

Fusion Energy Science Program Priorities

by
T.S. Taylor

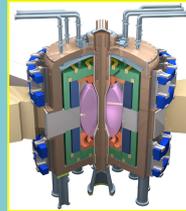
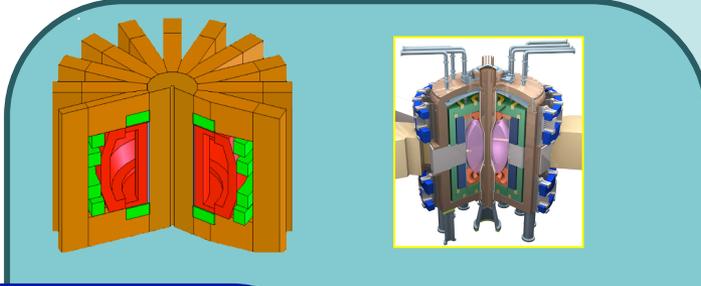
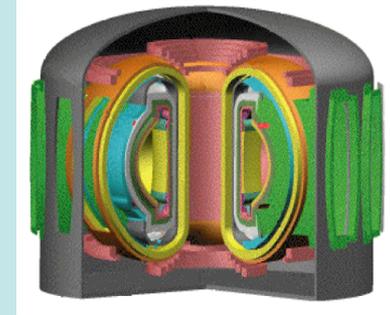
Presented to the
**FESAC Subcommittee on
MFE Priorities
Bethesda, Maryland**

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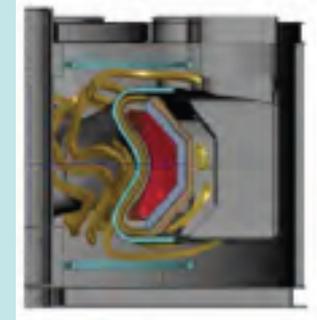
Identified Steps to Fusion Energy Are Founded on Strong Scientific Base

Excellent Science and Innovation are strengths of the U. S. Magnetic Fusion Program

DEMO
net electricity



FNSF
materials
fuel cycle



ITER
high gain
BP Physics

Strong Scientific Base

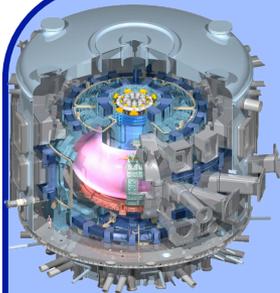
Plasma science
Theory/modeling

Engineering Science
Students

Innovative Experiments,
Workforce

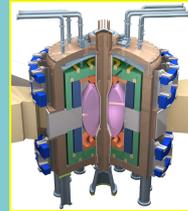
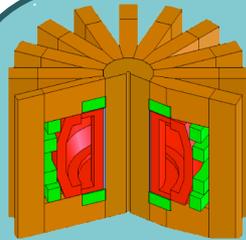
Identified Steps to Fusion Energy Are Founded on Strong Scientific Base

It is time to move forward to energy development



ITER

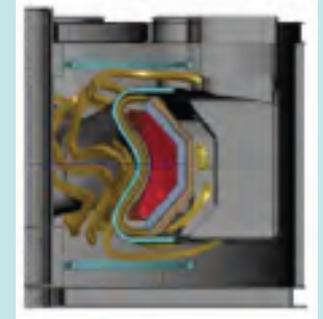
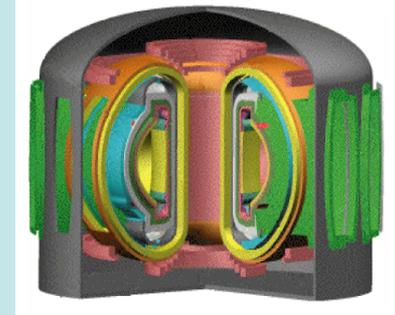
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Strong Scientific Base

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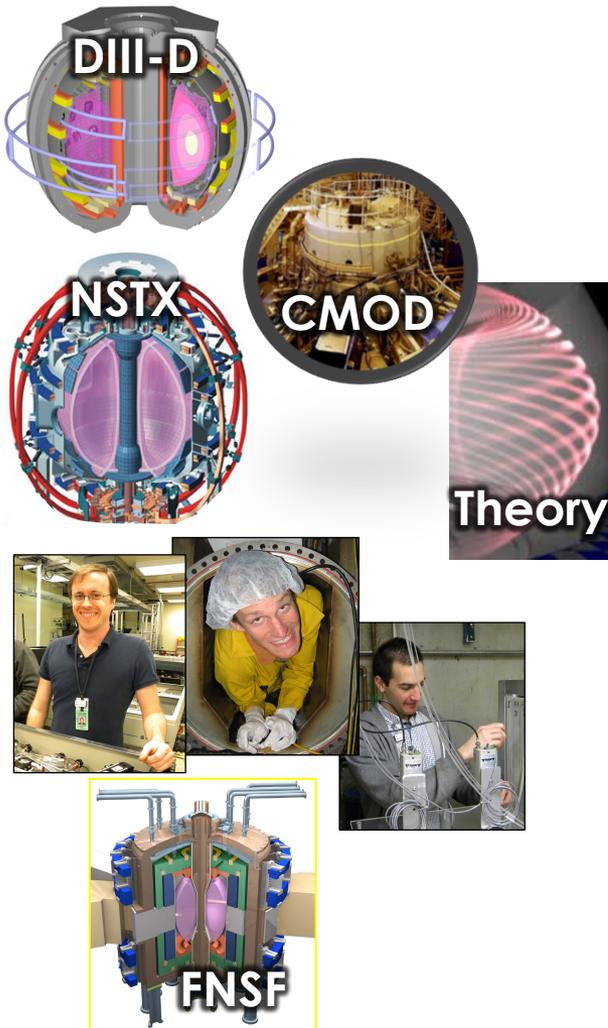
Developing MFE Priorities: Guiding Principles

Overarching Theme
Progressing from Scientific Excellence
to Fusion Energy Research and Development

- **Maintain high level of scientific excellence, as a part of an integrated fusion energy program**
- **Accelerates development of fusion energy: make progress now**
- **Directly supports ITER: physics and design solutions, operations**
- **Supports FNSF: design choice, physics basis**
- **Utilizes unique capabilities of U. S. Fusion Program**
- **Advances U. S. leadership in key areas to enable fusion energy**
- **Leverages international collaboration:
*contributes to ... and benefits from...***

A Strong Domestic Program Positions the U.S. to Produce Fusion Energy

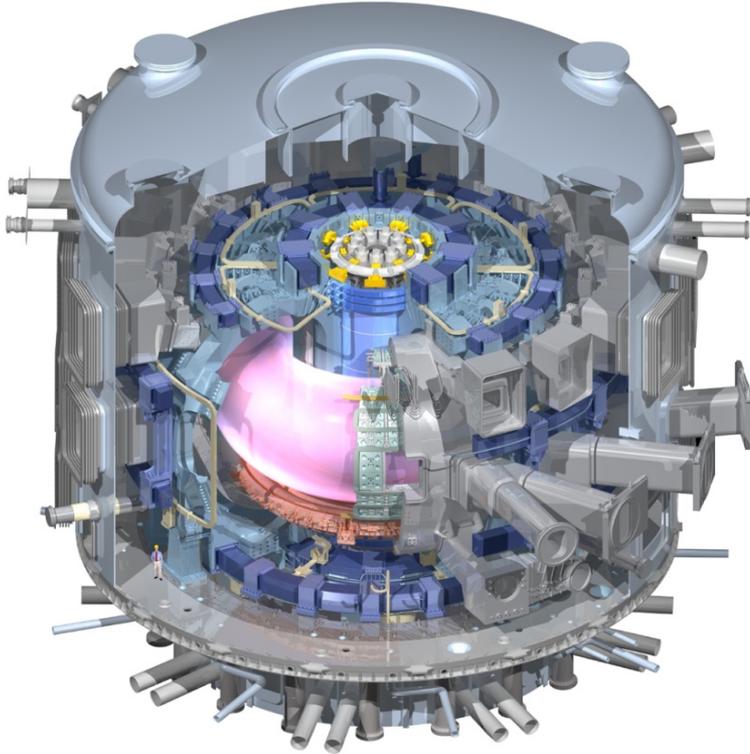
Essential elements for U.S. Leadership



- **Experiments**
 - Develop physics and design solutions for ITER and FNSF
 - Relevant experiments and innovation provide basis for distinctive U.S. leadership
- **Theory/Simulation**
 - Validated basis for confident extrapolation to future devices
- **Workforce:**
 - Develop U.S. experts to take leadership roles
- **Fusion Nuclear Science Program:**
 - Develop fusion materials and nuclear technology needed for fusion energy

Burning Plasma Research In ITER Is the Top Priority On the Path to Magnetic Fusion Energy

The Success of ITER should be the number 1 priority of the non-ITER MFE Research Program



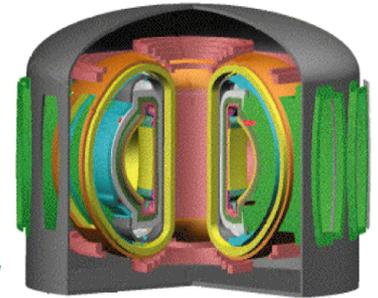
- **Provide critical physics and design solutions**
- **Develop operational scenarios to meet ITER goals and other facilities**
- **Grow physics capability to exploit new science and take leading positions on ITER**
- **Provide confidence in ITER projections**
- **Train a talented workforce to support and exploit ITER**

“to demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes”

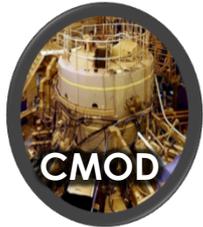
Tokamak Path to Fusion Energy: Informs Priority Choices

Fusion Nuclear Science Facility (FNSF) challenges:

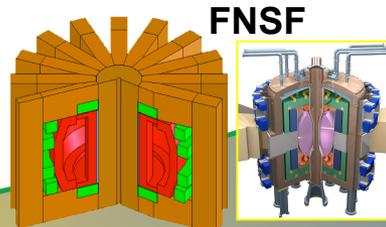
- High performance, steady-state operation
- Makes its own fuel
- Materials for extreme environments



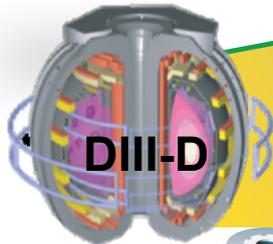
Power Plant



CMOD



FNSF



DIII-D



NSTX



ITER

ITER

- High Energy gain, $Q > 10$
- Science of burning plasmas
- Technology development for fusion

Comments on Budget Priorities

- **FY 13 level, ~\$250 M**
 - A priority should be to increase productivity/experimental time for operating U. S. facilities: present total is 10 weeks/yr for all 3 facilities
- **FY 12 level ~ \$300M**
 - Increase operation time on U. S. facilities
 - Upgrade to U. S. experimental facilities to enable high priority research in support of ITER and FNSF
 - Fund conceptual design work for FNSF
 - Provide targeted theory support to address key ITER & FNSF Issues
- **Program in Fusion Materials Science and Harnessing Fusion Power > \$375M**
 - Provide funding for engineering design of FNSF
 - Provide funding for a linear plasma device for materials evaluation
 - Develop a program in nuclear irradiation of materials, starting with existing sources
 - Fund a program in breeding blanket technology
 - Engage BES to develop “materials by design” for fusion

Summary

U. S. MFE Program has excelled in establishing a strong scientific base for fusion energy

It is time to move forward with fusion energy

Success in ITER must be the # 1 priority of the non-ITER MFE program

A strong U. S domestic program is essential for the success of ITER and realizing fusion energy in the next decade