



U.S. Department of Energy's
Office of Science

Fusion Energy Sciences Program Update

Fusion Energy Sciences Advisory Committee



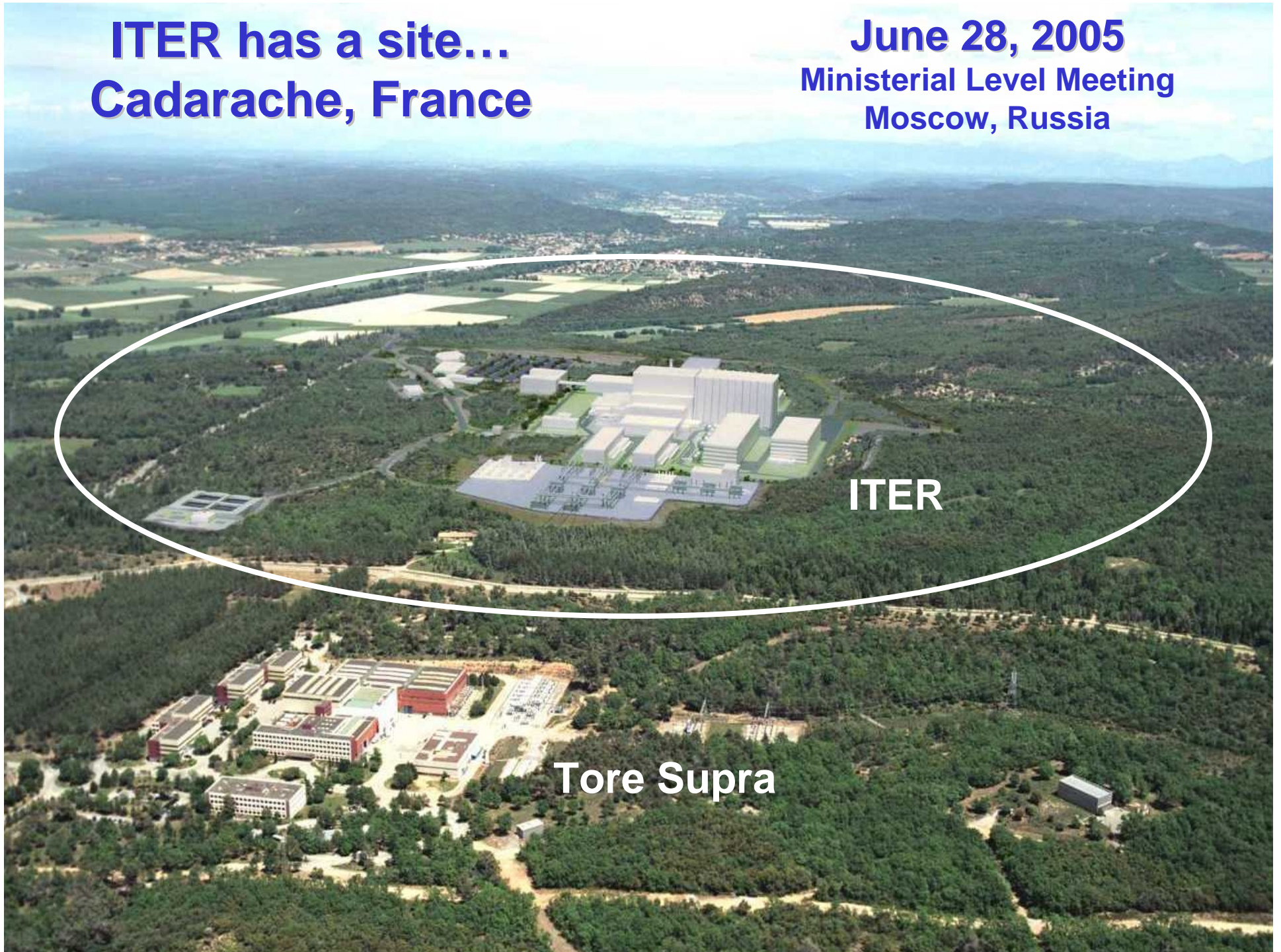
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July 19, 2005

**ITER has a site...
Cadarache, France**

**June 28, 2005
Ministerial Level Meeting
Moscow, Russia**



ITER

Tore Supra

FY 2006 Fusion Energy Sciences Budget Status

	FY 2004 <u>Actual</u>	FY 2005 <u>July Fin Plan</u>	FY 2006 <u>Cong. Req.</u>	FY 2006 <u>House</u>	FY 2006 <u>Senate</u>
Science	142.7	148.6	142.8	156.7	151.1
Facility Operations	85.7	89.4	127.5	112.0	112.0
Enabling R&D	<u>27.5</u>	<u>28.9</u>	<u>20.3</u>	<u>27.5</u>	<u>27.5</u>
<i>OFES Total</i>	<i>255.9</i>	<i>266.9</i>	<i>290.6</i>	<i>296.2</i>	<i>290.6</i>
DIII-D	54.4	55.8	51.4	57.0	57.0
C-Mod	22.3	22.0	21.5	22.8	27.2
NSTX	35.6	34.6	30.7	36.5	38.8
NCSX	16.7	18.3	16.6	18.2	16.6
ITER	3.2	5.1	55.5	19.6	21.5
Non-ITER	252.7	261.8	234.9	276.6	270.1
SBIR/STTR	0	0	(6.3)	(7.3)	(7.1)

FY 2006 Fusion Budget Highlights

Congressional Request

(Changes with respect to FY 2005 July AFP)

- o **Begin U.S. ITER Fabrication Effort (\$55.5M, +\$50.4M)**
 - \$46M for MIE Project
 - \$3.5M for Enabling R&D support
 - \$6.0M for transitional activities that need to be completed before starting MIE
- o **Close out fusion materials science research (-\$7.3M)**
 - Basic materials research in BES
 - ITER will have to address materials needs as part of program
- o **Cut back HEDP Research (-\$6.6M)**
- o **Reduce Major Facility operations and research (-\$8.8M)**
 - No operation on NSTX, 5 weeks on DIII-D, 12 weeks on C-Mod
- o **Eliminate one major concept in ICC program (-\$2.8M)**
- o **Reduce NCSX to FY 04 level (-\$1.7M)**
 - Estimated 1+ year delay and \$6.0M increase in cost
- o **Reduce Plasma Technologies to focus on ITER specifics (-\$4.2M)**
- o **Other reductions in Theory, Advanced Design and SBIR (-\$1.6M)**

FY 2006 Fusion Budget Highlights

OFES Response to House Mark

- o Nation needs to maintain a **strong domestic program** for training next generation of researchers
- o **Reduce ITER** by \$29.9 M from request and increase total to \$296.2 M (+\$5.6 M)
- o Restore domestic program to **FY 2005 level** (\$35.5 million)
 - +\$7.2 M to restore **Materials Research Program**
 - +\$7.1 M for **Heavy Ion Beams** research and fast ignition studies
 - +\$1.6 M for **NCSX**
 - +\$1.1 M for **QPS**
 - +\$0.4 M for **MST**
 - +\$2.8 M for **Small Experiments**
 - +\$0.9 M for **Theory**
 - +\$12.7 M for **Facilities** research and operations (48 total weeks of operation)
 - +\$1.7 M for miscellaneous

FY 2006 Fusion Budget Highlights

OFES Response to Senate Mark

- o Reduces ITER by \$28 M due to lack of site. If a site is selected, the Committee will work with DOE to provide an allocation consistent with project needs. Reduction is spread to provides \$28 M to ensure full operations (DIII-D: 14 weeks; C-Mod & NSTX: 25 weeks each) and research at the three major facilities
 - +\$5.6 M for DIII-D (only able to operate 14 weeks due to upgrade activities)
 - +\$5.6 M for C-Mod
 - +\$8.1 M for NSTX
 - +\$7.2M for Materials Research
 - +\$0.8 M for SBIR/STTR
- o High Energy Density Physics Budget has \$1.0 M in funding for research at the Atlas pulsed power facility (Nevada Test Site)

FY 2006 Fusion Budget Highlights

Senate Mark

This amendment to the SEWD bill was accepted on the floor of the Senate.

Provided further, That the Committee directs the Government Accountability Office too undertake a study of the Office of Science Fusion Energy program in order to define the roles of the major domestic facilities, DIIIID, Alcator C-Mod, and NSTX in the support of the ITER Program, including making recommendations that may include the possible shutdown or consolidation of operations or focus of these facilities to maximize their value to the ITER program;

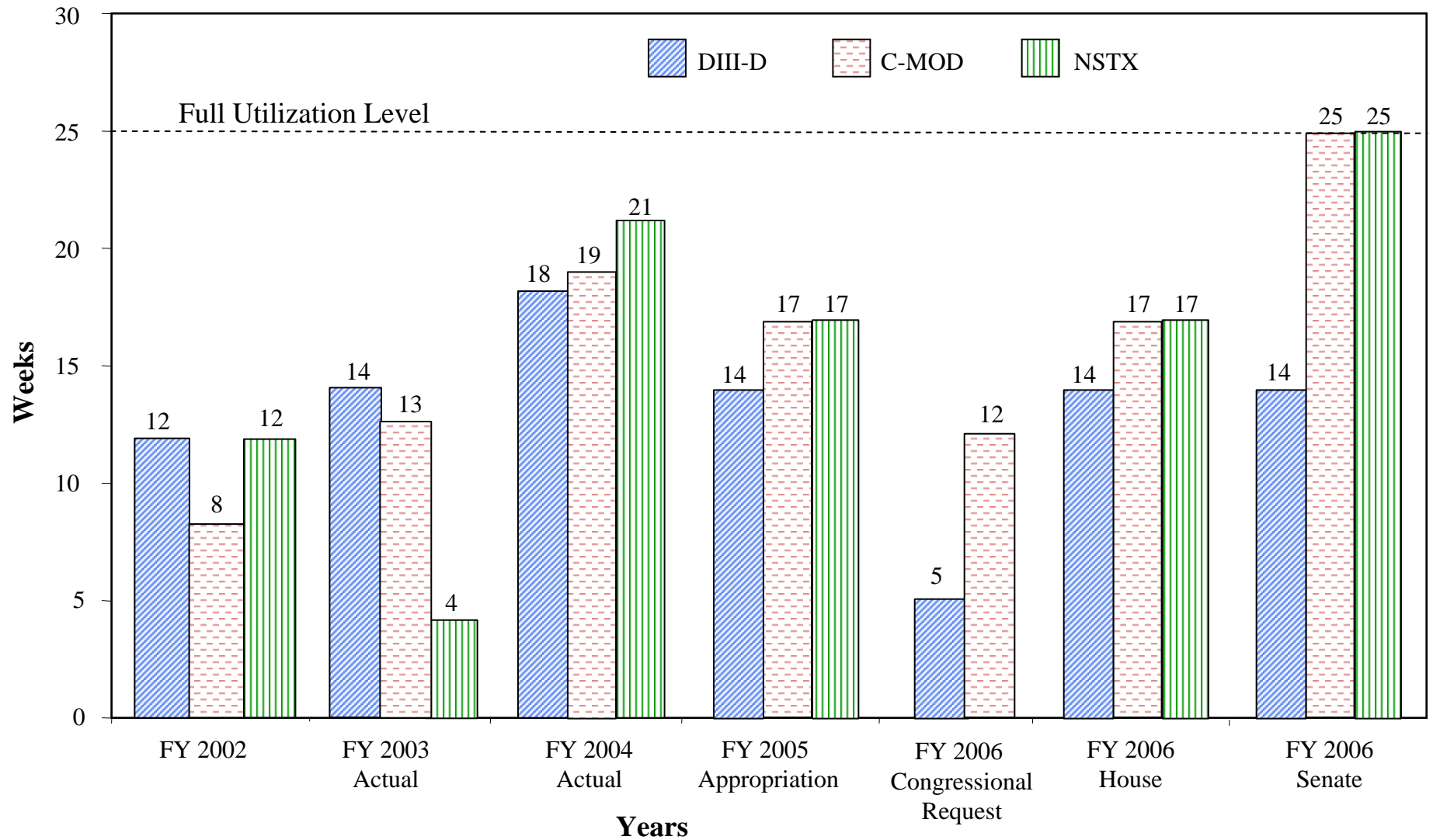
Provided further, That given the major international commitment to ITER and the tokamak concept, the GAO shall consider any other magnetic fusion confinement system as a possible fusion demonstration facility that will follow ITER and given the major NNSA investment in the physics of Inertial Confinement Fusion, the GAO shall evaluate the opportunities for the Office of Science to develop the appropriate science and technology to better leverage the NNSA investment and develop Inertial Fusion Energy as an alternative to the tokamak concept.

FY 2006 Fusion Budget Highlights

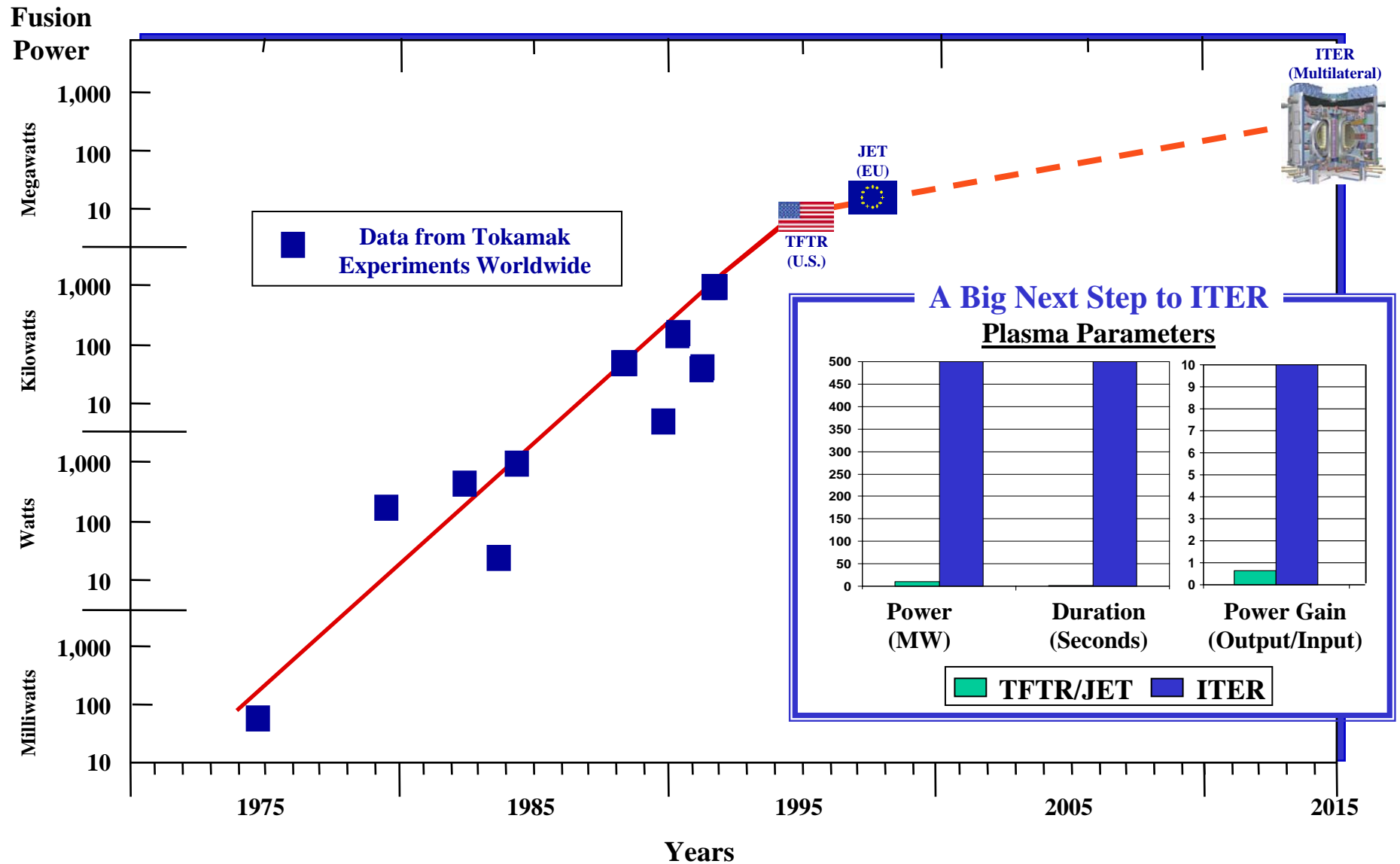
Boehlert Amendment

"None of the funds made available by this Act [the FY 2006 Energy and Water Development Appropriations bill] may be used before March 1, 2006, to enter into an agreement obligating the United States to contribute funds to ITER, the international burning plasma fusion research project in which the President announced United States participation on January 30, 2003."

Major Fusion Facilities Operating Times



Progress in Magnetic Fusion Research and Next Step to ITER



Near-term Activities Following Site Selection

- o ITER Parties: Select/appoint Director General and key staff and form ITER working team at Cadarache, including assignment of U.S. personnel
- o ITER Parties: Negotiate text on the international ITER Agreement
- o DOE: Continue to complete project activities in U.S.
- o U.S. Congress: Address FY06 Budget Request and ITER in Energy Bill
- o U.S.G. and Congress: Consult on progress of text negotiations
- o ITER Parties: Complete negotiations on international ITER Agreement
- o ITER Parties: Governments initial the international ITER Agreement
- o DOE: Obtain Administration approval via Circular 175 authorizing the U.S. to sign the ITER Agreement
- o ITER Parties: Sign international ITER Agreement
- o ITER Parties: Ratify/Accept the signed Agreement and its Entry into Force
- o ITER Parties: Establish international ITER Organization

July to
Dec
2005

Jan
2006
and
Beyond

Sequence of Upcoming Events Based on 6-Party Meeting in Moscow

Meeting	Date	Location
Working Group	7-14 September	Cadarache, France, EU
<i>(Policy Meeting for Director General Nominee Selection)</i>	<i>TBD</i>	<i>TBD</i>
Working Groups	19-25 October	China
Policy Meeting	2-4 November?	Austria
Working Groups	1-7 December	Korea
Policy Meeting	21 December?	Japan

- o Policy Meetings are meetings of Heads of Delegation to address policy issues
- o Working Meetings are working level meetings to prepare input to the N meetings

U.S. Burning Plasma Organization, ITPA, and ITER Physics Tasks

- o Prof. Ray Fonck of the University of Wisconsin has agreed to be the BPO Leader
 - An interim steering committee is working with Ray to get the program moving ahead (more from Ray later)
- o The ITPA Coordinating Committee held its annual meeting at Moscow in June
 - We have resumed holding some ITPA Topical Group meetings in the U.S. (Annual IEA/ITPA experimental coordination meeting at GA in November 2005)
 - Progress is being made with the update of the ITER Physics Basis
 - The IFRC approved the extension of ITPA for two years to July 2007
- o Five ITER physics tasks are being developed for the U.S. to contribute to in CY2005
 - Resistive Wall Mode control in ITER Steady State operation (Columbia U)
 - Vertical Displacement Events, Disruptions and their mitigation in ITER (GA)
 - Fast Particle Confinement in ITER (PPPL)
 - Radiation transfer effects on the ITER divertor (MIT)
 - Benchmarking of ICRF codes for ITER plasma and antenna (ORNL)

Fusion Simulation Project Status

- o The Fusion Simulation Project (FSP) will unify and accelerate progress on a complete, integrated simulation and modeling capability for ITER-class burning plasma
- o Creating this capability entails integrating physics models that heretofore have largely been considered in isolation
- o In FY 2006, OFES and OASCR will begin the first phase of the FSP by conducting initial integration efforts called “Focused Integration Initiatives” in the FESAC Report
- o A competitive review organized last spring resulted in four high-quality proposals being submitted to OFES. Two on edge physics and two on RF/MHD
- o Funding decisions made, PI’s being notified

OFES FY 2005 Solicitations

Innovative Confinement Concepts

- o 18 proposals received. Funding decision scheduled for mid November
- o A Special Review due to a funding cutback in the CE ICC program of about \$2.7M relative to FY05
- o Projects which are normally due for review in 2005: SSPX (Spheromak at LLNL), TCS (FRC at U. Washington), Pegasus (ST at U. Wisconsin), HIT-SI (U. Washington), HBT (High-beta Tokamak at U. Columbia), FRC at Princeton
- o Major CE projects included in the Special Review: MTF (Magnetized Target Fusion at LANL and AFRL), HSX at U. Wisconsin, Levitated Dipole at MIT/U. Columbia, Lithium Tokamak at PPPL
- o If funding level is restored later, the review will drop back to the normal review - the Special CE projects will be exempted

Junior Faculty

- o 6 proposals reviewed
- o 2 funded in FY 2005

OFES FY 2005 Solicitations (continued)

Innovative HEDP – Fast Ignition and Plasma Jets

- o Received 18 non-Lab proposals, 5 Lab proposals
- o Selection Panel: Francis Thio (Chair), Ken Hill, Ralph Schneider (NNSA), L K Len (HEP)
- o 12 proposals were ranked Very Good or better, 8 proposals were ranked Good or better
- o 8 proposals were funded covering the areas of fast ignition, plasma jets and plasmas in intense magnetic fields
- o Awards announcement was made May 12, 2005. All grants have been issued with start date Aug 1, 2005

OFES FY 2005 Solicitations (continued)

General Plasma Physics Program Supported at the DOE Laboratories (Lab 05-06)

- o The program to fund General Plasma Physics at the DOE labs was last competed in 2000
- o The Program Announcement Lab 05-06 for “Opportunities in Basic Plasma Science” was posted on the SC-64 website on December 7, 2004
- o 18 applications were received at the end of February 2005 and have been reviewed
- o Based upon the reviews and programmatic considerations, it was decided to fund 6 of the projects
- o A summary of the results of this competition appears on the OFES web site: <http://www.ofes.fusion.doe.gov/News/Lab-05-06award.pdf>

OFES FY 2005 Solicitations (continued)

NSTX Research

- o 16 proposals received by October 14, 2004 (11 renewals, 5 new)
- o 9 of 11 renewals funded
- o 1 of 5 new proposals funded (Old Dominion University/Polish Academy of Science)
- o \$1.4M per year for FY 2005-2007
- o Selection decisions posted on OFES web site