The charge for advice on strategic planning

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U.S. DEPARTMENT OF ENERGY
Office of Science

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The Office of Science needs your objective advice

- Congress has requested a strategic plan for fusion from DOE
- Request came in the Omnibus Appropriation in January 2014

Excerpts from the strategic plan charge letter

"The FY 2014 Omnibus Appropriations Act requires the Department to submit a strategic plan for the FES program by January 2015 with the following guidance:

> 'The ten-year plan should assume U.S. participation in ITER and assess priorities for the domestic fusion program based on three funding scenarios with the fiscal year 2014 enacted level as the funding baseline: (1) modest growth, (2) budget growth based only on a cost-of-living-adjusted fiscal year 2014 budget, and (3) flat funding. The January 2013 Nuclear Science Advisory Committee report on priorities for nuclear physics used similar funding scenarios and should serve as a model for assessing priorities for the fusion program.'"

Excerpts from the strategic plan charge letter (2)

"Based on this direction, we are asking FESAC to address the following three scenarios with the FY 2014 appropriation for the domestic program as the baseline ($305M):

1. Modest growth (use +2.0 percentage points above the published OMB inflators for FY 2015 through FY 2024)

2. Cost of living (use the published OMB inflators for FY 2015 through FY 2024)

3. Flat funding

We are also asking FESAC to consider a fourth scenario with the FY 2015 President's Request for the domestic program as the baseline ($266M):

4. Cost of living (use the published OMB inflators for FY 2015 through FY 2024)"

Excerpts from the strategic plan charge letter (3)

"We ask FESAC to assess the priorities among continuing and potential new FES program investments required to ensure that the U.S. is in a position to exert long term leadership roles within and among each of the following areas:

- *Burning Plasma Science: Foundations* – the science of prediction and control of burning plasmas ranging from the strongly driven to the self-heated state;

- *Burning Plasma Science: Long Pulse* – the science of fusion plasmas and materials approaching and beyond ITER-relevant heat fluxes, neutron fluences, and pulse lengths;

- *Discovery Plasma Science* – the study of laboratory plasmas and the high energy density state relevant to astrophysical phenomena, the development of advanced measurement for validation, and the science of plasma control important to industrial applications."

Excerpts from the strategic plan charge letter (4)

"You are to prioritize between the program elements defined for you by FES; your report may also include your views on new facilities, new research initiatives , and facility closures. FES interest in the study of driven as well as self-heated burning plasmas is motivated by the need to establish the scientific basis for advancing fusion nuclear science."

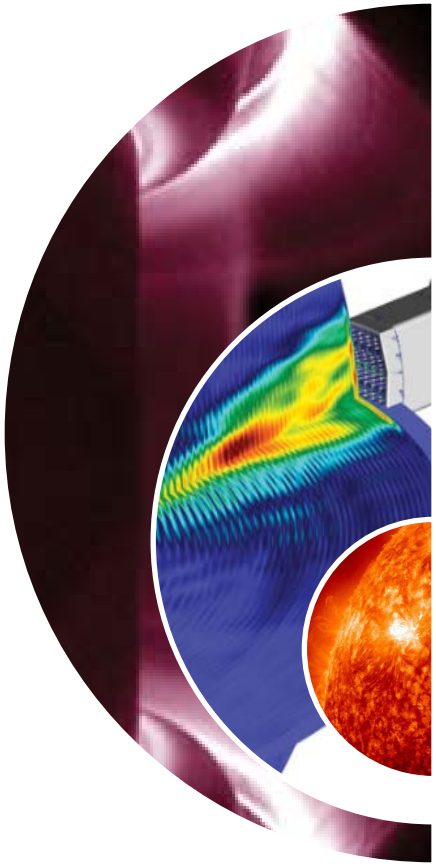
Excerpts from the strategic plan charge letter (5)

"Include in your report an assessment of the potential for strengthened or new partnerships with other federal and international research programs that may foster important scientific opportunities otherwise unavailable to U.S. fusion scientists. These may include partnerships to enable research in equilibrium sustainment of long pulses (hundreds of seconds and more), fusion neutron materials science, and multi-scale computing."

Some perspectives on U.S. fusion and planning

- *Maintaining the status quo – managing the elements we have if our spending power remains flat – is itself a risky path with guaranteed consequences*
- *The competition in the Office of Science is intense. Programs that grow are programs that promote change*
- *Scientific and intra-DOE isolation is a risky attribute that FES has lived with, both scientifically and politically. But smart leverage through partnerships can change this*
- *Scientifically: Our challenges are too deep, and the stakes are too high, to not use resources outside of our immediate sphere that could help advance the fusion cause.*
- *Politically: No one will help you fight for research dollars and defend you if they don't have a shared interest in and respect for your program*

Organizing along scientific topical lines can help align community interests with national mission needs



Burning Plasma Science

New budget structure being developed in FES

Foundations

Focusing on domestic capabilities; major and university facilities in partnership, targeting key scientific issues. Theory and computation focus on questions central to understanding the burning plasma state

Challenge: Understand the fundamentals of transport, macro-stability, wave-particle physics, plasma-wall interactions

Long Pulse

Building on domestic capabilities and furthered by international partnership

Challenge: Establish the basis for indefinitely maintaining the burning plasma state including: maintaining magnetic field structure to enable burning plasma confinement and developing the materials to endure and function in this environment

High Power

ITER is the keystone as it strives to integrate foundational burning plasma science with the science and technology girding long pulse, sustained operations.

Challenge: Establishing the scientific basis for attractive, robust control of the self-heated, burning plasma state

Discovery Science

Plasma Science Frontiers and Measurement Innovation

General plasma science, non-tokamak and non-stellarator magnetic confinement, HEDLP, and diagnostics

9

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Comparison of budget categories

Existing categories

SCIENCE
DIII--D Research
C-Mod Research
International Research
Diagnostics
Other (HBCU, Education, Outreach, Reserves, etc.)
SBIR/STTR
NSTX Research
Experimental Plasma Research
High Energy Density Lab Plasmas
MST Research
Theory
SciDAC
Fusion Simulation Program
General Plasma Science Research

FACILITY OPERATIONS
DIII--D Operations
C-Mod Operations
NSTX Operations
NSTX Upgrade MIE
Infrastructure/GPP/GPE
ITER Line Item

ENABLING R&D
Plasma Technology
Advanced Design Studies
Materials Research

Proposed new categories

BURNING PLASMA SCIENCE: FOUNDATIONS
Advanced Tokamak
Spherical Tokamak
Theory & Simulation
GPE/GPP/Infrastructure
BURNING PLASMA SCIENCE: LONG PULSE
Long Pulse: Tokamaks
Long Pulse: Stellarators
Materials and Fusion Nuclear Science
BURNING PLASMA SCIENCE: HIGH POWER
Line Item: US Contributions to ITER Project
DISCOVERY PLASMA SCIENCE
Plasma Science Frontiers
Measurement Innovation
SBIR/STTR and Other

10

Burning Plasma Science

Foundations

Advanced Tokamak (DIII-D, C-Mod) & Spherical Tokamak (NSTX) and university-scale AT's and ST's

- *Highly collaborative; strong university partnerships*
- *High scientific complementarity between these facilities*
- *High potential for growing student engagement on our nation's major fusion science experimental facilities*

Theory and Simulation

- *US strength in engaging with experiment to develop predictive understanding*
- *Essential if high-risk gaps in fusion are to be closed*
- *Leverages DOE investments in leadership-class computing resources*

11

Burning Plasma Science

Long Pulse

Long-Pulse Tokamaks, Long-Pulse Stellarators, and U.S. university stellarators

- *Using partnerships on international facilities where US expertise is valuable and desired*
- *Creating opportunities for continued US leadership this decade in areas critical to fusion science*
- *Generate access for our scientists and students to what are becoming leading research endeavors around the globe*

Materials and Fusion Nuclear Science

- *Presently the Enabling Technologies portfolio. Investments will enable US leadership in fusion nuclear materials science and plasma-material interactions*

12

Burning Plasma Science

High Power

US Contributions to the international ITER Project

- U.S. ITER Project requirements and plans
- Concerns and approach regarding the international project

ITER participation is taken as a given in this exercise, and as an organizing principle for the program

13

Discovery Plasma Science

Plasma Science Frontiers

- *General plasma science portfolio: FES stewardship of non-MFE plasma science areas*
- *High energy density laboratory plasma research: matter at extreme conditions*
- *Small/intermediate-scale MFE experimental research on self-organized plasmas: platforms for verification & validation, study plasma self-organization*

Measurement Innovation

- *High-impact R&D on new plasma diagnostic techniques*

14

Panel considerations

- Mark Koepke will chair the subpanel

- His tasks will include ensuring the panel is strong scientifically, has representation with leadership experience, and executes processes that minimize concerns about conflict of interest, while obtaining sound input from stakeholders

Thank you