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NUCLEAR SCIENCE

DOE's Acceptance of Academy of Sciences' 1986 Inertial Fusion Technical Priorities



**Resources, Community, and
Economic Development Division**

B-210947

March 15, 1990

**The Honorable Jon Kyl
House of Representatives**

Dear Mr. Kyl:

On August 10, 1989, you requested that we review certain aspects of the Department of Energy's (DOE) Inertial Confinement Fusion (ICF) program. ICF research involves using lasers or particle beam accelerators (called "drivers") to bombard tiny fusion fuel capsules (called "targets") to cause a momentary fusion reaction.¹ Six participants are involved in the ICF research program: the Lawrence Livermore, Los Alamos, and Sandia National Laboratories; the Naval Research Laboratory; the University of Rochester; and KMS Fusion, Inc. (KMS), a private contractor that provides target components and other research support services. The National Academy of Sciences reviewed the ICF program in 1986 and currently has another review underway.²

As agreed with your office, we addressed the following questions:

- What program priorities did the Academy's 1986 review panel recommend for DOE's ICF program?
- Which program priorities recommended by the Academy in its 1986 review of DOE's ICF program were accepted by DOE?
- Which tasks in DOE's contract with KMS were designed by DOE to satisfy the program priorities recommended by the Academy and accepted by DOE?

¹DOE plans to use the results of this research to support nuclear weapons studies because of the similarities between ICF laboratory-scale reactions and nuclear explosions.

²The Academy issued an interim report in January 1990 based on its current review of the ICF program.

In summary we found that:

- The Academy's 1986 report, Review of the Department of Energy's Inertial Confinement Fusion Program, lists the following priority areas for the ICF program to pursue in the subsequent 5 years: (1) the Centurion-Halite Program (a classified underground test program to help design ICF fusion targets conducted jointly by the Los Alamos and Lawrence Livermore Laboratories); (2) exploitation of the capabilities of the "new" major ICF facilities, including Livermore Laboratory's glass laser (Nova) and Sandia Laboratory's Particle Beam Fusion Accelerator; and (3) maintaining smaller-scale ICF research activities, such as those at the University of Rochester and the Naval Research Laboratory. The Academy panel also recommended that funding for the ICF program remain at the fiscal year 1985 level for the subsequent 5 years so that the laboratories could follow the priorities recommended by the panel.

- According to the Director of the Inertial Fusion Division, DOE has generally directed its program toward the technical priorities recommended by the Academy's 1986 panel, and the ICF laboratories have generally responded in their individual programs.³ That is, the Centurion-Halite program objectives have been pursued by Livermore and Los Alamos; ICF capabilities at the major laboratories have been pursued; and the role of the smaller programs at the University of Rochester and the Naval Research Laboratory has been strengthened. Total program funding, however, has not kept pace with inflation. Thus, there has been more than an \$80 million cumulative deficit compared with the 1985 funding level (in real terms) recommended by the Academy.⁴ In its January 1990 report on the program, the Academy said that because funding has fallen significantly short of the recommended level, some laboratories could not accomplish program objectives.

³According to the Director of DOE's Inertial Fusion Division, the Congress did not explicitly require DOE to implement the Academy's recommendations. Thus, DOE implemented these recommendations "only to the extent that they made sense programmatically in DOE's judgment."

⁴The cumulative deficit includes the period of fiscal years 1986 through 1989.

-- The 1986 Academy panel recognized that target fabrication was essential to the experimental programs of the ICF laboratories. Thus, when DOE wrote the 3-year ICF support contract (that KMS now has),⁵ DOE made contractor fabrication and delivery of target components for use in the experimental programs of the ICF laboratories the highest priority in the contract. In that sense, the most urgent task assigned to KMS directly supports the Academy's recommendation for target-physics experiments. The next priority for KMS is general target fabrication, and the lowest contract priority is KMS' in-house experimental laser and target-physics programs.⁶

The Academy's 1990 study panel also observed that DOE and some of the laboratories, especially Livermore, have given advanced laser development a somewhat higher priority than what was recommended by the 1986 panel. The Academy's panel believes that this occurred because DOE is in the planning process for a Laboratory Microfusion Facility which includes the eventual selection of a driver (an advanced laser or particle beam accelerator) to do ICF tests. Livermore's ICF program director told us that it is important to maintain an "institutionally" balanced program of target-physics experiments, advanced laser development, and Microfusion Laboratory studies. Otherwise, if objectives are pursued sequentially, by the time enough has been learned from experiments, the program still will not have a laser advanced enough to apply this knowledge in a Microfusion Laboratory. However, the Academy's 1990 panel concluded that the present ICF program is somewhat distracted from orderly scientific progress by (1) a desire to push ahead to the Microfusion Laboratory and (2) too much concern for issues of institutional balance. The 1990 panel recommends a strong program emphasis on fusion target-physics experiments. That is, the panel believes that more basic science needs to be done before a proper advanced driver can be developed for the Microfusion Laboratory.

⁵DOE plans to recompute this cost-plus-fixed-fee contract when it expires in 1990.

⁶In 1986, the panel recommended against upgrading KMS' laser facility and more recently in its January 1990 report recommended terminating all KMS ICF laser work.

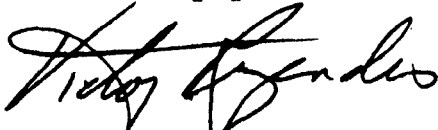
SCOPE AND METHODOLOGY

To answer your questions, we gathered and analyzed data at DOE headquarters and DOE field offices in San Francisco and Albuquerque, and at the six ICF program participants. We also asked DOE's Director of Inertial Fusion to respond formally to your questions, and verified his responses through discussions with the Academy and the ICF participants. In addition, we used the results of our draft report Nuclear Science: Performance of Participants in DOE's Inertial Confinement Fusion Program, which will soon be completed and issued. We conducted our review between September 1989 and February 1990. The Director of DOE's Inertial Fusion Division reviewed this fact sheet and generally agrees with its contents.

We plan to send copies of this fact sheet to the Secretary of Energy; the Director, Office of Management and Budget; the National Academy of Sciences; and other interested parties, including the six participants.

If you have any questions, please contact me at (202) 275-1441. Major contributors to this fact sheet are listed in appendix I.

Sincerely yours,



Victor S. Rezendes
Director, Energy Issues

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