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TYPE: INFORMATION DOCUMENT NUMBER: 9124758
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

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FROM: HECKER, S.S.: LOS ALAMOS NATIONAL LABORATORY

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 11/12/91

SUBJECT: HE IS PROVIDING DR. BROMLEY WITH A COPY OF HIS WRITTEN STATEMENT BEFORE CONGRESS REGARDING THE CRITICAL ROLE LOS ALAMOS HAS PLAYED IN HIGH PERFORMANCE COMPUTING.

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DIRECTORATE ASSIGNED: STAFF ASSIGNED:

ACTION REQUIRED: STAFF ACTION:

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COPIES TO: D. Allan Bromley
PHYSICAL SCIENCES → Please route to E Wing (re High Performance Computing)

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Los Alamos National Laboratory
of the University of California
Los Alamos, New Mexico 87545

November 12, 1991

The Honorable D. Allan Bromley
Science Advisor to the President and
Director of the Office of Science &
Technology Policy
The Old Executive Office Building
17th Street and Pennsylvania Avenue, NW
Washington, DC 20506

Dear Dr. Bromley:

I am delighted that you will be able to attend the Supercomputing '91 Conference in Albuquerque on November 19. Your presentation on the national HPCCI should be most timely. As you know Los Alamos has played a critical role in high-performance computing for almost 5 decades. We continue to have a keen interest. I am enclosing a copy of my written statement at a congressional hearing earlier this year plus a concept paper related to the Computer Systems Policy Project (CSPP). I hope you find our ideas interesting.

I look forward to having dinner with you on Monday, Nov. 18. I am also enclosing a copy of a very recent testimony on civilian research and development at Los Alamos. I hope we can discuss some of the topics raised next Monday.

Sincerely,

S. S. Hecker
Director

SSH:dl

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COMMENTS ON
THE DEPARTMENT OF ENERGY
HIGH-PERFORMANCE COMPUTING ACT OF 1991 (S. 343)

PREPARED FOR THE ENERGY RESEARCH AND DEVELOPMENT SUBCOMMITTEE
OF THE
SENATE ENERGY AND NATURAL RESOURCES COMMITTEE

SIEGFRIED S. HECKER
DIRECTOR
LOS ALAMOS NATIONAL LABORATORY

APRIL 11, 1991

Executive Summary

High-performance computing (HPC) is a critical strategic technology vital to the long-term scientific and economic leadership of the United States. The Department of Energy (DOE) and its laboratories have played an important role in developing high-performance computing because of the need to solve complex computational problems stemming from demanding DOE applications. This experience places the DOE laboratories in an excellent position to help keep the United States at the leading edge of computing.

The pervasive importance and dynamic nature of the computing field suggests that DOE's overall response should be integrated within a larger, coordinated Federal government effort. A special feature, if not the focal point of the DOE initiative, should be the establishment and support of a few centers of excellence that shape the frontiers of this strategic technology. The centers should feature extensive interactions between computing manufacturers and center researchers who define and develop the computational environment for future demanding applications. At the Los Alamos National Laboratory, we have performed this role historically. Recent experience with our Advanced Computing Laboratory demonstrates that we continue to play this role today in the application of massively parallel machines. Featuring early production high-performance computers, the centers of excellence would build the computational environment essential to the advancement of the state of the art in problem solving. Such an environment includes: massive data storage and retrieval, ultrahigh-speed graphics, advanced numerical algorithms, software, networks and interfaces, and user-friendly terminals. The latest innovations will be incorporated not only through the computer manufacturer interface, but also via close ties with academia.

A second major feature of the centers should be the dissemination of this problem-solving capability to a greater fraction of society. To compete with and complement the increasing power of stand-alone (personal) computers, the interface between the user and the high-performance environment must be made as transparent as possible; that is, it should be accessible with the touch of a mouse. The most important element of the expanded user community has to be U.S. industry, but it should be followed by businesses, schools, local communities, and eventually households.

The centers of excellence should be collaborative (with universities and industry as noted) and they should be distributed, comprised of a lead institution, several principal participants, and a number of affiliated organizations. Finally, because of the rapidly changing environment, the DOE should have maximum flexibility in establishing and adapting the centers to changing times and requirements.

I will discuss three matters in my remarks today. First, I will review some of the reasons why I support the concept of a coordinated national effort in high-performance computing (HPC). Second, as an example of the important role that the Department of Energy (DOE) and its national laboratories are already playing in HPC, I will review the HPC efforts at Los Alamos National Laboratory. Finally, I will suggest how the DOE role in a coordinated national effort can be enhanced.

The Need for a National High-Performance Computing Initiative

I believe that there is no end in sight to the revolution we call the computer age. Better performance will enable scientists and engineers to solve increasingly complex problems. High-performance computing has yet to make its greatest impact on business, industry, and on our everyday lives.

The technology supporting high-performance computing has grown rapidly. Over the past forty years, some applications have enjoyed an increase in computing speed of ten billion, or ten orders of magnitude. This increase has come in almost equal parts from advances in computer hardware and from more sophisticated software and numerical algorithms. In the past few years, it has become increasingly apparent that new algorithms and massively parallel computer architectures offer the greatest potential for dramatic performance improvements. With increased speed has come the recognition of other significant requirements for large-scale computing:

- Real-time visualization,
- High-speed networking to provide convenient and powerful computing capability at your desk,
- Software tools to facilitate writing sophisticated scientific computer programs,
- High-performance data storage, retrieval, and analysis.

In testimony before this Committee last year and in response to follow-up questions for the record, I argued that high-performance computing is a critical strategic technology that contributes to U.S. military and economic strength and benefits the quality of life, and, therefore, is of such pervasive importance to the United States as to demand continued strong leadership. Such leadership, I stressed, could only be maintained with enhanced funding levels and greater interagency coordination. I emphasized the critical need to establish a few centers of excellence (which I called Collaborative R&D Centers) in HPC that keep the United States at the leading edge of high performance computing. Such centers would meld the experience and expertise resident at DOE laboratories with that at universities and U.S. industry. The centers would be an excellent vehicle to help provide more useful supercomputing capability to a greater fraction of our society. This approach is in general agreement with the Federal High-Performance Computing and Communications (HPCC) Program and S. 343.

As pointed out in S. 343, the DOE is an agency with great depth of knowledge in and dependence upon all aspects of high-performance computing and communications. HPC is, however, such a fast moving, technically demanding, and broad field that no single agency should be expected to play <u>the</u> lead role. Indeed, substantial progress in this field requires the coordinated efforts of several government agencies, agencies that have both extensive HPC experience as well as mission-specific computing requirements.

It is most important that high-performance computing requirements be driven by applications. Such applications include the demanding requirements of U.S. industry and the mission requirements of Federal agencies. (For example, the challenging problem of nuclear weapons design has driven and defined HPC requirements for decades.)

Among the most demanding applications today are the "Grand Challenge" problems. These consist of fundamental problems whose solution is critical to national needs and include: modeling of global climate-change; understanding turbulence, pollution dispersal and combustion; designing new molecules, pharmaceuticals, and materials; determining molecular, atomic and nuclear structure; mapping the human genome and understanding biological structure; etc. Tackling these applications requires the most advanced computational and communications resources - a high-performance computational environment that must be continually updated to include a combination of the most powerful number-crunching capabilities, rapid and efficient data storage and retrieval, visualization and analysis techniques, and high-speed networks.

An interagency format is appropriate for this program because each agency has its own particular areas of focus, interest, and strength. For example, the National Science Foundation continues to support very innovative basic research in computational science and computing concepts. The Defense Advanced Research Projects Agency (DARPA) has helped to pioneer new hardware and software for massively parallel processing. The Department of Energy and NASA have been instrumental in using the latest generation high-performance computers to solve demanding mission-oriented problems. The DOE, through several of its laboratories, has been instrumental in developing a high-performance computing environment that makes this possible. An important part of that environment is a high-speed network - DOE's Energy Sciences Network (ESNET), which connects its laboratories with universities across the nation.

The DOE has mission-oriented needs which will require multigigabit per second single-application access to a national network. In contrast, the National Science Foundation is interested in supporting a broader user community but at much lower individual rates. Consequently, a national network will have to address a variety of requirements and users. Therefore, this capability must be planned, implemented, and managed in the national interest as a cooperative venture, rather than by any one particular agency.

Increased U.S. industrial competitiveness must be a fundamental goal of any national-level effort in HPC. This is an explicitly stated goal of the Federal HPCC program and, in my opinion, should also be specifically mentioned in S. 343. The current business climate does not encourage corporate America to invest sufficiently in enabling technologies for which the payoff is long term and less immediately oriented toward marketable products. For the United States to continue to hold a primary position in the international economic community, it will be important to develop a forward-looking strategy with respect to the use of computers for research, for advanced simulations, and for engineering design. We believe that the S. 343 concept of national centers of excellence will provide an excellent vehicle for working with industry in demonstrating the value of modern computational resources, developing desired industrial expertise, and providing appropriate technology for solving industrial applied problems.

Los Alamos Role in HPC

Supercomputing originated with the "Los Alamos problem," as predicting the performance of the first atomic bomb was called during the Manhattan Project. We actually designed and built one of the world's first large-scale electronic computers, the MANIAC. Over the past 40 years, we have worked with leading supercomputer manufacturers - including IBM, Control Data Corporation, Cray Research, Inc. (CRI), and most recently Thinking Machines Corporation (TMC).

Our role has been that of a sophisticated user with the goal of maximizing the productivity of the individual. In that capacity, we often develop new software and algorithms to solve

complex problems. And occasionally we even develop new hardware.

In 1976 Seymour Cray brought his first Cray-1 to Los Alamos without software and with no operating system. We helped him bring it on line for large-scale problems. At last year's hearing, John Rollwagen, Chairman and CEO of Cray Research Inc., put the role of DOE and Los Alamos in perspective with his comment, "Cray would not exist if it were not for DOE and Los Alamos."

Today, Los Alamos is the most powerful scientific computing center in the world with the equivalent Cray power of about 50 of the original Cray-1 computers plus the two largest Connection Machines ever produced, serving more than 8,000 users throughout the nation via a national computing network. But it is our own computationally intensive applications, starting with the complexity of designing nuclear weapons and now including a wide range of programs critical to emerging national and global challenges such as energy, environmental, and economic concerns, that require us to remain at the leading edge of computing technology.

Recent Progress at Los Alamos - The Advanced Computing Laboratory

In 1988, Los Alamos established the Advanced Computing Laboratory (ACL). It has been a catalyst for leading-edge research in the technologies that comprise an HPC environment. The current focus is on demanding applications using the second-generation Thinking Machine Corporation's (TMC) Connection Machine which has 65,536 processors, 8 gigabytes of memory, 4 frame buffers and monitors, a high-performance parallel interface (HIPPI), and a 20-gigabyte data storage system.

Over the past two years Los Alamos and TMC have demonstrated that many of today's greatest computational challenges can be met with the massively parallel processing approach afforded by the Connection Machine. Los Alamos researchers are now routinely solving scientific and technological problems beyond our reach just a year or two ago. A few examples follow.

Novel numerical algorithms have been developed at Los Alamos which are almost perfectly suited for the massively parallel architecture of the CM-2. For the first time anywhere, using the synergism of computing resources and the resident expertise at Los Alamos in computer science and mathematics, we have been able to successfully simulate very complex, small-scale fluid flow through porous media such as sandstone and other oil-bearing rock.

Today, Mobil, Chevron, and Amoco are working with us in research collaborations using this computational technology to interpret experimental data gathered to enhance oil recovery. In a recent letter, E.W. Jones, President of Chevron Oil Field Research Company, complemented the effort by stating:

> "Through our interaction with LANL's researchers, the Advanced Computing Laboratory, and the Numerical Computing Laboratory, we were able to successfully test run a reservoir simulation model with over two million grid points using LANL's Connection Machine recently. This size of reservoir model is about two orders of magnitude larger than those typically used in the oil industry. With this new capability, we will greatly improve the geologic definition of the reservoir models, which recent research has shown to be vital in predicting reservoir performance."

In the area of global climate change and in collaboration with the National Center for Atmospheric Research and the Naval Postgraduate School, Los Alamos has developed a global ocean model significantly more accurate than previous models. The significance is that

scientists are now realizing the greater importance of ocean flows and ocean eddy currents to the overall global climate system. Again, this model was an outgrowth of the combination of theoretical expertise in oceanography and expertise in using the attributes of the massively parallel Connection Machine; this effort resulted in the first implementation of a global ocean circulation model on a massively parallel computer. It is only with the parallel architecture of the Connection Machine and its large memory that this more accurate model was possible.

Los Alamos is also actively involved in global change studies with other University of California institutions. The main thrust of this project is to perform research contributing to the development of an advanced, coupled atmosphere-ocean climate model that takes advantage of high-performance computing. To date, this work has been done principally on our top-of-the-line Cray Y/MPs. The project is a three-way collaboration with Los Alamos, the Scripps Institution of Oceanography, and the Lawrence Livermore National Laboratory; the project has been expanded to include all nine of the University of California campuses - a fact which reflects both the success of the project and the increasing interest in global climate change. Graduate and postdoctoral students play a significant role in this research.

Assuring the safety of the nation's nuclear stockpile is one of the key responsibilities of the DOE nuclear weapons program. Fulfilling this responsibility requires the extensive use of computer modeling to simulate the behavior of nuclear weapons components in possible accident environments. The complexity of such scenarios, involving difficult three-dimensional geometries, complicated physical phenomena, and great sensitivity to small changes, has always placed extreme demands on available simulation capability. Recent advances in parallel computer architectures and the development of innovative numerical techniques have now provided a new level of capability for three-dimensional simulations of nuclear weapons safety issues. A most important component to this capability has been the expertise of Los Alamos scientists in the development of the free-Lagrange hydrodynamics method and its implementation on the Connection Machine.

These examples demonstrate our continuing role in shaping the leading edge in high-performance computing applications. Adding his support is Danny Hillis, Founding Scientist of TMC, who in recognizing the continuing critical role played by Los Alamos asserts: "Los Alamos has, by taking a leadership role in the application of parallel supercomputers, proved to the scientific community that the Thinking Machines approach to high performance computing is applicable to a wide variety of real world applications."

But supercomputers themselves do not represent the only area in which Los Alamos has close ties to the computing industry. The High-Performance Parallel Interface (HIPPI) was conceived and designed at Los Alamos to satisfy our requirements for very high-speed networking, including communications between supercomputers and real-time visualization of scientific computations. This innovation is becoming an industry standard, with more than sixty computing vendors showing interest; almost two dozen different manufacturers are already building HIPPI-based equipment. These include CRI, IBM, TMC, Ultra Network Technologies, Network Systems Corporation, IPITEK, and Broadband Communications Products.

The recent developments discussed above allow large amounts of data (for example, the results of a computer simulation) to be transferred through a network in a reasonable time. However, an obstacle that still remains in supporting grand-challenge applications is to provide data storage capabilities that allow the massive amount of data generated to be stored in a timely and reliable manner, and that allow the data to be easily retrieved for analysis and display. Such a high-performance data system will be the successor to the Common File System, a Los Alamos designed and implemented system now marketed by General Atomic. Even as efficient, fast, and successful as the Common File System is, some current applications generate so much data that it can take several hours just to store the data plus several more hours to retrieve it

for use in another calculation. IBM will be a major industrial collaborator in this new project.

Progress was also made in several of the other objectives for centers of excellence. Los Alamos continues to work closely with universities to bring the latest innovations to bear on solving demanding computational problems. We are proud to be a part of the NSF Science and Technology Center for Research on Parallel Computation. Charter members are Rice University (lead), Caltech, Los Alamos, and Argonne. The Center's goal, to make parallel computation truly usable, and the Los Alamos goals for HPC are truly synergistic. Our participation in this collaboration provides the Laboratory with access to innovative software to incorporate in our high-performance computing environment and provides the Center with a unique, full-scale testbed for the tools developed as part of that research effort.

Last year I proposed that centers of excellence sponsor graduate research assistantships in computational science to increase support for students in this important field. The Scientific Computing Staff at DOE has just established such a Computational Science Graduate Fellowship Program through Oak Ridge Associated Universities. The response has been overwhelming with 400 applicants for the 22 positions created in FY91.

Last year's hearing highlighted the need for greater utilization of HPC by U.S. industry. This theme was echoed in the Frontiers in Supercomputing II Conference (held in Los Alamos in August 1990 and cosponsored by Los Alamos, the National Security Agency, DOE, NASA, NSF, and DARPA).

We at Los Alamos have launched several initiatives to enhance industrial participation. In November 1990, Los Alamos and Cray Research Incorporated jointly sponsored a two-day applications symposium. The main purpose of this workshop was to develop a broad-spectrum collaboration between the two organizations. Five initial collaborative projects of interest to both parties have resulted to date:

- Automotive engine combustion code development
- Integrated simulation tool
- High-resolution global climate modeling
- Computational chemistry
- Computational electromagnetics in ultra high-speed electronics design

Nine additional areas of potential collaboration have been identified. In addition, cooperative projects have been initiated with CRI in advanced networking, massively parallel processors, and supercomputing education.

We propose to use this basic approach, suitably modified for each interaction, to generate broad collaborations between Los Alamos and industry. For example, together with a researcher from DuPont who is working in our Advanced Computing Laboratory for two years, we have been actively pursuing a DuPont/Los Alamos symposium. A host of other industrial collaborations is also being pursued.

Educational outreach is a most important aspect of bringing useful high-performance computing to a greater fraction of society. Last year Los Alamos, Sandia, New Mexico Technet and several private sector companies initiated a special experiment we call the New Mexico Supercomputing Challenge. This is an academic-year long competition that provides teams of high school students throughout New Mexico with the opportunity to become involved in computational science projects using high-performance computers. The purpose of this Challenge is to expose students and teachers to the tools and mechanisms to solve difficult problems typically not possible in high school classes. The enthusiastic response from New Mexico schools – 235 students and 55 teachers in 65 teams from 40 schools in the first

Challenge alone – demonstrates significant interest, motivation, and untapped potential for science education at the high school level. We would like to expand this program under the aegis of the Federal HPCC program to other states next year.

Potential for an Enhanced DOE Role

The future computing environment will continue to evolve in unforeseen ways in response to new requirements and opportunities. The Federal HPCC initiative correctly points out that many Federal agencies must contribute and that their efforts must be coordinated with U.S. industry, universities, and national laboratories. I will concentrate only on a potential DOE role since that is the focus of S. 343.

The DOE continues to require the application of leading-edge high-performance computing for its mission requirements in defense, energy, environment, and basic research along with grand-challenge scientific problems. Consequently, I believe that the DOE's principal focus should be to help *shape the leading edge of high-performance computing.* As already pointed out, Los Alamos has always played a strong role in this area. We have accomplished this in the past almost entirely with the financial support of the nuclear weapons program. That is no longer appropriate, nor possible today, since our contributions now cover a much broader spectrum, ranging from the human genome project to enhanced oil recovery.

In addition, the DOE can contribute significantly to putting a more useful computing capability into the hands of U.S. business, industry, and a broader segment of society. A computing environment that is friendly and available to large segments of our population would likely change the entire fabric of American life. Business decisions and operations already depend largely on computing, but complete connectivity and access to national data bases with powerful computers and high-speed networks would increase their productivity and hence the nation's international competitiveness. Access to data bases could influence daily decisions that vary from health care and diagnosis to automobile repair. The DOE laboratories have developed an extremely productive collaborative relationship with U.S. computing manufacturers that would serve as a starting point. In addition, they have also established a groundwork of educational initiatives that reach out to students early in their careers.

Recommendation

Both of these objectives are incorporated into the concept that I presented to this committee last year, the Collaborative Research and Development Centers for HPC. Similar "centers of excellence" are featured in the Federal HPCC program and referred to as High-Performance Computing Research Centers. I remain convinced that "centers of excellence" for HPC should be the cornerstone of the DOE's response to the Federal initiative. The Department should also support the science associated with grand-challenge problems and bring greater computing capabilities to all of its researchers through advances in hardware, software, and networks.

The Centers Concept

Centers of excellence at DOE laboratories would continue to shape the leading edge of computing and promote greater access to useful HPC capabilities. The objectives of the centers should be to:

1. Collaborate with computing manufacturers to develop the high-performance computing environment of the future (including high-speed communications and protocols) by solving demanding grand-challenge problems;

2. Collaborate with academia to continue to bring the latest innovations into this environment and to offer a training ground for students;

3. Develop an industrial user program to encourage greater use of HPC capabilities for industrial design, manufacturing, process enhancement, and business applications;

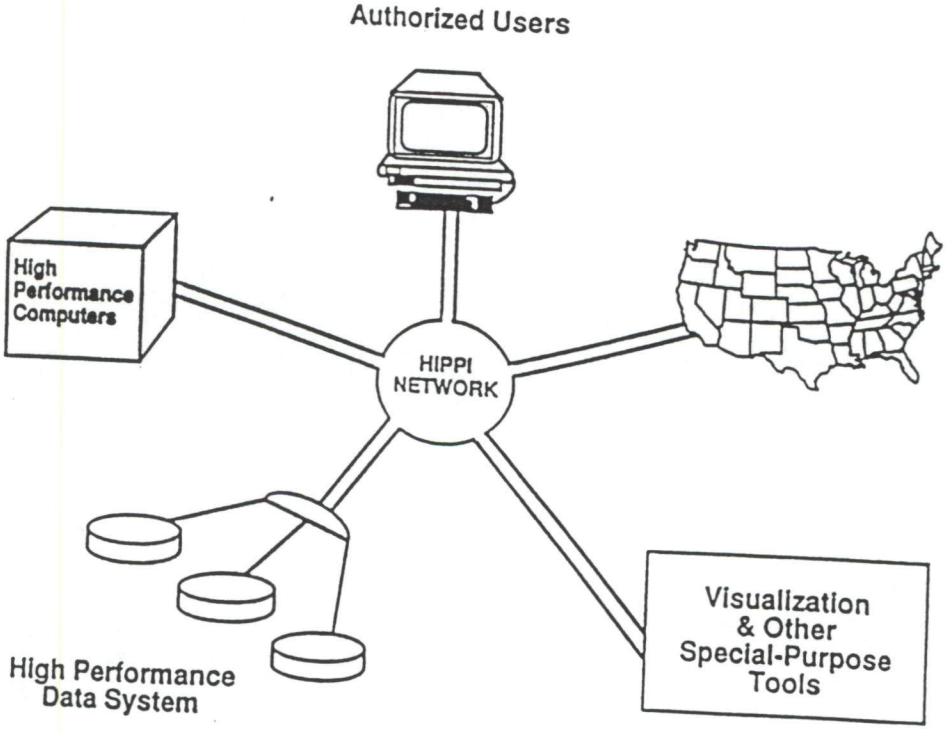
4. Develop a general user program designed to provide user-friendly computing through networks to local communities for business, secondary schools, and universities; and

5. Develop enabling technologies for high-performance computing in conjunction with U.S. industry and with other Federal agencies such as DARPA.

DOE Centers of Excellence for HPC

The accomplishments at Los Alamos this past year demonstrate that the Advanced Computing Laboratory can serve as a model for DOE centers of excellence. The principal focus of the centers of excellence should be to keep the United States at the leading edge to solve increasingly demanding problems of science and technology. This can be best accomplished through extensive interactions with computing manufacturers and by solving grand-challenge and other demanding mission-oriented problems. Solutions to these problems continue to demand a computational environment considerably beyond the capabilities that exist today.

In the future, we envision a high-performance computing environment that distributes the individual components, including massive computing capabilities; systems and applications software developed for specific architectures; data systems that enable the storage, retrieval and analysis of staggering amounts of data, all tied together with a high-speed network. These pieces will be integrated into a single, logical environment that permits the researcher to easily manage the problem across the disparate elements. The basic components of this environment are shown in the figure below.



The high cost of the next-generation hardware and the extensive people resources required will dictate that only a few such centers of excellence continue to define the leading edge. The centers would not only continue to push the frontiers of this computational environment by incorporating the latest hardware or advances in software, but also make the interface between the user and this environment as seamless or transparent as possible. A goal should be to make the power of a supercomputer accessible through the touch of a mouse on a desktop. This way, high-performance systems will continue to provide a high-end alternative to increasingly powerful stand-alone (personal) computers.

Developing the computation environment of the future will require effort on all five objectives listed above for centers of excellence. However, effort should be focused immediately on the first objective: collaborating with computer manufacturers to develop the HPC environment of the future by solving demanding grand-challenge and mission-oriented problems. As we pointed out last year, this will require:

- Challenging computer performance and computing tools with demanding applications.
- Identifying requirements for suppliers and inventors.
- Testing this new computational environment, integrating new architectures, software, and visualization.
- Developing software, hardware, algorithms, etc., in collaboration with high-performance computing manufacturers.
- Helping develop and test new distributed networking systems.
- Disseminating knowledge and experience gained to others.

I believe that the centers of excellence will be most effective as collaborative and distributed centers comprised of a lead institution, several principal participants, and a number of affiliated organizations; a center of excellence is in effect a team of several organizations. While individual sites will make important contributions, the geographically distributed nature of the national computing resource must be key in the organization of the center itself. Thus, high-end use of networking and other technologies by a center of excellence to effect distributed computing will play an important role in the broader goal of developing efficient and distributed massively-parallel computing over a large geographical area.

Centers should be established at a few leading institutions, those that currently have outstanding computing facilities, significant grand-challenge and mission-oriented problem-solving programs, and track-records of working successfully with computing manufacturers as well as U.S. industry, in general. Since computational science is such a rapidly moving field it would be wise to provide the DOE with the maximum flexibility in establishing and operating its centers.

Thank you for the opportunity to share my views on the future of high-performance computing and the role that DOE and its laboratories can play.

COMPUTER SYSTEMS INDUSTRY INITIATIVE (CSII)
A CONCEPT PAPER

Los Alamos National Laboratory
August 23, 1991

The Initiative:

A major collaboration between the DOE laboratories and the computer systems industry to develop new hardware, software, and networking capabilities for U.S. industry.

Background:

The Computer Systems Policy Project (a group of CEOs from 11 computer systems companies) identified the federal laboratories as an underutilized resource for collaboration in computer systems R&D. Through interactions with OMB (Richard Darman), the CSPP targeted the DOE laboratories to explore collaboration. Following a six-month study, the CSPP decided on June 7, 1991, to pursue formal collaboration with the DOE and its laboratories.

The DOE has developed an action plan for its part of the Federal High-Performance Computing and Communications Initiative (HPCCI) in conjunction with the FCCSET interagency process. The DOE plan is aimed principally at its laboratories and universities, although it encourages interaction with industry.

Industry Collaboration:

Technical Aspects

The range of potential scientific and technical collaborations is very broad – it encompasses hardware, software, and networking. The following provide a few examples of important potential laboratory/industry collaboration (some of which are already under way):

- High-performance network communications
- Data storage and retrieval technology
- Computer security
- Software and applications technology
- Microelectronics and ultrashort wavelength photolithography
- Advanced materials and manufacturing processes
- Human interfaces and visualization

Business Arrangements

Design the business interface to be a CRADA mechanism patterned after the 1989 NCTTA. Establish a DOE/Laboratories working group to develop with CSPP model CRADAs and model Joint Work Statements that respond to the needs of the industry. The objective should be to cut the red tape and time required for one or more companies to complete CRADAs with one or more

laboratories. Intellectual property rights issues and information protection should be handled similarly.

Funding

The computer systems industry initiative CRADAs must be funded. The DOE should seek major increments to its HPCCI program or a complementary program to fund the DOE laboratories to participate with computer systems industry partners (and not limited to just CSPP members).

Right now, there is considerable confusion and uncertainty about CRADA funding. Many in OMB and DOE expect funding to occur as spin-offs from existing programs. However, to make a significant impact in computing systems R&D, CRADAs will need significant funding support.

The CSPP effort will have a very high visibility. It has strong backing at the highest levels of government and industry. Furthermore, some of the DOE laboratories have a lot to offer since high-performance computing, modeling, electronics, and materials are among their core competencies. Hence, we propose that DOE launch a large – say $30 million – effort in this area for FY1993. It could be an initiative of the Secretary of Energy, OMB, and the CSPP.

This initiative would supplement the currently planned DOE effort in the HPCCI planned for FY1993 which is aimed more in the direction of computing applications to grand challenge problems as well as developing the computational environment of the future.

Management:

The DOE would manage the federal portion of the initiative. We believe that it would be managed best by an aggressive program management office that has a strong technology transfer charter – either in the Office of Energy Research or Defense Programs.

This initiative should augment and not be in place of the current plans that DOE has as its part of the national HPCCI.

DOE Headquarters must play a strong role in helping to clear the hurdles for the computer systems industry to develop a clean business interface with the laboratories. This includes helping to develop the "model" joint work statements and "model" CRADAs. The actual implementation of CRADAs with the laboratories should be accomplished at the DOE field offices to provide the most expeditious process possible.

CRADAs should be developed on a "free market basis." Industry should be encouraged to work with whatever DOE

laboratories have the necessary expertise and attitude. An industrial advisory committee should help DOE to set up proper selection criteria and processes. Such an advisory committee should also periodically assess the quality and direction of the program.

The bottom line should be – no industrial partner, no funding. We would advise allowing for a sliding scale of industry cost sharing. Overall, the goal should be 50 percent. However, some of the higher-risk research, especially with small companies, may require greater government support at the outset. As the ideas move closer to market realization, the industry share should increase.

Pre-CRADA funding would also be desirable in some cases to develop Laboratory ideas sufficiently to determine if there is industrial interest. This could be accomplished through a competitive program run by the DOE program manager (the funds would be taken from the overall CSII). Or laboratories with operational CRADAs could be allowed to use a small fraction of their CRADA funds for this type of pre-CRADA technology maturation effort.

Benefits:

The CSII proposed here would provide significant incentive to encourage the computer systems industry to leverage their research expenditures with the large investment the federal government is making in computation research at the DOE laboratories.

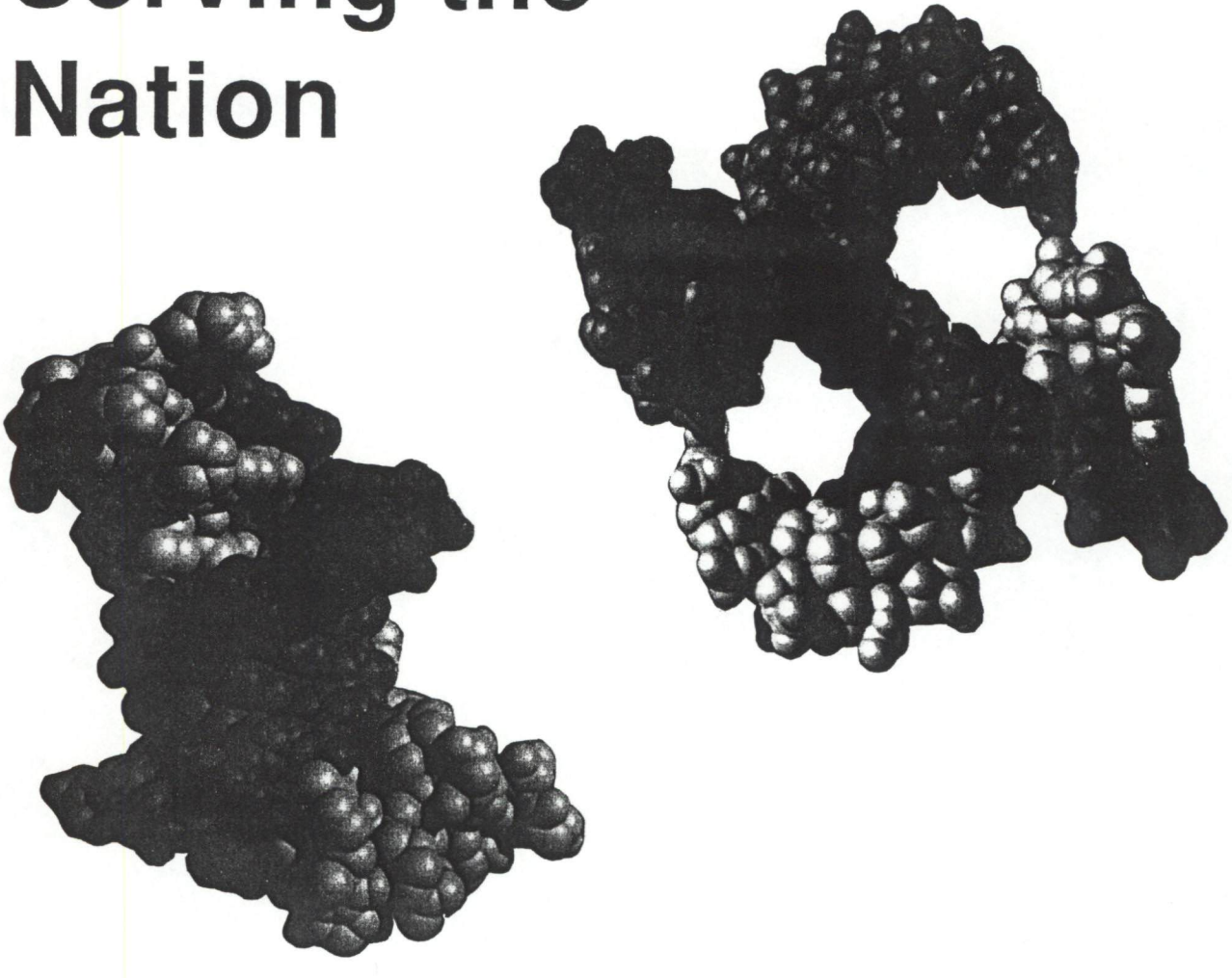
Such collaborations could help make the U.S. computer systems industry more competitive in the international marketplace. This initiative should also accomplish a stated CSPP goal: to increase the federal investment in computer systems R&D.

The initiative would help some of the DOE laboratories retain one of their most critical core technologies – high-performance computing and modeling, which, in turn, would have great benefits for their federal missions in defense, energy, and basic research.

LA-UR-91-3350
October 1991

Los Alamos:

Science Serving the Nation



October 1991

"Document Control"

TYPE: INFORMATION
DOCUMENT NUMBER: 9124613
ORIGINATOR: 02 STATUS C DIRECTORATE STATUS

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FROM: RODGER, Alan S.: GEOSPACE COUPLING GROUP, BRITISH ANTARCTIC SURVEY

TO: DR. D.A. BROMLEY

DATE OF CORRESPONDENCE: 10/25/91

NOV 4 1991

SUBJECT: RE: HIS VIEWS REGARDING THE PROPOSED MOVE OF THE GEOPHYSICS LABORATORY.

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PHYSICAL SCIENCES

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REMARKS: Doug Brown to see
PHONE: EXT:

Jim Ling to see. JDS

Priscilla - Will Dr Bromley reply? or should we? Please check with Damon

OSTP RECEIVED: 10/31/91 DEPT RECEIVED:

We can answer, 11/5 pg per Damon.

FILE: P-PHYSICAL SCIENCES-GEOPHYSICS

CENTRAL FILES:

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Dr D Allan Bromley
Assistant to the President for Science and Technology
Office of Science Technology Policy
Old Executive Building
17th Street and Pennsylvania Avenue NW
Washington
DC 20506
USA

25 October 1991

Dear Sir

I believe that the US Air Force is considering refocussing and relocating the division involved in basic and applied geophysics research to New Mexico. I thought that you might like a few personal observations made by an independent and unbiased observer.

1. The Requirement for Solar Terrestrial Physics (STP) Research

   I believe that STP research still has a crucial role to play in many areas critical to military work such as in communications (ground to ground and ground to satellite), global positioning and the lifetime and general well-being of satellites. We are still quite a long way from being able to predict the detailed geospace environment in a particular place at a specific time after a given disturbance upon the sun. However, the STP community has made enormous strides in recent years, and I believe there is a 'new era' of understanding just around the corner. It would be very sad if one of the main players, namely the Air Force, in these studies withdrew support at such a crucial time.

2. The Quality of Research

   I have worked in solar terrestrial physics for nearly 20 years. I have been very impressed with the quantity and quality of this work coming into the open literature from the Phillips Laboratory and its previous incarnations. This factor was exemplified to me in the last month as I acted as guest editor a special issue of an international journal. I selected the best people in the various topics to act as referees and find that many of them came from the Phillips Laboratory, and the Laboratory supplied more than any other research organisation.

3. The Effects of the Move

   In the UK a decade ago, there was a move to rationalise research establishments with the usual arguments concerning the greater cost-effectiveness provided by the economy of scale. These did not materialise and many of the high quality staff left the organisation rather than move leaving the less able staff still on complement. Even after all this time, I do not believe that the calibre of staff has recovered totally.

I trust that these points will be taken into account when coming to your final decision.

Yours faithfully,

Alan Rodger

Alan S Rodger
Head, Geospace Coupling Group
Upper Atmospheric Sciences Division
British Antarctic Survey

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

November 6, 1991

Dear Mr. Rodger:

I am writing in response to your recent letter to Dr. Bromley, in which you express concern about the potential relocation of the Air Force Geophysics Laboratory from Massachusetts to New Mexico. It is my understanding that the final decision on this matter has not yet been made. However, in making that decision the Air Force must necessarily take into account a variety of factors including the ones you mentioned in your letter. The final outcome will certainly be influenced by the need to retain scientific excellence at the Laboratory.

Your interest in the Air Force's geophysics program is greatly appreciated.

Sincerely,

Karl A. Erb
Acting Associate Director
for Physical Sciences and Engineering

Alan S. Rodger
Head, Geospace Coupling Group
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