DOCUMENT RESUME

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[Need for Improvements in the Evaluation System for Unsolicited Nuclear Fusion Research Proposals]. EMD-78-63; B-164105 April 26, 1978. 9 pp.

Report to Secretary, Department of Energy; by Monte Canfield, Jr., Energy and Minerals Div.

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The system the Department of Energy uses for assessing unsolicited proposals in the fusion area needs to be improved to assure that all potential approaches to fusion power are objectively and consistently evaluated. The Department's Division of Magnetic Fusion Energy (MFE), now the Office of Fusion Energy, uses varying procedures for reviewing unsolicited proposals. Proposals are sent to the national laboratories and other experts in the area for review or are reviewed by a panel of scientists selected for their competence in the area under consideration. MFE's procedures for evaluating the unsolicited proposal from the Fusion Energy Corporation (FEC) were reviewed. Following review by a technically qualified panel, MFE declined to fund FEC's proposals for fusion research based on the lack of promise of the proposed concept and on MFE program priorities. Questions about the issues of similarity and identicalness between devices raised some queries about the effectiveness of MFE's evaluation system. Since the emphasis must be on formal and systematic evaluation procedures to ensure that reasonable and scientifically sound evaluations have been performed, the development of such procedures should consider the need for: a determination that potential panelists do not have direct financial interests in proposals under review, explicit provision for the expression of minority views in panel reports, and an independent appeal process and administrative review outside the technical program. The Secretary of Energy should direct MFE to develop and issue standard review procedures and require that a determination be made of the adequacy of such procedures. (RRS)

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

ENERGY AND MINERALS
DIVISION

B-164105

APR 26 1978

The Honorable
The Secretary of Energy

Dear Mr. Secretary:

We have completed our review of certain aspects of the fusion program being funded by your Department. In particular, our work focused on the system the Department uses for assessing unsolicited proposals in the fusion area. We found that this system needs to be improved to assure that all potential approaches to fusion power are objectively and consistently evaluated.

The Department's regulations set out factors that are to be used to evaluate unsolicited proposals, specifically:

--The potential contributions to the Department's mission.

--The capabilities, experience, facilities or techniques of the proposer.

--The qualifications, capabilities, and experiences of key personnel.

--How the proposal differs from current work in the same subject area and how significant the difference is.

--That the proposal was submitted solely on the proposer's own initiative.

--That the objective of the proposed work is to explore a method, approach, or idea which (a) does not unnecessarily duplicate work already underway or contemplated and is not already known or (b) has previously unrecognized merit or value.

--That acceptance is otherwise authorized by statute.

EMD-78-63
(30703)

Department regulations require that a project officer and any other necessary personnel, including external review groups, evaluate the unsolicited proposal fairly and objectively. If an evaluation is unfavorable, the regulations require that a notification be sent to a proposer setting forth the basis for rejecting the proposal.

The Department of Energy and before it, the Energy Research and Development Administration, have been funding a program to develop fusion power. Nuclear fusion is highly complex and the scientific feasibility of the concept has not yet been demonstrated. In view of the Department's emphasis on certain approaches to achieving fusion, we wanted to see how it evaluated the merits of unsolicited proposals, particularly those for alternative approaches to fusion.

We examined the unsolicited proposal evaluation system of the Department's Division of Magnetic Fusion Energy (MFE), now the Office of Fusion Energy. MFE's procedures for reviewing unsolicited proposals vary. For example, proposals can be sent to the national laboratories and other experts in the area for review, or be reviewed by a panel of scientists. Panel members are selected by MFE based on their areas of competence.

During fiscal year 1977, MFE received 83 new unsolicited proposals. About 10 percent of them were reviewed by panels. A few proposals for alternative approaches to fusion energy were evaluated by MFE during fiscal year 1977. One such approach was described in an unsolicited proposal from the Fusion Energy Corporation (FEC). In our review of MFE's evaluation of this proposal we were not concerned with the feasibility or merits of FEC's concept but rather with MFE's evaluation process. MFE stated that about 250 staffdays were spent in reviewing the FEC proposal and that the panel which reviewed the proposal was one of its best qualified.

CHRONOLOGY OF MFE'S REVIEW

In September 1976 FEC submitted unsolicited proposals for fusion research and development. The program under one proposal was estimated to cost about $66 million over a 5-year period. FEC had already spent over $4 million on its fusion concept. In November 1976 MFE appointed a 12-member review panel drawn mainly from the national laboratories and other magnetic fusion contractors.

On December 1 and 2, 1976, the review panel and MFE personnel met at FEC. On December 3, 1976, a three-page letter by the review panel set out the problems the panel had with FEC's concept.

On December 8, 1976, FEC sent an eight-page letter clarifying and defending its proposal, and on December 9, 1976, it submitted a proposal for experimentation and theory work at a cost of about $2.4 million.

On January 21, 1977, the MFE panel released its report concluding that the concept should not be funded or endorsed and claiming that there were fundamental obstacles to it.

In March 1977 MFE received FEC's response to the panel's report. In summary, the FEC alleged, among other things, that there were errors and inconsistencies in the MFE panel's analyses.

MFE's final report was issued in April 1977. MFE declined to fund either of FEC's proposals for fusion research. MFE's decision was based on the lack of promise of the proposed concept as a fusion reactor and on MFE program priorities. In addition, MFE claimed FEC's near-term experimental research program had scientific objectives which the proposed experiments were unlikely to achieve.

ANALYSIS OF THE FEC REJECTION

The panel recommended rejection of FEC's proposals for five reasons. Three of the reasons related principally to the FEC concept as a fusion reactor and two related mainly to the FEC near-term experimental program to achieve higher densities and progress towards a fusion reactor. The latter two reasons involved a claim that FEC's concept was similar to other devices researched 15 to 20 years earlier and there was no scientific evidence to support that the concept was unique. Specifically, the panel concluded:

> "1. The FEC * * * concept is generically similar to the mirror machines with ion injection which were extensively studied in the [United States, Soviet Union, Great Britain,] and France during the period 1956-1966. The Panel can find no scientific foundation for the FEC claim that their scheme has unique properties which make it qualitatively different from these earlier devices.
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> "5. The proposed experimental program aims to increase the accumulated particle density by 3-4 orders of magnitude over its present level [1,000 to 10,000 times]. To achieve this, the experiment must enter a regime in which a number of * * * instabilities

> are predicted to occur, and have been observed in other injection experiments * * * There is no reason to believe that the FEC experiments would avoid these instabilities * * *."

MFE's panel specifically identified and discussed two devices in its report. The panel claimed that certain experiments with one device were similar to FEC's device and that, except for operating at lower energy, the other system was identical to FEC's device.

The claim of similarity and identicalness between devices was a key element in the panel's conclusions and it is an issue which, in our opinion, is not yet resolved. Our discussions with individual members of the review panel for the FEC proposals, information from other scientifically or technically qualified persons, and patents related to these devices in highly industrialized foreign countries, provided scientific and technical views which are different from the panel's claim of similarity and identicalness between devices.

We discussed the review of the FEC proposal with a majority of the review panelists. All supported the overall conclusions in the report; however,

--one panelist stated that the report's strong conclusions needed more evidence to adequately support them and

--another panelist stated that the statement in the report about identicalness between devices was not correct.

We discussed the issue of similarity and identicalness between devices with three scientifically or technically competent independent reviewers. Each questioned the panel's claim. Two of the reviewers were nuclear physicists. One who was familiar with the magnetic fusion program told us that the FEC concept is not substantially similar in operation to either of the devices cited by the review panel and that extrapolation of results from these devices to the FEC device is not possible.

MFE officials stated that several of the MFE panelists either worked on related experiments or had done theoretical work on instabilities in mirror devices and that the expertise of the MFE panelists to address the issues associated with the FEC proposal is clearly documented by their publications and experience and they are recognized as some of the foremost experts in magnetic mirror confinement and particle orbit physics.

MFE officials also stated that nuclear physicists generally do not have expertise in plasma physics and an indepth knowledge of the issues associated with magnetic mirror devices.

We identified the criteria for issuing patents in five highly industrialized foreign countries which had issued patents for the FEC concept after having patented the features and operations of one or both of the devices that the review panel said was similar or identical. The criteria was similar in all countries, requiring, among other things, that an invention be unique. All of the foreign government representatives stated that their patent examiners were, or had access to, highly competent scientists and engineers. Two of the countries--Great Britain and Sweden--independently determine the uniqueness of an invention before issuing a patent.

The granting of a patent does not mean an invention will work. It does mean that the features and operations of the FEC device were not considered by the patent examiners to be sufficiently similar to previously patented features and operations of other devices.

In Great Britain, a nuclear physicist determined that no previous device was sufficiently similar to the FEC device after examining all of the previously granted patents on the features and operations of the other devices. The Swedish technical patent examiner found that the previous devices were not similar and that no technology conflicts existed.

MFE officials believe that our analysis gives inappropriate weight to FEC's patents on fusion-related technology. They stated that the reasons for granting a patent are substantially different than the reasons for supporting research and development work. For example, the questions of economic feasibility or the assessment of the probabilities that proposed scientific objectives could be achieved with FEC's near-term experimental research program are important for supporting research and development efforts but play no role in the issuance of a patent. They emphasized that the review panel spent considerable effort in examining the claim that the FEC system is qualitatively different from other confinement systems, and concluded that the differences were more in terminology than in substance.

This view, however, is not shared by the patent examiners who determined that the features and operations of the previous devices were not sufficiently similar to the features and operations of the FEC device. As previously stated, this represents a scientific and technical view which is different than the panel's claim of similarity and identicalness between devices.

OTHER PROBLEMS IN MFE'S EVALUATION PROCESS

MFE officials emphasized that the decision for not supporting the FEC proposal was made by MFE, not by its review panel. MFE noted that the panel report was only one factor in the decision and contended it had carefully considered FEC's response to the panel's report in its decisionmaking process.

However, we noted other problems in MFE's evaluation system involving the selection of reviewers and the propriety of allowing panelists to evaluate proposals when they were involved with other proposals undergoing review by MFE at or about the same time.

Variations in the selection of reviewers

MFE is inconsistent in the method it uses to identify and select review panel members. For evaluating the FEC proposal, MFE identified and selected the initial panel without any information from or desire expressed by FEC on the makeup of the panel. MFE then provided an opportunity for FEC to comment on the proposed panel. FEC objected to the imbalance of the backgrounds of the panel members and MFE subsequently made two changes before completing the panel.

In contrast, there was a different sequence of events in appointing a review panel to evaluate another proposal. Before the initial panel membership was decided, the proposer suggested 12 individuals to MFE whom he claimed could address the technical issues in the proposed concept. MFE discounted two of the suggested individuals and stated that the rest had already been identified as potential panelists and that they were among those being considered. Four of them were appointed to the initial 12-member panel for evaluating the proposal.

MFE officials stated that the panel selection process was essentially the same for both proposals, and in neither case did the proposer choose members of the review panels.

Whether MFE was influenced by suggestions for panelists received from the proposer in appointing its review panel is not the issue. Obviously, groundrules are needed so that the process for appointing reviewers is consistent for all proposers.

Contrary interests of panelists

Panelists are mainly selected from within the existing fusion community either from the national or special purpose laboratories supported by the Department or from academic institutions involved in Department-supported fusion research.

At least four of the panelists evaluating the FEC proposal were directly associated with other proposals undergoing review by MFE at or near the same time. Such situations presented clear opposing interests for these panelists. Of 26 panelists who reviewed three unsolicited proposals received from private companies, seven had this type of conflict.

CONCLUSIONS

It is important that the Department give unsolicited proposals fair and objective evaluations. Nuclear fusion is a highly complex technology with the potential of becoming a virtually inexhaustible source of electrical energy. But this potential cannot be realized until one or more of these approaches is first proven to be scientifically feasible and then commercially viable. Which approach will eventually be commercially developed is speculative. But the potential for funding and developing a successful approach is increased if all approaches are considered and evaluated consistently and objectively.

Because funds are not earmarked for unsolicited proposals, these proposals compete for the same dollars as do the Department-supported laboratories and contractors. Yet, when panels are chosen to evaluate these proposals, they are largely drawn from these laboratories and contractors which may lose funding for their programs if the proposals are accepted. Such dependence appears to be largely unavoidable. However, in the FEC case there is evidence on both sides of the issue of similarity and identicalness between devices which raises some questions about the effectiveness of MFE's evaluation system. Consequently, the emphasis must focus on formal and systematic evaluation procedures to help ensure that reasonable and scientifically sound evaluations have been done. The development of such procedures should consider the need for:

--A determination that potential panelists do not have direct financial interests in proposals currently under review by, or soon to be submitted to, the technical program.

--Explicit provision for the expression of minority views in review panel reports.

--An independent appeal process and administrative review outside the technical program of final negative decisions on unsolicited proposals to assure that all pertinent evidence and principal scientific arguments were addressed and that the conclusions reached were adequately supported by the evaluation.

MFE officials do not believe that we have provided evidence on both sides of the issue of similarity and identicalness between devices or that questions can be raised about the effectiveness of MFE's evaluation system. In their view the issue is the competence of the MFE panel and that of our reviewers. We do not agree. Our concern about this issue does not only depend on the reviewers' comments. It was also based on our discussions with review panelists, the existence of duplicate patents, and other problems in the evaluation system for unsolicited proposals, as discussed beginning on page 4.

RECOMMENDATIONS

We recommend that the Secretary of Energy

--direct MFE to develop and issue standard review procedures for evaluating unsolicited nuclear fusion proposals and to take immediate action to correct the direct contrary interests which we have described and

--require that a determination be made of the adequacy of such procedures after they are developed and whether there is a need for Department-wide procedures.

MFE officials agreed with the recommendation to develop and issue standard review procedures.

As to the issue of the FEC proposal itself, MFE officials stated that we only addressed the issue of similarity and identicalness between devices and provided no evidence that the panel's overall recommendation was incorrect. Further, they argued that we did not question the panel's other negative conclusions on key technical issues, specifically that the FEC concept would not produce net electrical power. According to MFE officials, the conclusion that the FEC concept would not produce net electrical power was a major reason for rejecting the proposal and any reexamination of the evaluation would not result in a different conclusion.

Our interest in looking at the FEC proposal was to examine it as a case study of the evaluation system. We did not evaluate the feasibility or merits of FEC's concept. Therefore, while we are not asking for reevaluation of FEC's proposal for

the purpose of funding by the Federal Government, we do believe that a reexamination by the Department of the handling of the FEC proposal in light of the matters discussed in this report and of the need for the kind of formal and systematic evaluation procedures we have outlined above would be useful in its efforts to implement our recommendations. From our point of view, it represents a good case study of the problems inherent in the present system and can provide useful "lessons learned" to aid the Department in the development of new standard review procedures. Finally, we believe that every conclusion made on an unsolicited proposal should be fairly stated and adequately supported and that it is a primary responsibility of MFE to determine that its panels fairly state their conclusions.

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A draft of this report was furnished to Department officials responsible for the matters discussed. Their comments were considered in preparing this report.

As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the four committees mentioned above and to the Chairmen of the energy-related congressional committees. We are also sending copies to the Director, Office of Management and Budget.

Sincerely yours,

Monte Canfield, Jr.
Director