

**Written Statement
Of
Dr. Stephen O. Dean
President, Fusion Power Associates
To
Meeting of DOE Fusion Energy Sciences Advisory Committee
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Public Comment Session

First, let me say that I endorse the recommendation just made by Dr. Earl Marmor of MIT that no irrevocable decisions be made relative to reductions in the fusion program, as proposed in the President's FY 2013 budget submission to Congress, until a vetting of such reductions occurs within the U.S. fusion community. This should be done by FESAC, or otherwise, to seek community consensus relative to priorities identified previously by FESAC.

Much of the discussion has been focused on the proposed termination of the Alcator C-Mod program at MIT. The proposed termination is of serious concern, since that program has made, and is making, important contributions to our understanding of tokamak physics and, furthermore, is important to the training of the next generation of fusion scientists. Termination of Alcator C-Mod would mean a "double whammy" for the MIT fusion program, since DOE terminated the other significant experimental facility there last year, the Levitated Dipole Experiment (LDX). Without these two facilities, MIT will lack the facilities to continue providing experience to students doing experimental fusion research.

But the problem with the proposed reductions is much broader and more serious than just the role and future of the MIT program. Reductions in other areas, such as High Energy Density Laboratory Plasmas (HEDLP), theory, and systems studies will result not only in a loss of valuable talent and expertise throughout the U.S. fusion program, but will also mean that research results these people and facilities would otherwise provide in the coming years will not be obtained. On that subject, I would note that the practice of requiring many fusion programs to compete for renewal periodically via open solicitations is not working well, especially if those programs are imbedded in larger institutions having upper layers of management. One example is that of the heavy ion fusion effort at the Lawrence Berkeley National Laboratory. Using "stimulus" funding, LBNL has finally been able to complete a new facility with which to study warm dense matter physics. However, they were notified that they had to compete against other proposals, not yet received by DOE, after DOE advertises broadly for proposals in HEDLP. These solicitations often get delayed for months beyond the date expected. Upper management at LBNL, understandably, has to make plans to possibly layoff many personnel in case there is a funding lapse or no funding at all in FY2013. So, unintended consequences can result from these procedures.

The reductions proposed in the domestic fusion program were deemed necessary by DOE in order to increase funding for the U.S. contribution to ITER from \$105 million in FY 2012 to \$150 million in FY 2013. As several FESAC members noted yesterday, we have not been told by DOE how much is really needed in FY 2013, how much will be needed in future years to meet the November 2019 ITER first plasma target date, or where these funds will come from. We were told yesterday that Japan plans to spend \$250 million in 2013 to maintain their ITER commitment. Since the U.S. has the same one-ninth share of ITER commitments, it would seem logical that the U.S. may really have needed roughly that amount in order to meet the ITER schedule. Thus, even with \$150 million in FY 2013, the U.S. may not have the funds it really needs for ITER in FY 2013.

In July 2002, approximately 280 fusion scientists assembled in Snowmass, Colorado, to assess our options for a burning plasma experiment. Three were identified: Ignitor (a short pulse, copper high field magnet tokamak), FIRE (an intermediate-length pulse, superconducting tokamak), and ITER (a long pulse, superconducting tokamak). In August 2002, a special FESAC panel met in Austin, Texas, and identified ITER as the preferred choice, but under certain assumptions. At the time, ITER was estimated to cost about \$5 billion and the U.S. share was estimated to be ten percent of that, or \$500 million. I was a member of that panel. I believe the panel would have chosen the FIRE concept except for the fact that we were being offered a bargain: for \$500 million we could have a much more capable facility, since we only would have to pay ten percent of the cost. The full FESAC adopted the panel's recommendations in September but emphasized that the U.S. ITER contribution had to be provided on top to the existing domestic (or base) fusion program. The FY 2003 OFES budget at that time was \$241 M. The U.S. was not an ITER participant at that time, but rejoined about one year later.

In spite of the FESAC proviso, in FY 2004 and 2005, the President started requesting funds for ITER by reducing the domestic fusion budget, but the Congress largely (but not completely) rebuffed these efforts. The OFES fusion technology efforts were largely terminated to accommodate these conflicts. FESAC, on its own initiative, wrote a strong letter to Office of Science director Ray Orbach saying, "Devastating cuts in certain program elements are alarming; this note expresses our most serious concerns."

The President's request for FY 2006 contained a \$17 million increase for OFES, but also a proposed \$51 million increase for ITER. Congress refused to go along with this, cutting the ITER request by \$30 million and directing it into the domestic program, stating, "As in previous years, the conferees direct the Department to fund the U.S. share of ITER in fiscal 2007 through additional resources rather than through reductions to domestic fusion research or to other Office of Science programs." For FY 2007, the President, for the first time, requested an increase in the total OFES budget that was approximately equal to the proposed increase for ITER (there was a \$4 million decrease proposed for the domestic program). The Congress eventually went along with this budget through an omnibus appropriation that did not pass until 5 months into the fiscal year.

In sending the FY 2007 request to Congress, the President re-estimated the cost of the U.S. contribution to be \$1.122 billion, as follows:

FY 2006	19.3 M
FY 2007	60.0 M
FY 2008	160.0 M
FY 2009	214.5 M
FY 2010	210.0 M
FY 2011	181.3 M
FY 2012	130.0 M
FY 2013	116.9 M
FY 2014	30.0 M
Total	1122.0 M

This is the only out-year projection ever made publicly available by DOE. However, in 2008, DOE stated that the total required had been increased to a “range” of \$1.4 to \$2.2 billion. The total appropriated for ITER and the domestic program (third column), starting with FY 2006, is as follows:

FY 2006	25.0 M	263 M
FY 2007	60.0 M	259 M
FY 2008	10.7 M	276 M
FY 2009	124.0 M	282 M
FY 2010	135.0 M	291 M
FY 2011	80.0 M	287 M
FY 2012	105.0 M	296 M
FY 2013	150.0 M	248 M (requested)

Thus, if US ITER receives the requested \$150 M in FY 2013, it will have spent \$690 M. If ITER is to operate in November 2019, essentially all needed construction funds must be spent by end of FY 2018. Since the latest (informal) estimate of the total US contribution to ITER has risen reportedly to \$2.6 billion, the President will need to request, and the Congress will need to appropriate, an additional nearly \$2 billion over the five fiscal years 2014-2018, or an average of nearly \$400 million per year. Clearly this cannot come by continuing to decrease the US domestic fusion program. Something needs to be done.

On January 30, 2003, the U.S. decided to rejoin the ITER project. The decision was made at the highest level of the U.S. government, an announcement from President George W. Bush stating, “I am please to announce that the United States will join ITER, an ambitious international research project to harness the promise of fusion energy.”

To ensure the successful completion of the ITER project, without destroying the U.S. domestic program, requires that we regain the high level U.S. government support for the project that seems to have been lost in the FY 2013 budget submission. The ITER project must be again recognized as a presidential commitment that cannot be funded by reducing the U.S. domestic fusion effort.

There has been much talk at this meeting of making a new plan for fusion; in fact, Congress has requested it. Some feel that preparing such a plan could be the vehicle for getting the issues of ITER and domestic fusion funding resolved. I doubt that.

Next summer, I will have been working in fusion for half a century. I have seen and/or been involved in preparing many fusion plans over this time period. While all have been exemplary in their logic and content, they have all essentially been ignored after completion. Furthermore, plans take time to prepare well; and we are in a crisis situation with respect to the funding of the US domestic fusion program. I do not sense that the DOE wants to proceed on an urgent basis with a new planning activity. So I suggest that the fusion community should self-organize to do the required vetting of the FY 2013 budget proposals and not depend on, or wait, for a DOE-initiated planning activity to begin.

Yesterday, Dr. Brinkman told us that when he arrived at DOE Secretary Chu told him, with regard to ITER, he needed to “fix it or kill it.” I think now is the time Dr. Brinkman should respond to the Secretary, “I have fixed it. Now help me pay for it.”

The U.S. domestic fusion program does not have sufficient funds to pay for the U.S. contribution to ITER construction.