



INSTITUTE FOR FUSION STUDIES
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June 7, 2001

Dr. James Decker, Acting Director
Office of Science
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Dr. Decker:

In the enclosed report, a Sub-panel of the Fusion Energy Sciences Advisory Committee (FESAC) recommends that the National Compact Stellarator Experiment (NCSX) be designated as a Proof-of-Principle experiment. The FESAC endorses this recommendation.

The decision to construct a device on the scale of NCSX would represent a major step in US fusion research. As noted in the Sub-panel report, the associated budget plans must respect program balance, including present work and emerging opportunities, within available program resources. Hence, an overview of program priorities becomes appropriate. We have requested more information about those priorities, as viewed by the Office of Fusion Energy Sciences, for discussion at our next meeting. We have also requested a presentation from the stellarator community concerning the compact stellarator research program, including such issues as theoretical and technological support and other stellarator experiments, extending beyond the device itself.

The NCSX program offers an exciting opportunity in fusion research for several reasons. First, a plausible case has been made (for example, at the NCSX Physics Validation Review) that a fusion power system based on a compact stellarator may resolve two significant issues for fusion power systems: reduction or elimination of plasma disruptions, and provision for steady-state operation. These gains earn for the compact stellarator an important place in the portfolio of confinement concepts being pursued by the US Fusion Energy Sciences program. Second, the NCSX would complement research now underway on the advanced tokamak, which addresses closely related issues by different methods. It also complements stellarator research outside the US, which has emphasized different geometries and plasma regimes. Finally, understanding the behavior of magnetized plasmas in three-dimensional configurations is an important scientific frontier area, which the NCSX program would advance and strengthen.

Yours truly,

A handwritten signature in black ink, appearing to read "R D Hazeltine".

Richard D. Hazeltine, Chair
Fusion Energy Sciences Advisory Committee

RDH/de

cc: N.A. Davies
FESAC Members

FESAC Proof of Principle Sub-Panel Report
26 March 2001
PPPL, Princeton, NJ

In August 1999 the FESAC Proof of Principle (PoP) subpanel met to determine the readiness of three concepts for Proof of Principle status. Among these was the Compact Stellarator Program (CS). After review, the PoP subpanel did not recommend approval of the CS as a PoP program because of an important technical issue that needed to be resolved; specifically, the conceptual design embodiment (NCSX) needed to exhibit robustness of the equilibrium configuration throughout the plasma evolution. Nevertheless, the PoP subpanel stated it was confident that the Compact Stellarator can become an important PoP program and therefore recommended that the NCSX design effort complete an optimized design addressing the issue of robustness.

The PoP Panel reconvened 26 March 2001 at PPPL to review the NCSX design as part of a broader Physics Validation Review. The NCSX design team has made significant progress on validating the robustness of the QAS equilibria over a broad parametric range of pressure and current profiles, beta values, and start-up scenarios. Based on the information presented to the panel, it was concluded that the design has adequately addressed the issue of robustness of the equilibrium configuration throughout the plasma evolution. Therefore we conclude that the CS is ready for PoP designation.

Although we recommend that NCSX be designated as ready for PoP status, we recognize that construction would be a relatively costly investment over many years by the Fusion Energy Sciences Program. Therefore, we recommend FESAC and the OFES address the larger programmatic issues to determine whether or not to proceed with construction of NCSX and, if so, on what time scale. These include the issue of program balance within available fusion program budgets, needs of present element in the program, and opportunities for other new starts and collaborations.