

**AGREEMENT
FOR
INTERNATIONAL RESEARCH COOPERATION
USING THE EARTH SIMULATOR
BETWEEN
THE EARTH SIMULATOR CENTER OF JAPAN MARINE SCIENCE &
TECHNOLOGY CENTER (ESC/JAMSTEC)
AND
NATIONAL ENERGY RESEARCH SCIENTIFIC COMPUTING (NERSC)
CENTER AT LAWRENCE BERKELEY NATIONAL LABORATORY**

WHEREAS, the Earth Simulator Center of Japan Marine Science and Technology Center (hereinafter referred to as “ESC/JAMSTEC”) and the National Energy Research Scientific Computing Center (hereinafter referred to as “NERSC”) desire to cooperate in international research activities in computational science. Cooperation under this Agreement shall be carried out only for peaceful purposes and aforementioned research activities and its results shall not be used for any military purpose.

THEREFORE, ESC/JAMSTEC and NERSC (together referred to as the “Parties”) do hereby agree as follows:

Article 1: Purpose of Research Cooperation

The Parties shall together promote research cooperation with a view to contribute to the advancement of scientific research and technological development in computational science.

Article 2: Areas of Research Cooperation

Principal areas of research cooperation to be pursued under this Agreement shall include, but not be limited to, those fields specified in the Appendix. Additional areas of research cooperation may be added by mutual agreement.

Article 3: Forms of Research Cooperation

3.1 Forms of research cooperation may include, but not be limited to:

- Exchange of personnel;
- Exchange of information;
- Implementation of cooperative research programs; and
- Joint use of facilities

3.2 Research cooperation in forms other than those mentioned in the preceding section shall be determined through mutual consultation and agreement.

Article 4: Meetings

Representatives of both Parties shall meet, as occasion demands, to review the progress of research cooperation that is currently underway.

Article 5: Procedures

5.1 Details concerning the sharing of expenses, publication of research results, ownership of research results, and other matters shall be determined through mutual consultation and agreement by the Parties. An Implementing Arrangement may be prepared for describing the details of implementation of research cooperation.

5.2 Transportation and living expenses for researchers of NERSC to use the Earth Simulator will be covered by NERSC.

5.3 The Parties shall strive to make research results publicly known to the scientific community and society at large primarily through publications, seminars, lectures, and conferences. Procedures for disclosing research results shall be determined through mutual consultation and agreement by the Parties.

5.4 This Agreement may be amended by written consent of the Parties.

5.5 Matters not provided for in this Agreement shall be determined through mutual consultation and agreement.

Article 6: General Provisions

6.1 Research cooperation will be in concert with each organization's national and local regulations, procedures and policies.

6.2 Treatment of intellectual property rights will be determined between the Parties through mutual consultation and agreement on a case-by-case basis, consistent with principles of existent laws of Japan and the United States, as well as each party's local regulations, procedures and policies. The Parties agree that this Agreement does not itself constitute any grant or license under any intellectual property rights now or in the future held by either Party, except as may be provided for in a separate written agreement.

Article 7: Period of Validity

This Agreement is intended to memorialize the understanding of the Parties to encourage and promote cooperation in international research activities in computational science. The Parties agree that this Agreement is not intended to be legally binding and that if the Parties desire to create specific, legally-binding obligations with respect to performance of activities as part of such cooperation and/or collaboration, such binding obligations shall be set forth in a separate written agreement signed by duly authorized representatives of both Parties.

This Agreement shall become effective on the date it is signed by both Parties and be valid for five (5) years. Written notice of intent to terminate shall be given by one Party to the other Party at least six (6) months prior to the date of the termination.

IN WITNESS WHEREOF, the Parties have executed this Agreement and represent that they approve, accept and agree to the terms contained herein.

**NATIONAL ENERGY RESEARCH
SCIENTIFIC COMPUTING CENTER**

**EARTH SIMULATOR CENTER OF
JAPAN MARINE SCIENCE &
TECHNOLOGY CENTER**

By:
Horst D. Simon, Director

By:
Tetsuya Sato, Director-General

Date:

Date:

Appendix : Areas of Research Cooperation

The architecture and programming of a system such as the Earth Simulator raise the important question of whether various scientific applications are scalable on this new generation of parallel vector machines. As a leading supercomputing center, ESC/JAMSTEC and NERSC would like to investigate how conventional algorithms and implementation techniques typical for the computational science community will perform on the Earth Simulator. A study of key performance metrics of parallel vector machines, in the context of competing HPC systems, is a crucial step in determining the potential scope of these architectures and effectively guiding future scientific code development. It is possible that new approaches may be required to achieve high performance, and the sooner this information is known, the more effectively computational scientists can pursue more effective schemes.

ESC/JAMSTEC and NERSC therefore want to collaborate with in the following investigations of benchmarking and performance evaluation.

a) Microbenchmarks

The goal of this effort is to capture low-level system performance such as the bandwidth and latency characteristics for different levels of memory hierarchies under various types of read and write operations.

b) Kernel Benchmarking

Kernel benchmarks consist of smaller test programs that encapsulate a single compact algorithm, or even a single loop. Kernels provide a vehicle for reducing the complexity of the analysis and modeling, relative to working directly with the full application codes. We will examine kernels that are both well suited and inherently at odds with the parallel vector architectures.

c) Application benchmarks

We will examine the performance of several full-scale applications representing key disciplines and algorithms for the high-performance computing mission. This is a critical step in evaluating the true performance and functionality of the system.

Candidate codes are as stated below. Provided, however, that in case of necessity, additional code to be added to the other Appendix by mutual agreement :

When requested, ESC/JAMSTEC reserves a rights to examine a code used for the Earth Simulator.

Paratec: A material science code that computes the electronic structure and optimal geometry of crystalline solids.

TLBE: A Thermal Lattice Boltzmann equation solver that models turbulence and collisions in a plasma.

GTC: Gyrokinetic Toroidal Code (GTC) is a fusion code used to study collisional and transport processes in magnetically confined plasmas.

NAMD: NAMD is a production molecular dynamics program for high performance simulation of large biomolecular systems.

MADCAP: The Microwave Anisotropy Dataset Computational Analysis Package (MADCAP) is an astrophysics package that analyses Cosmic Microwave Background (CMB) Radiation.

CACTUS: An astrophysics code that calculates the direct evolution of Einstein's equations by solving a coupled set of non-linear hyperbolic, elliptic equations.

CCM3: The Community Climate Model is a global climate model with coupled sea ice, land, ocean and atmospheric components communicating through a coupler.