Burning Plasma Next Steps: Discussion of Key Developments

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NSO Program Advisory Committee Meeting
General Atomics, San Diego
27-28 February 2003

Summary of Major Developments

July 2002	Fusion Summer Study 2002, in Snowmass, CO
Aug/Sept 2002	Austin Panel/FESAC Burning Plasma Strategy
Dec 2002	NRC/NAS Interim Report on Burning Plasmas
Jan 30, 2003	DOE and Presidential Announcement that US will join ITER Negotiations
Feb 3, 2003	FY04 Budget Submitted: $257 million for OFES
Feb 3, 2003	OFES proposes major cuts in technology programs & redirection of FIRE effort to ITER
Feb 6, 2003	President Bush discusses fusion for H_2
Feb 13, 2003	FY03 Budget passed: ~ $248.5 million for OFES
Feb 18-19, 2003	8th ITER Negotiators' Meeting, St. Petersburg
Feb. 27-28, 2003	NSO PAC Meeting
March 5-6, 2003	FESAC Meeting

Snowmass Conclusion #3

- **IGNITOR, FIRE, and ITER would enable studies of the physics of burning plasma, advance fusion technology, and contribute to the development of fusion energy. The contributions of the three approaches would differ considerably.**
  - IGNITOR offers an opportunity for the early study of burning plasmas aiming at ignition for about one current redistribution period.
  - FIRE offers an opportunity for the study of burning plasma physics in conventional and advanced tokamak configurations under quasi-stationary conditions (several current redistribution time periods) and would contribute to plasma technology.
  - ITER offers an opportunity for the study of burning plasma physics in conventional and advanced tokamak configurations for long durations (many current redistribution time periods) with steady state as the ultimate goal, and would contribute to the development and integration of plasma and fusion technology.

Snowmass Conclusion #3 - Common Benefits

- **The three candidate burning plasma devices would contribute a number of key benefits, i.e., capabilities for studies of the physics and technology of burning plasmas (under the assumption that each facility will achieve its proposed performance).**

- **Common benefits from all three candidate burning plasma devices include the following:**
  - PHYSICS
    - 1. Strongly-coupled physics issues of equilibrium, stability, transport, wave-particle interactions, fast ion physics, and boundary physics in the regime of dominant self-heating.
  - TECHNOLOGY
    - 2. Plasma support technologies (heating, fuel delivery, exhaust, plasma-facing components, and magnets) will benefit most because parameters and plasma conditions will be close to those required for power production.
    - 3. Nuclear technologies (remote handling, vacuum vessel, blankets, safety and materials) will advance as a result of the experience of operating in a nuclear environment. The level of benefit will depend on tritium inventory, pulse length, duty factor, and lifetime fluence.

Conclusion #3 - IGNITOR

- **Key benefits from IGNITOR are the following:**
  - PHYSICS
    - 1. Capability to address the science of self-heated plasmas in a reactor-relevant regime of small ρ^* (many Larmor orbits) for globally MHD-stable plasmas at low βN (normalized plasma pressure).
    - 2. Capability to study sawtooth stability at low beta with isotropic alpha particles and self-consistent pressure profile determined by dominant alpha heating.
  - TECHNOLOGY
    - 3. Development of high-field copper magnets with advanced structural features, including bucking and wedging and magnetic press.
    - 4. Development of high-frequency RF antennas for wave heating in a burning plasma environment.

Conclusion #3 - FIRE

- **Key benefits from FIRE are the following:**

  – PHYSICS
    - 1. Capability to address the science of self-heated plasmas in reactor-relevant regimes of small ρ* (many Larmor orbits) and high βN (normalized plasma pressure) with a large fraction of non-inductive current sustained for up to a few current relaxation times.
    - 2. Exploration of high self-driven current regimes with strong shaping and active MHD stability control.
    - 3. Study of removal of helium ash and impurities with exhaust pumping.

  – TECHNOLOGY
    - 4. Development of electrical insulation for high-field pulsed copper magnets in a high neutron fluence environment.
    - 5. Development of high heat flux plasma-facing components with steady-state heat removal capability (tungsten/beryllium).

Conclusion #3 - ITER

- **Key benefits from ITER are the following:**
  - PHYSICS
    - 1. Capability to address the science of self-heated plasmas in reactor-relevant regimes of small ρ^* (many Larmor orbits) and high βN (plasma pressure), and with the capability of full non-inductive current drive sustained in near steady state conditions.
    - 2. Exploration of high self-driven current regimes with a flexible array of heating, current drive, and rotational drive systems.
    - 3. Exploration of alpha particle-driven instabilities in a reactor-relevant range of temperatures.
    - 4. Investigation of temperature control and removal of helium ash and impurities with strong exhaust pumping.
  - TECHNOLOGY
    - 5. Integration of steady-state reactor-relevant fusion technology: large-scale high-field superconducting magnets; long-pulse high-heat-load plasma-facing components; control systems; heating systems.
    - 6. Testing of blanket modules for breeding tritium.

Snowmass Conclusion #4 - Assessment of the Feasibility of the Options

- There are no outstanding engineering-feasibility issues to prevent the successful design and fabrication of any of the three options.
  However, the three approaches are at different levels of design and R&D.

- There is confidence that ITER and FIRE will achieve burning plasma performance in H–mode based on an extensive experimental database.

  IGNITOR would achieve similar performance if it either obtains H–mode confinement or an enhancement over the standard tokamak L–mode. However, the likelihood of achieving these enhancements remains an unresolved issue between the assessors and the IGNITOR team.

General Observations from Snowmass

- **IGNITOR, FIRE and ITER would all produce scientific and technological benefits**
  - their missions are distinct, and were clarified

- **All 3 approaches have science and technology issues, but NO SHOW STOPPERS: the issues are being addressed by continuing R&D**

- **The Snowmass Study performed the technical assessment,
IT DID NOT SELECT THE PREFERRED APPROACH(es)**

- **Strong sense of excitement and unity in the community for moving forward with a burning plasma step [quite unprecedented!]**

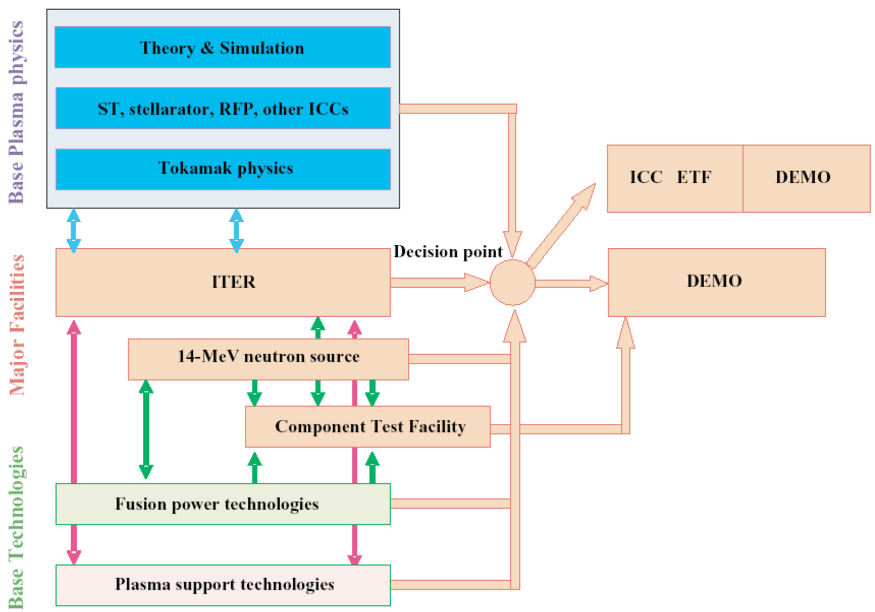
- **Snowmass Participants Strongly Confirmed: "NOW is the time for action!"**

FESAC/Austin BP Strategy

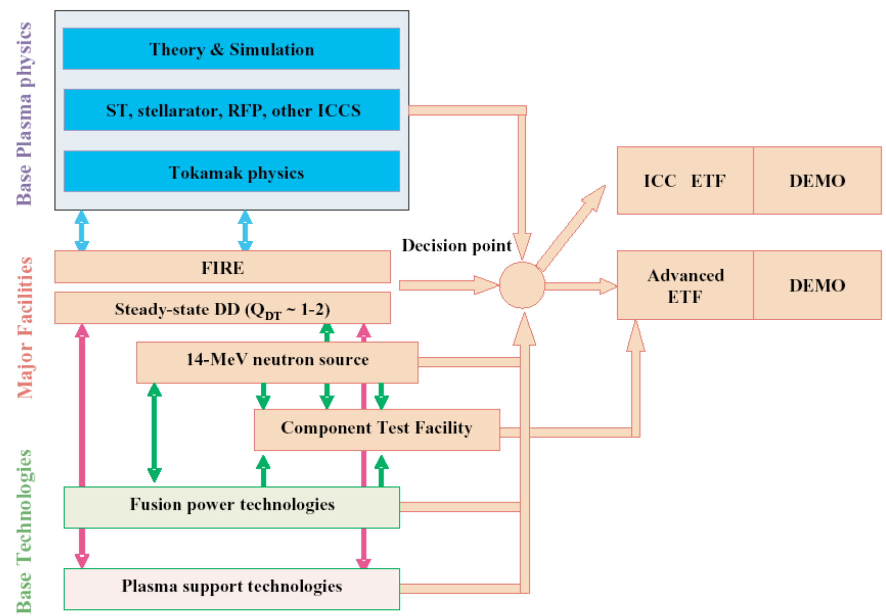
ITER and FIRE are each attractive options for the study of burning plasma science. Each could serve as the primary burning plasma facility, although they lead to different fusion energy development paths.

Because additional steps are needed for the approval of construction of ITER or FIRE, a strategy that allows for the possibility of either burning plasma option is appropriate.

FESAC/Snowmass Plans Similar Structure, BUT With a Significant Strategic Difference



ITER Development Path
Integration Now



FIRE Development Path
Deferred Integration

Both Paths Identify a CTF as Critical Pacing Item
FESAC 35 Year Panel Supporting This View

FESAC/Austin BP Strategy

Since ITER is at an advanced stage, has the most comprehensive science and technology program, and is supported internationally, we should now seek to join the ITER negotiations with the aim of becoming a partner in the undertaking, with technical, programmatic and timing considerations as follows:

The desired role is that the U.S. participates as a partner in the full range of activities, including full participation in the governance of the project and the program. We anticipate that this level of effort will likely require additional funding of approximately $100M/yr.

The minimum acceptable role for the U.S. is at a level of effort that would allow the U.S. to propose and implement science experiments, to make contributions to the activities during the construction phase of the device, and to have access to experimental and engineering data equal to that of all partners.

The U.S. performs a cost analysis of U.S. participation and reviews the overall cost of the ITER project.

FESAC/Austin BP Strategy

Since FIRE is at an advanced pre-conceptual design stage, and offers a broad scientific program, we should proceed to a physics validation review, as planned, and be prepared to initiate a conceptual design by the time of the U.S. decision on participation in ITER construction.

If ITER negotiations succeed and the project moves forward under terms acceptable to the U.S., then the U.S. should participate. The FIRE activity should then be terminated.

If ITER does not move forward, then FIRE should be advanced as a U.S.-based burning plasma experiment with strong encouragement of international participation.

FESAC/Austin BP Strategy

A strong core science and technology program is essential to the success of the burning plasma effort, as well as the overall development of fusion energy. Hence, this core program should be increased in parallel with the burning plasma initiative.

A burning plasma science program should be initiated by the OFES with additional funding in FY04 sufficient to support this strategy.

NRC/NAS BP Interim Report: 20 December 2002

This interim report…addresses only two aspects—the importance of a burning plasma experiment for fusion energy and the scientific and technical readiness to undertake a burning plasma experiment—and offers advice on entering ITER negotiations.

…considerations of the broader scientific value of burning plasma science and of the Fusion Energy Science Advisory Committee's (FESAC's) proposed dual-track strategy for developing a burning plasma experimental program are deferred to the committee's final report.

Principal NRC/NAS Interim Recommendations:

Subject to the conditions listed below, the committee recommends that the United States enter ITER negotiations while the strategy for an expanded U.S. fusion program is further defined and evaluated.

A strategically balanced fusion program, including meaningful U.S. participation in ITER and a strong domestic fusion science program, must be maintained, recognizing that this will eventually require a substantial augmentation in fusion program funding in addition to the direct financial commitment to ITER construction.

The fusion program strategy should include cost estimates and scenarios for involvement in ITER, integration with the existing fusion science program, contingency planning, and additional issues as raised in this letter. The United States should pursue an appropriate level of involvement in ITER, which at a minimum would guarantee access to all data from ITER, the right to propose and carry out experiments, and a role in producing the high-technology components of the facility, consistent with the size of the U.S. contribution to the program.

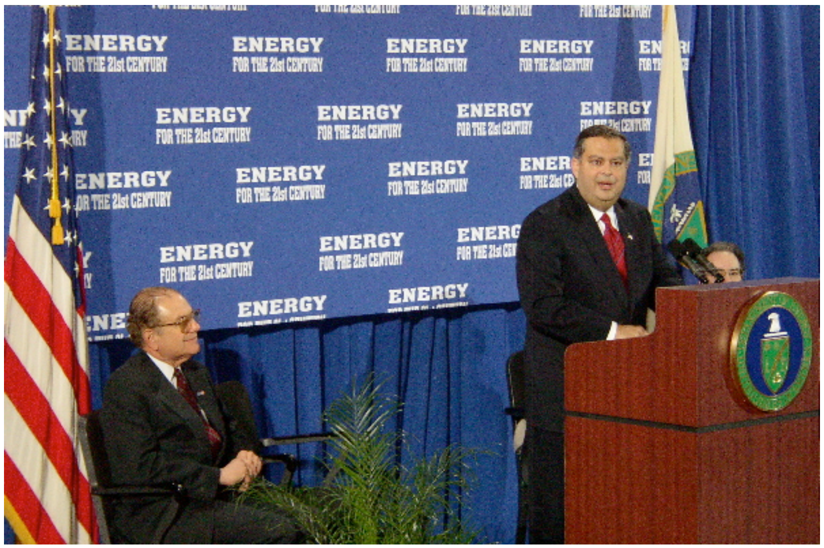
<u>From the narrative section of the NRC/NAS Interim report</u>:

There is a clear consensus among members of the fusion community who participated in the 2002 Snowmass meeting, the subsequent FESAC panel, and FESAC itself that the United States should now seek to join the ITER negotiations. As a result of what it learned from presentations at its first two meetings, the committee agrees with that proposal. Furthermore, **no matter how one envisions a future development path for fusion energy, the fusion community has concluded, and the committee agrees, that a burning plasma experiment is a necessary and the next immediate step**.

This Two Year Coordinated Effort of

Snowmass + FESAC + Nat'l Academy Resulted in…

"I am pleased to announce today, that President Bush has decided that the United States will join the international negotiations on ITER."



Secretary of Energy Spencer Abraham
30 January 2003

…we know that this experiment is a crucial element in the path forward to satisfying global energy demand.

President Bush has faith in American science. And he knows the huge energy challenges for the United States and for the world that fusion science seeks to tackle.

And let me tell you, he is not one for taking baby steps when leaps are called for.

By the time our young children reach middle age, fusion may begin to deliver energy independence and energy abundance to all nations rich and poor. Fusion is a promise for the future we must not ignore.

But let me be clear, our decision to join ITER in no way means a lesser role for the fusion programs we undertake here at home. It is imperative that we maintain and enhance our strong domestic research program … at the universities and at our other labs.

the White House
President George W. Bush

For Immediate Release
Office of the Press Secretary
January 30, 2003

Statement by the President

I am pleased to announce that the United States will join ITER, an ambitious international research project to harness the promise of fusion energy. The results of ITER will advance the effort to produce clean, safe, renewable, and commercially-available fusion energy by the middle of this century. Commercialization of fusion has the potential to dramatically improve America's energy security while significantly reducing air pollution and emissions of greenhouse gases.

The United States will be working with the United Kingdom, other European Union nations, Russia, China, Japan and Canada on the creation of ITER. Today, I am directing the Secretary of Energy to represent the United States at the upcoming ITER meetings in St. Petersburg, Russia. We welcome the opportunity to work with our partners to make fusion energy a reality.

Hydrogen Fuel Initiative Can Make "Fundamental Difference" for the Future

Remarks by the President on Energy Independence

President George W. Bush
6 February 2003

…I believe we can lead the world for creating a market for hydrogen. We're also going to work to produce electricity and hydrogen through a process called fusion. Fusion is the same kind of nuclear reaction that produces -- that powers the sun. The energy produced will be safe and clean and abundant. We've spent quite a bit of money, as the senators here will tell you, on whether or not fusion works. And we're not sure if it will be able to produce affordable energy for everyday use. But it's worth a try. It's worth a look. Because the promise is so great.

So the United States will work with Great Britain and several European nations, as well as Canada, Japan, Russia and China, to build a fusion test facility and create the largest and most advanced fusion experiment in the world. I look forward to working with Congress to get it funded. I know you all have considered this in the past.

It's an incredibly important project to be a part of. Imagine a world in which our cars are driven by hydrogen and our homes are heated by electricity from a fusion power plant. It'll be a totally different world than what we're used to. The quality of life will be advanced. And people will say, gosh, I'm glad those folks went to Washington and were willing to think beyond the current…have a vision for what is possible.

Back to Reality…

The FY04 Budget Submission

FY 2004 Fusion Energy Sciences Congressional Budget Request

	FY 2002	FY 2003 Cong.	FY 2003 Feb. Fin Plan	FY 2004 Cong.
Science	134.3*	142.6	144.0	144.7
Facility Operations	70.8	78.6	67.0	87.7
Enabling R&D	36.0	36.1	37.5	24.9
OFES Total	*241.1*	*257.3*	*248.5*	*257.3*
DIII-D	50.9	55.6	52.3	56.6
C-Mod	17.6	22.3	19.2	22.8
NSTX	28.0	33.1	30.4	35.2
NCSX (MIE)	5.4**	11.0	11.7	16.7

*Without SBIR
**Operating Only

Fusion Energy Sciences

The President has decided the U.S. should join negotiations to build ITER to provide a sustained, burning plasma experiment

ITER ($12M for new direct expenses related to ITER participation, are redirected within the Science Technology and Facilities operations subprograms)

Science ($144.7M, $+2.1M)

- Broad consensus that a burning plasma experiment is the next step (FESAC, NRC, SEAB)
- Conduct ITER-specific experiments on DIII-D and C-MOD
- Refocus SciDAC on an integrated simulation project supporting burning plasma physics
- Establish fusion plasma science "Centers of Excellence"
- Curtail international collaborations in order to support ITER
- QPS design efforts continue

Facilities Operations ($87.7M, $+9.1M)

- Operate 3 national facilities at 84% of full utilization
- Increase funding for NCSX MIE project, as planned, to complete final design and procure long lead items
- Support ITER transitional activities

Enabling R&D ($24.9M, $-11.2M)

- Focus plasma technology on needs of ITER
- Curtail longer range technology activities, in particular chamber technologies, in order to focus on directly supporting preparations for ITER construction and experiments
- **Redirect FIRE and other advanced design efforts to ITER transitional activities**

Fusion Program Elements Addressing ITER Needs

Elements	FY 2004 Resources
DIII-D Experimental Program	$5,000,000
Alcator C-Mod Experimental Program	2,000,000
Fusion Plasma Theory and Computation (SciDAC)	3,000,000
ITER Preparations	2,000,000
Total	*$12,000,000*

Fusion Energy Sciences

(B/A in Millions)

	FY 02 Actual	FY 03 Cong.	FY 2003 Feb. FP	FY 2004 Cong.
Science				
Tokamak Experimental Research	45.4	55.0	53.9	52.9
DIII-D	23.7	22.7	23.6	23.3
Alcator C-MOD	7.5	8.5	7.4	8.5
International Tokamaks	4.4	4.4	4.7	3.2
Other	2.7	5.8	5.0	4.3
Tokamak Experimental Plasma Research	3.1	3.2	3.1	3.1
Diagnostics	4.0	4.0	3.9	3.9
SBIR/STTR (Science)	0.0	6.4	6.2	6.6
Alternative Concept Experimental Research	52.4	50.9	53.4	52.2
NSTX	12.8	13.7	14.2	16.0
Experimental Plasma Research (Alts)	26.0	23.4	26.3	22.7
Inertial Fusion Energy (Science)	13.6	13.8	12.9	13.5
Theory	27.6	27.6	27.8	28.5
Fusion Plasma Theory	24.1	24.6	24.5	25.2
Advanced Computing	3.5	3.0	3.3	3.3
General Plasma Science	8.9	9.1	8.9	11.1
Subtotal Science	**134.3**	**142.6**	**144.0**	**144.7**
Facility Operations				
Tokamak Fusion Test Reactor	15.8	0.0	0.0	0.0
DIII-D	27.2	32.9	28.7	33.3
Alcator C-MOD	10.1	13.8	11.8	14.3
NSTX	15.2	19.4	16.1	19.2
NCSX	0.0	11.0	7.6	15.9
QPS MIE	0.0	0.0	0.0	0.0
GPP/GPE/ORNL Move	2.5	1.5	2.8	3.0
Burning Plasma Experiment	0.0	0.0	0.0	2.0
Subtotal Facility Operations	**70.8**	**78.6**	**67.0**	**87.7**
Enabling R&D				
Engineering Research	28.8	28.5	29.8	17.3
Plasma Technologies	12.0	12.1	12.3	14.0
Fusion Technologies	10.6	10.9	11.1	1.3
TSTA	3.0	2.9	2.9	0.0
MFE	5.1	5.4	5.0	0.8
IFE	2.5	2.6	3.2	0.5
Advanced Design and Analysis	6.2	5.5	6.4	2.0
MFE	5.1	5.3	5.4	2.0
IFE	1.1	0.2	1.0	0.0
Materials Research	7.2	7.6	7.7	7.6
Subtotal Enabling R&D	**36.0**	**36.1**	**37.5**	**24.9**
Total Fusion Energy Sciences Program	**241.1**	**257.3**	**248.5**	**257.3**
Recap				
Tokamak Fusion Test Reactor	15.8	0.0	0.0	0.0
DIII-D	50.9	55.6	52.3	56.6
Alcator C-Mod	17.6	22.3	19.2	22.8
NSTX	28.0	33.1	30.3	35.2
NCSX	5.4	11.8	11.7	16.7
IFE	17.2	16.6	17.1	14.0
Science	13.6	13.8	12.9	13.5
Enabling R&D	3.6	2.8	4.2	0.5

02/03/03

Analysis of the FY02 to FY04 Fusion Budget

Where did the money come from?

In FY02 the actual as spent fusion budget was 241.1M and it included 15.8M in TFTR D&D and 3.0M in the TSTA(tritium test facility). In FY04 the requested money was 257.3M with the TFTR D&D and TSTA program now set to 0, generating 16.2M in new funding and 18.8M in “freed-up” funds from the roll-off from TFTR D&D and TSTA, for a total of 35M. However, we must subtract 6.6M for SBIR programs that were off-budget in FY02 and were put into our budget in FY03, for a **net total of $28.4 million** available or about 12% of our FY02 funding level.

Where did the money go?

The $28.4 million in "new" money largely was applied to two major initiatives that were strongly recommended by the community through FESAC:

(1) Operate our major facilities (DIII-D, C-Mod, NSTX) at near full utilization.
(2) Construct the NCSX proof-of-principle compact stellarator at PPPL.

In FY02 we spent a total of 96.5M on our three major facilities, and the FY04 request includes a total of 114.6M to operate each of the three for 21 run weeks per year, costing **18.1M in additional funding**.

In FY02 we spent a total of 5.4M on NCSX design and the FY04 request includes a total of 16.7M to proceed with construction, costing **11.3M in additional funding**.

The total additional annual cost of these two major initiatives is 29.4M, or <u>1M more than we had</u> available from the TFTR roll-off and funding increases. In addition to these two major items, there were several smaller upticks from FY02 to FY04 totaling **4.7M in additional funding**:

(1) A new theory/computation center increased General Plasma Science 2.2M
(2) Experimental Plasma Research (largely MST moving to PoP funding level) increased 2.1M
(3) Materials research increased 0.4M

Taken together, **we 'overspent' the 28.4M by 5.7M**. So to balance the budget at 257.3M for FY04, several technology programs were drastically cut in the proposed FY04 budget. Fusion Technologies was cut 4.3M and Advanced Design and Analysis was cut 2.1M, for a total of $6.4M. In addition 2M was redirected from FIRE to ITER.

Within round-off error and small 0.1M deltas up and down in program sub-elements, this is the basic story of why we are in such trouble.

Why didn't we have this problem in FY03 when the budget was also $257.3 million?

If we perform the same analysis as above we get the same cost drivers, primarily the increase in major facility operations and the ramp-up of NCSX, but the numbers are smaller and the books balance.

In FY02 we spent a total of 96.5M on our three major facilities, and the FY03 request includes a total of 111.0M to operate each of the three for 21 run weeks per year, costing **14.5M in additional funding**.

In FY02 we spent a total of 5.4M on NCSX design and the FY03 request includes a total of 11.8M to begin construction, costing **6.4M in additional funding**.

The total cost increase of these two major initiatives is 20.9M. Since the 2.9M cost of TSTA was still carried on the books in FY03 that resulted in 4.6 M in funding still available for allocation from the TFTR roll-off and funding increases. This covered the smaller increases in Experimental Plasma Research for MST and an undefined uptick in the 'Other' category under Tokamak Experimental Research of 3.1M. The overall budget was balanced without the need to raid the technology programs.

The big changes from the FY03 request and the FY04 request that drove the devastating cuts of 6.4M in the fusion technology programs are due to the 3.6M increase (basically inflation) for operating the major facilities, the 4.9M increase for NCSX construction, and the 2.1M increase for the new theory/computational center.

FY 2003 Appropriations Omnibus Bill

Energy and Water Appropriations Subcommittee, February 20, 2003

"Fusion energy sciences.--The conference agreement includes $250,000,000 for fusion energy sciences, an increase of $1,505,000 over fiscal year 2002. The conferees note that the fiscal year 2002 funding level included $19,604,000 for the completion of decontamination and decommissioning of the Tokamak Fusion Test Reactor (TFTR), leaving $228,891,000 available for fusion research and facility operations in fiscal year 2002. By comparison, the conference agreement for fiscal year 2003 makes this $19,604,000, plus an additional $1,505,000, available for fusion research and facility operations, an increase of 9.2 percent over the comparable amount available in fiscal year 2002.

Within the funding available for fusion energy sciences, the Department should make additional funding of $1,500,000 available to the Princeton Plasma Physics Laboratory to support the National Spherical Torus Experiment (NSTX) research, NSTX operations, and preliminary design for the National Compact Stellarator Experiment (NCSX). Within available funding, the Department should report back to the Appropriations Committees no later than August 1, 2003, with an evaluation of the ``fast ignition'' concept and with any recommendations regarding the schedule and milestones of the High Energy Density Physics Program. "

Joint News Release

CHINA AND THE U.S. JOIN ITER NEGOTIATIONS
Site assessment shows all four potential locations meet ITER criteria

St. Petersburg, Russia, February 19, 2003 –An historic milestone was achieved at the Eighth ITER Negotiations Meeting, when delegations from the People's Republic of China and the United States of America joined those from Canada, the European Union, Japan and the Russian Federation in their efforts to reach agreement on the implementation of the ITER international fusion energy research project. St. Petersburg, Russia, celebrating its 300th anniversary this year, was the site of the Meeting. Mr. Igor Borovkov, First Deputy Minister of the Russian Federation on Atomic Energy, welcomed all the delegates, noting the significance of the addition of China and the United States to the Negotiations.

In their opening statements, the Heads of Delegation of both China and the United States declared their countries' commitment to developing fusion energy as a potential source of safe, secure and environmentally friendly energy. Delegations fully endorsed and welcomed the entry of China and the United States to the Negotiations noting the significant domestic fusion programmes of both.

The Head of the Chinese Delegation indicated that China, as the largest developing country in the world, has a great need to pursue alternative energy sources. China believes that ITER can potentially lead to new forms of energy and contribute to the peaceful and sustainable development of the world in the long-term. China expressed its strong wishes to be a valuable member of the ITER family, to make joint efforts with other partners to the successful exploitation of fusion energy.

The United States Head of Delegation noted that President Bush announced on January 30, 2003 that the United States would join ITER. In his statement, the President said: "The results of ITER will advance the effort to produce clean, safe, renewable, and commercially-available fusion energy by the middle of this century." The US remarked on the extensive reviews undertaken by their scientific and technical communities in arriving at the conclusion to join the ITER Negotiations.

To express support of the community for the Canadian host site, the Canadian Delegation included John Mutton, the Mayor of the Municipality of Clarington and Roger Anderson, Chair of the Region of Durham. Mayor Mutton emphasized the excellent technical and socio-cultural characteristics of the Canadian site and the enthusiasm of the local community to host ITER.

The EU Delegation informed that France has confirmed at the level of Prime Minister Raffarin its offer of hosting ITER in Cadarache as the European site, taking advantage of the well-known scientific, technical and socio-economic environment. The local authorities have expressed, in partnership with the government, their strong commitment on financial, educational, cultural and all other aspects to provide the best working and living conditions. The EU Delegation also informed that the Spanish Secretary of State for Science and Technology, Mr. Morenès headed an official delegation to meet with Commissioner Busquin to personally re-iterate the firm

Vandellos. Announcement was also made of the important step of starting the official licensing procedure for ITER in Spain two months in advance of the previously presented schedule.

The Head of Japanese Delegation reported that Prime Minister Koizumi visited Russia on 10th and 11th January and he referred to the importance of ITER both in the Summit meeting with President Putin and in his speech at the Kurchatov Institute. Also, Mr. Kimura, Governor of Aomori Prefecture, attending the meeting, promised to establish an international school and stressed on the recent and future improvement of public transportation, including an extension of a bullet train line and planned direct flights from Narita to Aomori.

The Negotiators approved the Report on the Joint Assessment of Specific Sites. It was completed within the framework of the Negotiations following detailed reviews and visits to all four potential locations: Clarington in Canada; Cadarache in France; Vandellos in Spain; and, Rokkasho-mura in Japan. The Report confirms that all four sites meet the criteria established for the location of the ITER project, although there are different strengths and weaknesses for each site. The Report can be found on the ITER Website (www.iter.org/jass).

Delegations discussed the possible approach to decision making and agreed to step forward by concentrating on the essential elements for decision making enthusiastically, in order to conclude the agreement and to start constructing ITER as soon as possible.

The addition of the new Participants will be of great benefit to the project, enhancing the prospects for its early success in developing fusion as a future energy source. The entry of the new Participants has increased the momentum, and this will result in the acceleration of the decision-making process.

The Ninth Negotiations Meeting will be held on 20-21 May 2003, in Vienna, hosted by the European Union and the International Atomic Energy Agency.

Fusion Energy Sciences Advisory Committee Meeting
March 5-6, 2003
Agenda

AgendaMar03Rev07

Time	Topic	Speaker
3/5 AM		
0900	Welcome/Meeting Logistics	Hazeltine
0905	DOE Perspective	Orbach
1000	OFES Perspective	Davies
1045	Break	
1100	Report on Developing Industrial Cost Estimates for ITER systems of possible interest to the US	Sauthoff
1115	Discussion of US Participation in ITER	FESAC
1230	Lunch	

Fusion Energy Sciences Advisory Committee Meeting
March 5-6, 2003
Agenda

Time	Topic	Speaker
3/5 PM		
1330	Discussion	FESAC
1500	Public Comments	TBD
1530	Break	
1545	Report from the Development Path Panel including facilities needs	Goldston
1645	Discussion of the Development Path and the Facilities Needs	FESAC
1730	Adjourn	

Fusion Energy Sciences Advisory Committee Meeting
March 5-6, 2003
Agenda

Time	Topic	Speaker
3/6 AM		
0900	Resume Discussion	FESAC
1000	Public Comments	TBD
1030	Break	
1045	Resume Discussion	FESAC
1200	Adjourn	