August 21, 2001

Professor Robert J. Goldston, Director
Princeton Plasma Physics Laboratory
Post Office Box 451
Princeton, New Jersey 08543

Dear Professor Goldston,

The Program Advisory Committee (PAC) for the Plasma Science Advanced Computing Institute (PSACI) met at the Princeton Plasma Physics Laboratory on August 3 and 4, 2001. The purpose of the meeting was for the members of the PAC both to become familiar with the Fusion Energy Science projects within the Scientific Discovery through Advanced Computing (SciDAC) portfolio and to provide feedback to the projects funded by the 2001 SciDAC competition. The portfolio includes five plasma science projects and the Fusion Energy Science Collaboratory. In addition to the previously funded projects on Microturbulence and Macrostability, there are new projects on Wave-Plasma Interactions, Magnetic Reconnection, and Atomic Physics for Edge Plasmas. The expanded portfolio has brought in talented new players as well as valuable new connections. For example, the Magnetic Reconnection project includes a collaboration with a program at the University of Chicago which is funded by the Accelerated Scientific Computing Initiative (ASCI). There is also an expanded outreach to other areas of physics, including atomic physics, space plasmas, and astrophysics. The Collaboratory represents a partnership between the three major MFE experimental facilities and key members of the Computer Science and Enabling Technology (CSET) community. This is a very positive development which will strongly improve beneficial coupling between fusion science and the CSET community. We applaud the successful efforts of PSACI management (William Tang and Vincent Chan) and the Department of Energy in securing funding for this enhanced program.

To maintain the momentum and demonstrate the value of advanced computing for plasma science, it is vital that timely and impressive technical progress be achieved. The goal is to demonstrate with substantive scientific results this year that the field is ready for terascale computing. It is important that PSACI management play a strong and proactive role in the oversight of these projects, helping them to focus on deliverables and on mutually-beneficial interactions. It is also important that DOE make clear to all the stakeholders the oversight responsibilities of PSACI. As a corollary of these responsibilities, the PSACI and its PAC, in consultation with DOE, should develop a well-defined procedure to provide concrete input to the future proposal review process.

Presentations on each science project and on the Collaboratory enabled detailed discussions of the technical plans and goals. Areas of synergy were identified, and mutually beneficial interactions were strongly encouraged. Interactions are especially recommended between the Macrostability and Magnetic Reconnection projects. The principal investigator of the Magnetic Reconnection project re-arranged his deliverables

to enable this interaction to take place more quickly. The PI of the Macrostability project is also strongly encouraged to enable such collaborative interactions to happen as soon as possible.

The importance of articulating CSET needs was strongly underscored. The principal investigator for the Collaboratory volunteered to survey and document computational practices such as languages, approaches to software modularity and encapsulation of legacy code, numerical methods, parallel algorithms, and visualization tools presently used in the PSACI projects, as well as the CSET requirements of each science project. The fusion SciDAC program has a great opportunity for access to advanced computing resources through the National Energy Research Scientific Computing Center (NERSC). It is important that the super-computing time made available by NERSC be visibly and productively used by the projects. The principal investigators also need to clearly identify other possible CSET support needs beyond computing time that NERSC could address.

Finally, each project was asked to articulate its one most important deliverable both in science and in the development of computational capabilities for each year. This exercise provoked very valuable discussions and helped more strongly focus the efforts. Ongoing work in identifying and refining these deliverables and in highlighting the exciting plasma science enabled by advanced computing is needed, especially for the upcoming SciDAC project leaders meeting in September.

The projects on Macrostability and Microturbulence have a special challenge, since their funding is significantly less than had been proposed and also because these areas are widely recognized as being major components of the base fusion theory program. These community-wide projects are focussed on key basic issues for fusion, as the PAC has previously emphasized. Their success is very important to make the case for increased funding of advanced computing in fusion science, which will benefit the entire plasma community. Support of these projects is also important to enable their increased interaction with the CSET community. The PAC recommends that PSACI management pay special attention to these vital areas of fusion physics when providing guidance to DOE on future program expansions. It is very important that extremely compelling proposals in these core areas are then put forward for the peer review and that the fusion SciDAC program does not become fragmented into subcritical efforts. The PAC urges that synergies with other projects in the portfolio be exploited to the extent possible to maximize progress in a constrained funding environment. In turn, these projects which are highly leveraged with the base program need to continually and clearly articulate what enhanced scientific achievements and modern computational advances are specifically enabled by the SciDAC funding.

Other PAC recommendations include

- Timely dissemination of physics and computational results to the broader physics community via presentations at the appropriate meetings,
- Timely publication of results and codes on websites and in relevant journals, including those not normally used by fusion scientists,
- Establishment of a PSACI Fellow or a Young Investigator award,

- Sensitivity to software cost issues for university programs using shared collaboratory software tools.

In summary, the Fusion Energy Science projects within the SciDAC portfolio represent a diverse set of very high quality and promising projects with important connections to other areas of physics. The fusion community has consistently been at the forefront of scientific computing. Our challenge is to now deliver timely and exciting results. PSACI will play a key role in providing technical oversight and coordination to help the projects meet the challenges.

Respectfully for the PSACI-PAC,

William L. Kruer
Chair, PSACI-PAC