray YMP physical memory requirements (megabytes)	
Cray YMP SSD (megabytes)	
Cray YMP temporary disk storage during job execution (megabytes)	
Permanent disk storage requirements	
Off-line storage (data migration to tape) in megabytes	
Printed output (pages)	
Magnetic tape transmittals	
Mode of communication (modem or Internet network)	
Please list any software you may need for your project (e.g., IMSL, FIDAP, GAUSSIAN)	

Proposal Guidelines

Proposals should delineate the modelling activity, numerical experiment and/or analysis concept and its relation to the SERDP. A schedule of work and Cray YMP time requested must be provided. Specific details of how modelling or analysis activity relates to SERDP goals must be provided in the proposal. Proposals may only request computing time and resources. Proposals may be submitted for a duration of up to 2 years.

Proposals will be reviewed on a quarterly basis by a technical review committee. The deadline for submission of the first round of proposals is November 30, 1992. Computing resources will be allocated on a first-come first-serve basis.

Submit eight (8) copies of proposals (not to exceed five (5) pages in length) and copy of the enclosed computing resources questionnaire to:

National Supercomputing Center for
 Energy and the Environment
 University of Nevada, Las Vegas
 4505 Maryland Parkway
 Las Vegas, Nevada 89154-4028

Ph: (702) 895-4153
 Fax: (702) 895-4156
 e-mail on Internet: bn@nye.nscce.edu

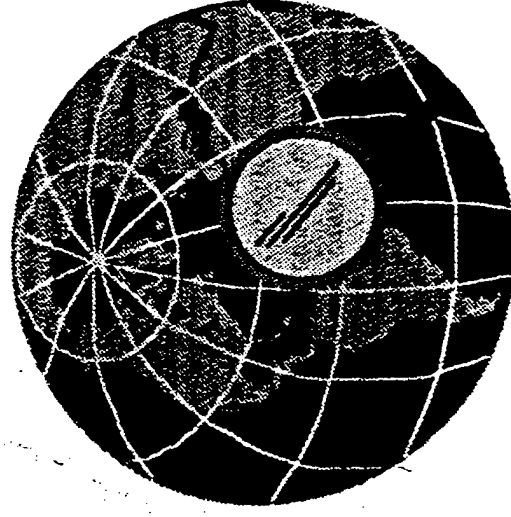


Strategic Environmental Research and Development Program (SERDP) Supercomputing Support

Program Announcement and Request for Proposals

sponsored by

The National Supercomputing Center for Energy and the Environment
 and
 The Naval Research Laboratory



Introduction.

The National Supercomputing Center for Energy and the Environment (NSCEE) is soliciting proposals in support of the Strategic Research and Development Program (SERDP). Public Law 101-510 established the Strategic Environmental Research Program in Fiscal Year 1990. The Naval Research Laboratory (NRL) and the NSCEE signed a three-year cooperative agreement in September 1992 to provide supercomputing support to the SERDP program.

This program supports the research and development program in atmospheric modelling and analysis in support of global environmental change which has been identified as a key component of the SERDP.

The purposes of the (SERDP) program are as follows:

- (1) To address environmental matters of concern to the Department of Defense and the Department of Energy through support for basic and applied research and development of technologies that can enhance the capabilities of the departments to meet their environmental obligations.
- (2) To identify research, technologies, and other information developed by the Department of Defense and the Department of Energy for national defense purposes that would be useful to governmental and private organizations involved in the development of energy technologies and of technologies to address environmental restoration, waste minimization, hazardous waste substitution, and other environmental concerns, and to share such research, technologies, and other information with such governmental and private organizations.
- (3) To furnish other governmental organizations

and private organizations with data, enhanced data collection capabilities, and enhanced analytical capabilities for use by such organizations in the conduct of environmental research, including research concerning global environmental change.

- (4) To identify technologies developed by the private sector that are useful for Department of Defense and Department of Energy defense activities concerning environmental restoration, hazardous and solid waste minimization and prevention, hazardous material substitution, and provide for the use of such technologies in the conduct of such activities."

Objectives

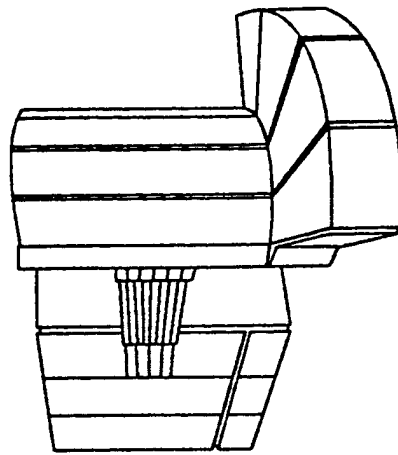
The objectives of this program are to:

- Provide a numerical laboratory for SERDP related research projects.
- Support advancement of modelling capability and understanding of climate change and predict potential human impacts on climate for the future.
- Support modelling experiments to quantify uncertainties associated with predicting climate change caused by human impacts on the environment.

Proposal Evaluation Criteria

The objectives of this program are to:

- Provide a numerical laboratory for SERDP related research projects.
- Support advancement of modelling capability and understanding of climate change and predict potential human impacts on climate for the future.



- Support modelling experiments to quantify uncertainties associated with predicting climate change caused by human impacts on the environment.

Numerical Laboratory

The NSCEE computing resources include a Cray YMP-2/216 with 16 million 64-bit words of central memory (128 megabytes), two processors, and an integrated Solid-state Storage Device (SSD) that contains 32 million 64-bit words (256 megabytes) of fast access memory. The Cray YMP-2/216 is capable of performing over 600 million 64-bit floating point operations per second. The Cray disk storage units have a total capacity of 24 gigabytes. Data migration is performed transparent to users for tape storage of aged files. NSCEE also operates a Convex C-220 and a Sun-MP690. All systems operate under the Unix operating system.

A full range of support services are available to NSCEE users. These services include assistance in troubleshooting computer problems, information on techniques to speed up computer model runs, and supercomputing training classes and documentation.

Computing Resource Requirements Questionnaire

Please specify your project requirements.

PI Name:	
Project Title:	
Affiliation:	
E-mail address:	
Resource Required	Quantity/ Method
Cray YMP CPU hours	
Cray YMP physical memory requirements (megabytes)	
Cray YMP SSD (megabytes)	
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Printed output (pages)	
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Mode of communication (modem or Internet network)	
Please list any software you may need for your project (e.g., IMSL, FIDAP, GAUSSIAN)	

Proposal Guidelines

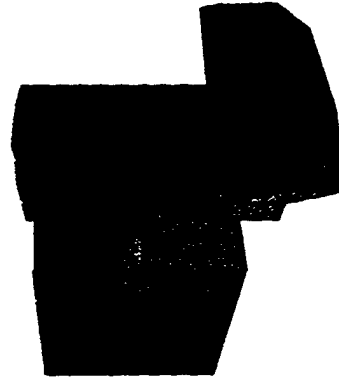
Proposals should delineate the modelling activity, numerical experiment and/or analysis concept and its relation to the SERDP. A schedule of work and Cray YMP time requested must be provided. Specific details of how modelling or analysis activity relates to SERDP goals must be provided in the proposal. Proposals may only request computing time and resources. Proposals may be submitted for a duration of up to 2 years.

The deadline for submission of the second round of proposals is April 5, 1993. Computing resources will be allocated on a first-come first-serve basis.

Submit seven (7) copies of proposals [not to exceed ten (10) pages in length], 2-page curriculum vitae, and copy of the enclosed computing resources questionnaire to:

National Supercomputing Center for
Energy and the Environment
University of Nevada, Las Vegas
4505 Maryland Parkway
Las Vegas, Nevada 89154-4028

Ph: (702) 895-4153
Fax: (702) 895-4156
e-mail on Internet: bn@nye.nscce.edu



Strategic Environmental Research and Development Program (SERDP) Supercomputing Support

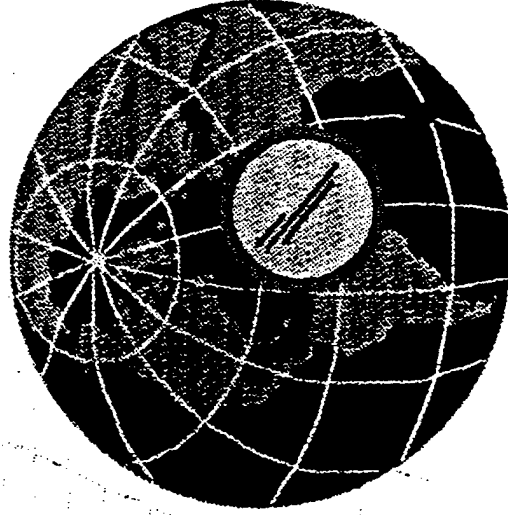
Phase II Program Announcement and Request for Proposals

sponsored by

The National Supercomputing Center for Energy and the Environment

and

The Naval Research Laboratory



Introduction

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Proposal Evaluation Criteria

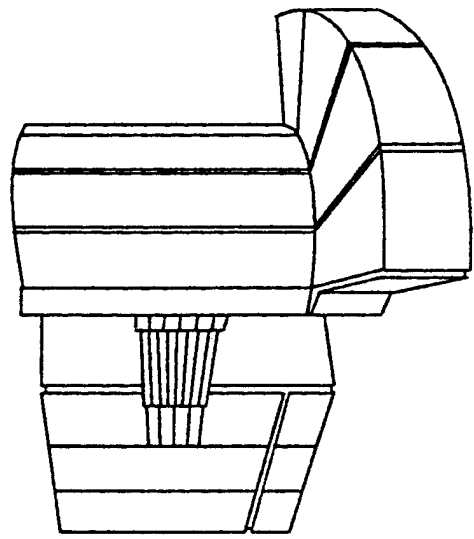
The proposals will be evaluated by a technical review committee based on the following criteria:

- Scientific merit (30%).
- Qualifications of PI and institution (30%).
- Relevance to SERDP goals (30%).
- Cost/benefit (10%).

Numerical Laboratory

The NSCEE computing resources include a Cray YMP-2/216 with 16 million 64-bit words of central memory (128 megabytes), two processors, and an Integrated Solid-state Storage Device (SSD) that contains 32 million 64-bit words (256 megabytes) of fast access memory. The Cray YMP-2/216 is capable of performing over 600 million 64-bit floating point operations per second. The Cray disk storage units have a total capacity of 24 gigabytes. Data migration is performed transparent to users for tape storage of aged files. NSCEE also operates a Convex C-220 and a Sun-MP690. All systems operate under the Unix operating system.

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Proposal Guidelines

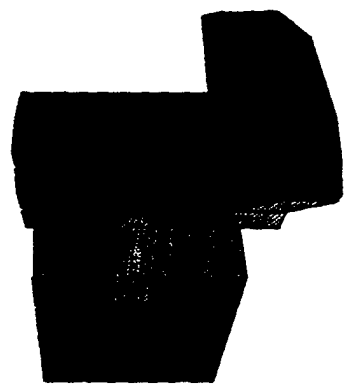
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The deadline for submission of the proposals is August 13, 1993. Computing resources will be allocated on a first-come first-serve basis.

Submit seven (7) copies of proposals (not to exceed ten (10) pages in length), 2-page curriculum vitae, and copy of the enclosed computing resources questionnaire to:

National Supercomputing Center for Energy and the Environment
University of Nevada, Las Vegas
4505 Maryland Parkway
Las Vegas, Nevada 89154-4028

Ph: (702) 895-4153
Fax: (702) 895-4156
e-mail on Internet: bn@nyc.nsee.edu



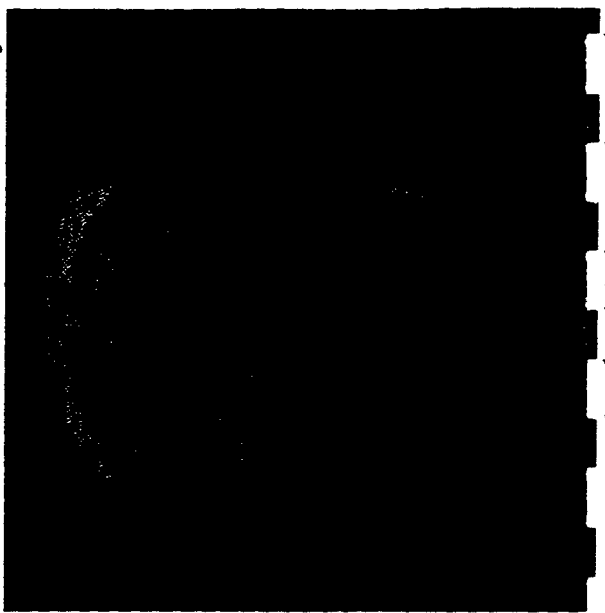
Strategic Environmental Research and Development Program (SERDP) Supercomputing Support

Phase III Program Announcement and Request for Proposals

sponsored by

The National Supercomputing Center for Energy and the Environment and

The Naval Research Laboratory



Introduction

The National Supercomputing Center for Energy and the Environment (NSCEE) is soliciting proposals in support of the Strategic Research and Development Program (SERDP). Public Law 101-510 established the Strategic Environmental Research Program in Fiscal Year 1990. The Naval Research Laboratory (NRL) and the NSCEE signed a three-year cooperative agreement in September 1992 to provide supercomputing support to the SERDP program.

This program supports the research and development program in atmospheric modelling and analysis in support of global environmental change which has been identified as a key component of the SERDP.

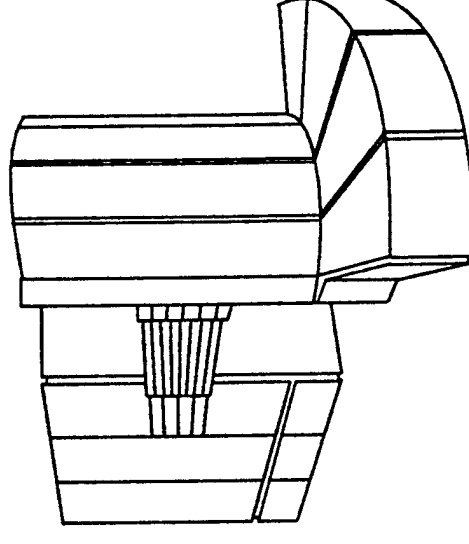
"The purposes of the (SERDP) program are as follows:

- (1) To address environmental matters of concern to the Department of Defense and the Department of Energy through support for basic and applied research and development of technologies that can enhance the capabilities of the departments to meet their environmental obligations.
- (2) To identify research, technologies, and other information developed by the Department of Defense and the Department of Energy for national defense purposes that would be useful to governmental and private organizations involved in the development of energy technologies and of technologies to address environmental restoration, waste minimization, hazardous waste substitution, and other environmental concerns, and to share such research, technologies, and other information with such governmental and private organizations.
- (3) To furnish other governmental organizations

Numerical Laboratory

The NSCEE computing resources include a Cray YMP-2/216 with 16 million 64-bit words of central memory (128 megabytes), two processors, and an Integrated Solid-state Storage Device (SSD) that contains 32 million 64-bit words (256 megabytes) of fast access memory. The Cray YMP-2/216 is capable of performing over 600 million 64-bit floating point operations per second. The Cray disk storage units have a total capacity of 24 gigabytes. Data migration is performed transparent to users for tape storage of aged files. NSCEE also operates a Convex C-220 and a Sun-MP690. All systems operate under the Unix operating system.

A full range of support services are available to NSCEE users. These services include assistance in troubleshooting computer problems, information on techniques to speed up computer model runs, and supercomputing training classes and documentation.



and private organizations with data, enhanced data collection capabilities, and enhanced analytical capabilities for use by such organizations in the conduct of environmental research, including research concerning global environmental change.

- (4) To identify technologies developed by the private sector that are useful for Department of Defense and Department of Energy defense activities concerning environmental restoration, hazardous and solid waste minimization and prevention, hazardous material substitution, and provide for the use of such technologies in the conduct of such activities."

Objectives

The objectives of this program are to:

- Provide a numerical laboratory for SERDP related research projects.
- Support advancement of modelling capability and understanding of climate change and predict potential human impacts on climate for the future.
- Support modelling experiments to quantify uncertainties associated with predicting climate change caused by human impacts on the environment.

Proposal Evaluation Criteria

The proposals will be evaluated by a technical review committee based on the following criteria:

- Scientific merit (30%).
- Qualifications of PI and institution (30%).
- Relevance to SERDP goals (30%).
- Cost/benefit (10%).

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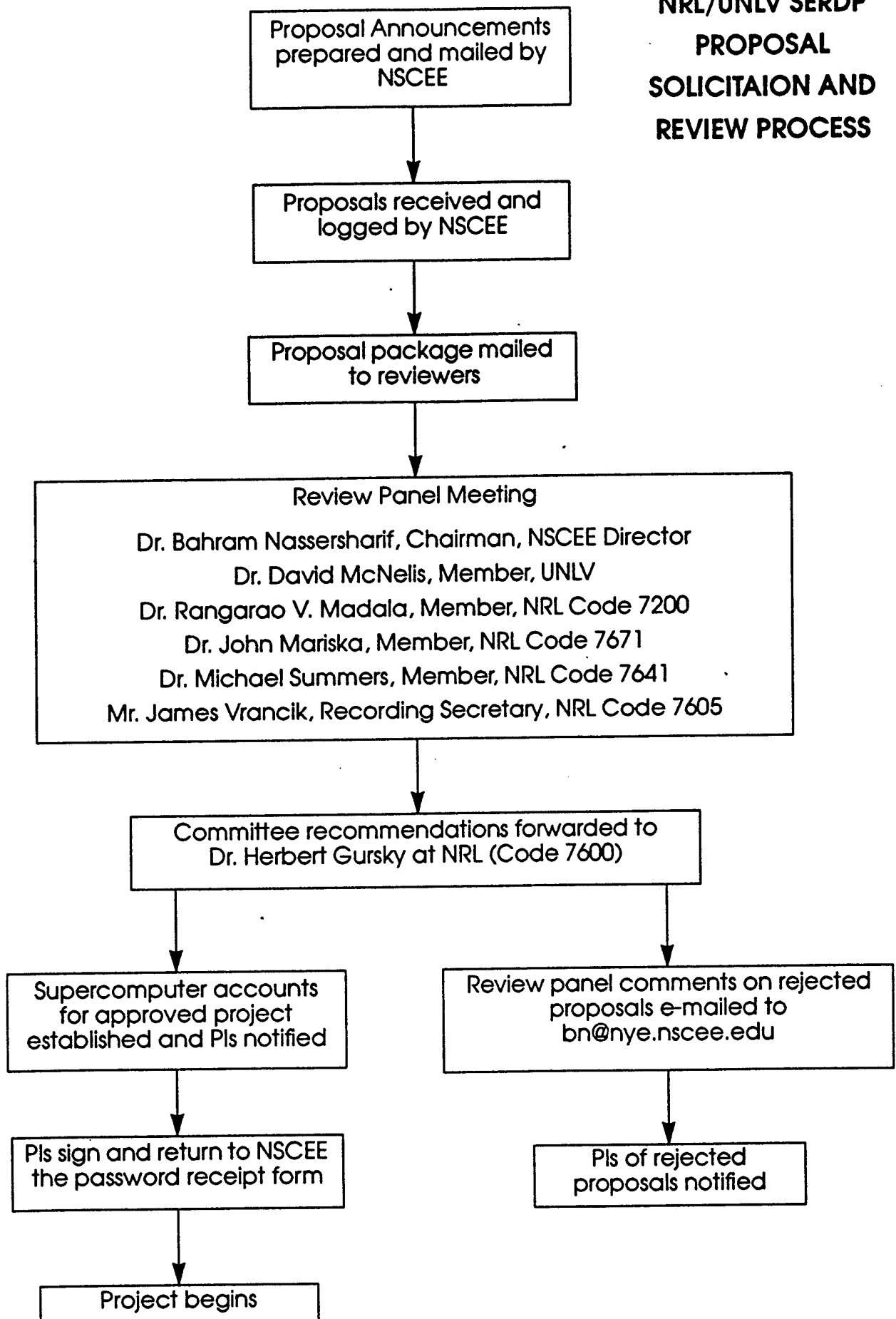
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The proposal solicitation and review process flow chart is shown on the following page. The proposal review panel consists of a chairman, four members and a recording secretary. The chairman and the four members each have one vote. The proposals are evaluated according to the following criteria:

- Scientific merit (30%).
- Qualifications of PI and institution (30%).
- Relevance to SERDP goals (30%).
- Cost/benefit (10%).

A consensus must be reached among the members of the review panel before a project can be recommended for support. The chairman of the review panel is responsible for notifying the Principal Investigators (PIs) of each proposal of the outcome of the review process. The authority for approval of the review panel's recommendations is Dr. Herbert Gursky, the Superintendent of the Space Science Division at the Naval Research Laboratory.

**NRL/UNLV SERDP
PROPOSAL
SOLICITAION AND
REVIEW PROCESS**



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The following sheets summarize the NSCEE systems, services, and installed software.