Under Secretary for Science
Washington, DC 20585

February 20, 2008

Professor Stewart C. Prager
Chair, Fusion Energy Sciences Advisory Committee
Department of Physics
University of Wisconsin
1150 University Avenue
Madison, Wisconsin 53706

Dear Professor Prager:

The October 2007 FESAC report, entitled "Priorities, Gaps, and Opportunities: Towards a Long-Range Strategic Plan for Magnetic Fusion Energy," identified the scientific gaps and opportunities that lie ahead in fusion science research for developing the knowledge base for fusion energy after success on ITER. While many of the issues raised are generic in nature, that report focused on issues arising from development of scientific understanding concentrating mainly on the tokamak confinement concept. In addition to the tokamak, alternate magnetic confinement concepts are being studied, at varying levels of effort, in the Fusion Energy Sciences program.

The last detailed discussion of alternate concepts is contained in the Alternative Concepts Sub-panel Report in the July 1996 FESAC Report. It was noted that there are two reasons for research in alternate confinement configurations. First, such investigations can advance fusion energy science to produce knowledge and discoveries not possible through the study of one configuration only. Second, an alternate concept might itself evolve into a fusion energy system.

To continue the planning process for a robust, integrated fusion science program in the ITER era, it is important to critically evaluate the status of, and scientific opportunities for, major alternate magnetic confinement configurations. The concepts that have attracted the most attention, and are the focus of this charge, are the stellarator, spherical torus, reversed field pinch, and compact tori (spheromak and field-reversed configuration). This charge is a follow-on to the 2007 FESAC report mentioned above, and is expected to follow a similar methodology where appropriate. However, the scope of this charge covers both reasons for alternate concept research.

For those concepts that are seen to have promise for fusion energy, please identify and justify a long-term objective for each concept as a goal for the ITER era. Each goal should, at a minimum, be eventual demonstration of a burning plasma, or a rationale for gaining relevant burning plasma information from ITER experiments, so that the concept could credibly contribute to fusion development beyond ITER. With that in mind, I ask

that FESAC: 1) critically evaluate the goal chosen for each concept, and its merits for fusion development; 2) identify and prioritize scientific and technical questions that need to be answered to achieve the specified goal; 3) assess available means to address these questions; and 4) identify research gaps and how they may be addressed through existing or new facilities, theory and modeling/computation.

It is also important to elucidate the merit of an alternate configuration even if it does not extrapolate to a fusion energy concept itself. I thus ask that FESAC identify and prioritize the unique toroidal fusion science and technology issues that an alternate concept can address, independent of its potential as a fusion energy concept. These specific issues should improve our basic understanding of toroidal confinement and/or synergistically improve potential fusion energy confinement systems through integrated program-wide science campaigns.

In my earlier charge to FESAC, dated February 7, 2007, I noted that a second charge would likely be sent to FESAC to help in developing a long-term strategic plan. I now anticipate a series of charges to FESAC to better address each major component of the program. The emphasis here should be on scientific issues and opportunities, while reserving more detailed considerations of specific activities and initiatives to the later discussions. Your reports from these charges will be integrated with additional studies within the fusion research community to build a resource-loaded long-term plan for the Office's programs.

Please respond to this charge by October 1, 2008.

Sincerely,

Raymond L. Orbach