October 19, 2004

Professor Richard D. Hazeltine, Chair
Fusion Energy Sciences Advisory Committee
Institute for Fusion Studies, RLM 11.218
University of Texas at Austin
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Austin, TX 78712-0262

Dear Professor Hazeltine:

I would like to express my appreciation to the Fusion Energy Sciences Advisory Committee for successfully completing a review of the DOE Inertial Fusion Energy (IFE) program providing an assessment of the status of the program. A special thanks goes to the IFE panel, chaired by Dr. Rulon Linford, for a thorough examination of the program and for the excellent report that clearly states the panel's findings and recommendations.

Although we are in substantial agreement with the findings of your report, fiscal constraints will make it difficult to follow through all the recommendations made in the report.

I have enclosed a detailed response to your report jointly from OFES and NNSA.

Sincerely,

(signed)

N. Anne Davies
Associate Director
for Fusion Energy Sciences
Office of Science

Enclosure

Response to the FESAC IFE Panel Report

Recommendation: The recent progress related to these approaches is substantial and the quality of the science and engineering research is excellent. All approaches are currently on track for developing the science and technology to properly evaluate their potential for IFE. However, the planned termination of technology programs in support of the Heavy Ion (HI) approach is not consistent with their importance to HI-IFE, and the Panel is concerned about the impact of this action.

> OFES Response: The issue is broader than Inertial Fusion Energy. It is the degree to which our Fusion Energy Sciences program should become an energy development program. The Administration position on this issue is that now is not the right time for us to invest in energy related R&D for fusion, for both MFE and IFE.

Recommendation: Each of the approaches to IFE may benefit if the technique of Fast Ignition proves effective.

> OFES Response: We recognize the opportunities provided by Fast Ignition. We have increased funding for research in this area. We have awarded a grant to the University of Rochester to form a Fusion Science Center that will help to address the fundamental scientific issues related to Fast Ignition. A competitive solicitation for research on the science of Fast Ignition and high energy density physics (HEDP) is under consideration, if additional resources become available.

Recommendation: The single near-term issue that appears to be most critical for Heavy Ion Fusion is the physics limits to the maximum phase-space density of space-charge-dominated HI beams and the resulting implications for HEDP and fusion ignition.

> OFES Response: We agree. We are directing the Virtual National Laboratory for Heavy Ion Fusion to make this the central scientific issue in its research plan for the next five years.

Recommendation: The single near-term issue that appears to be most critical for the High Average Power Laser (HAPL) program is the durability of KrF lasers, and efficiency and beam smoothing in the Diode Pumped Solid State Lasers (DPSSL) that will scale to the high-energy requirements for IFE.

> NNSA Response: We agree. For KrF lasers, durability is being addressed in a systematic way, and steady progress is being achieved using advanced materials and foil cooling techniques yielding advances of several orders of magnitude since the IFE panel report (7000 shots) have been achieved. For DPSSLs, beam smoothing and efficiency are issues

that require more effort once the basic Mercury architecture has been demonstrated.

Recommendation: The single near-term issue that appears to be most critical for Z-Pinch IFE is the physics limitations on power flow in a recyclable transmission line, including the coupling to the pulsed-power driver and the integral target assembly.

NNSA Response: These challenges are a major part of the planned effort.

Recommendation: The single near-term issue that appears to be most critical for Fast Ignition is the physics of fuel compression to a uniform-density sphere and of energy transport by relativistic electrons to that high-density fuel to achieve ignition.

OFES Response: We agree. Preliminary investigations of the transport of the relativistic electrons created by petawatt-class lasers in dense matter are being conducted in OFES funded experiments. These investigations will be further complemented by the research that will be conducted at the newly formed Fusion Science Center for Extreme States of Matter and Fast Ignition at the University of Rochester. However, the recommended study of the physics of fuel compression to a uniform-density sphere and of the energy transport by relativistic electrons to that high-density fuel to achieve ignition will require a substantial expansion of the present level of effort in this area and will require additional resources. It is not clear at this point whether the additional resources will be available in the near term.

Recommendation: These issues, along with many other important basic and applied science issues that form the basis of IFE research plans, must be addressed to assess the potential of IFE.

OFES Response: We agree with the identification of the issues. However, the Administration's position is that substantial investment in IFE should await the achievement of ignition for an inertially confined plasma in a controlled manner on NIF or other facilities. For this reason, we are phasing out IFE beginning with FY05, redirecting the research efforts towards high energy density physics that may in the long term have applications to IFE.

Recommendation: The scientific and technical challenges posed by IFE, along with their many connections to HEDP, have attracted many outstanding researchers from academia as well as federal laboratories. Success will depend on sustaining the commitment and involvement of such people in a broad spectrum of scientific disciplines.

OFES Response: As noted above, we are re-directing present program elements in IFE towards HEDP and have started work in Fast Ignition, an emerging subfield of HEDP. OFES will pursue some level of effort in HEDP to the extent permitted by the OFES budget as a whole, in meeting the overall priorities and balance in the OFES program.