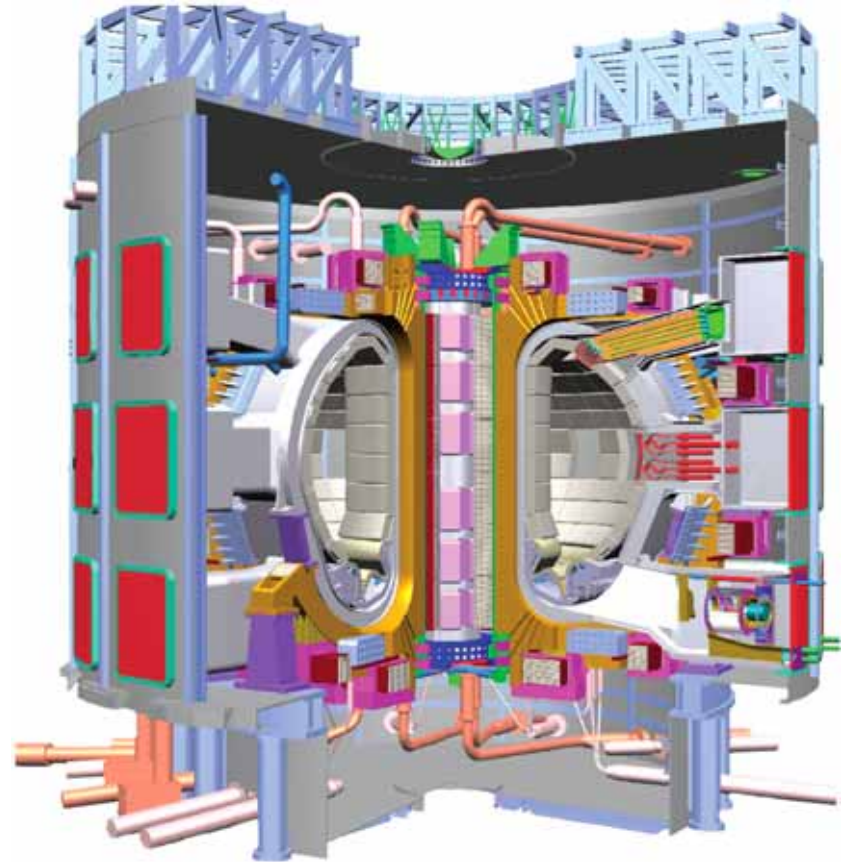

Status of Planning for ITER

Progress on Preparations

Fusion Power Associates Meeting
Gaithersburg, Maryland

Ned Sauthoff
December 13, 2004



Key Topics in this Preparatory Phase

- **Technical activities**
 - Addressing risk in US in-kind contributions and the project
- **International Project Organization**
 - Preparing for the ITER Organization's Construction Phase
- **US Domestic Agency**
 - Preparing to start US fabrication activities
- **US Burning Plasma Program**
 - Linking with the US Science and Technology Research Programs to enable effective design and research

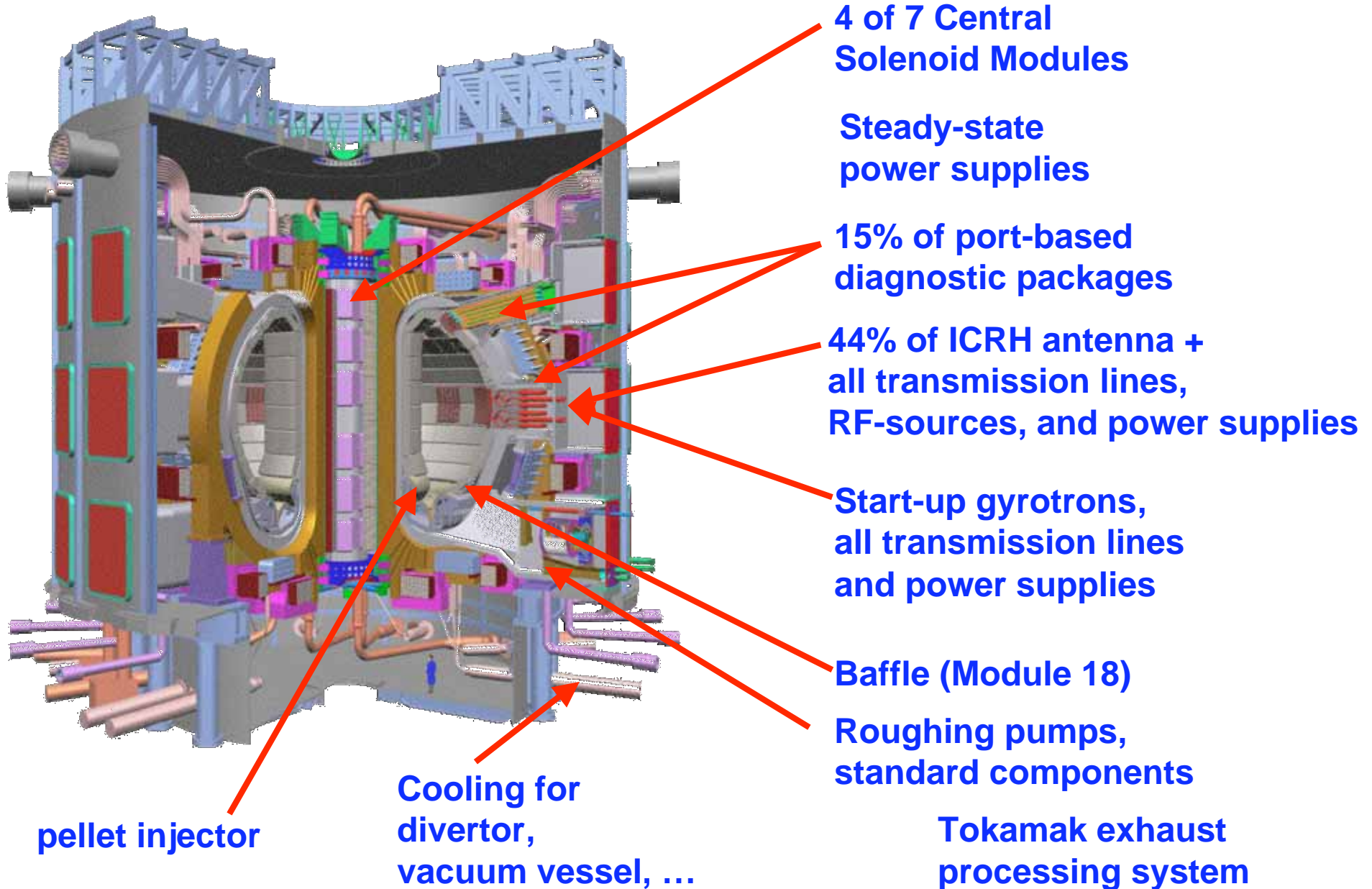
Key Topics in this Preparatory Phase

- **Technical activities**
 - Addressing risk in US in-kind contributions and the project
- **International Project Organization**
 - Preparing for the ITER Organization's Construction Phase
- **US Domestic Agency**
 - Preparing to start US fabrication activities
- **US Burning Plasma Program**
 - Linking with the US Science and Technology Research Programs to enable effective design and research

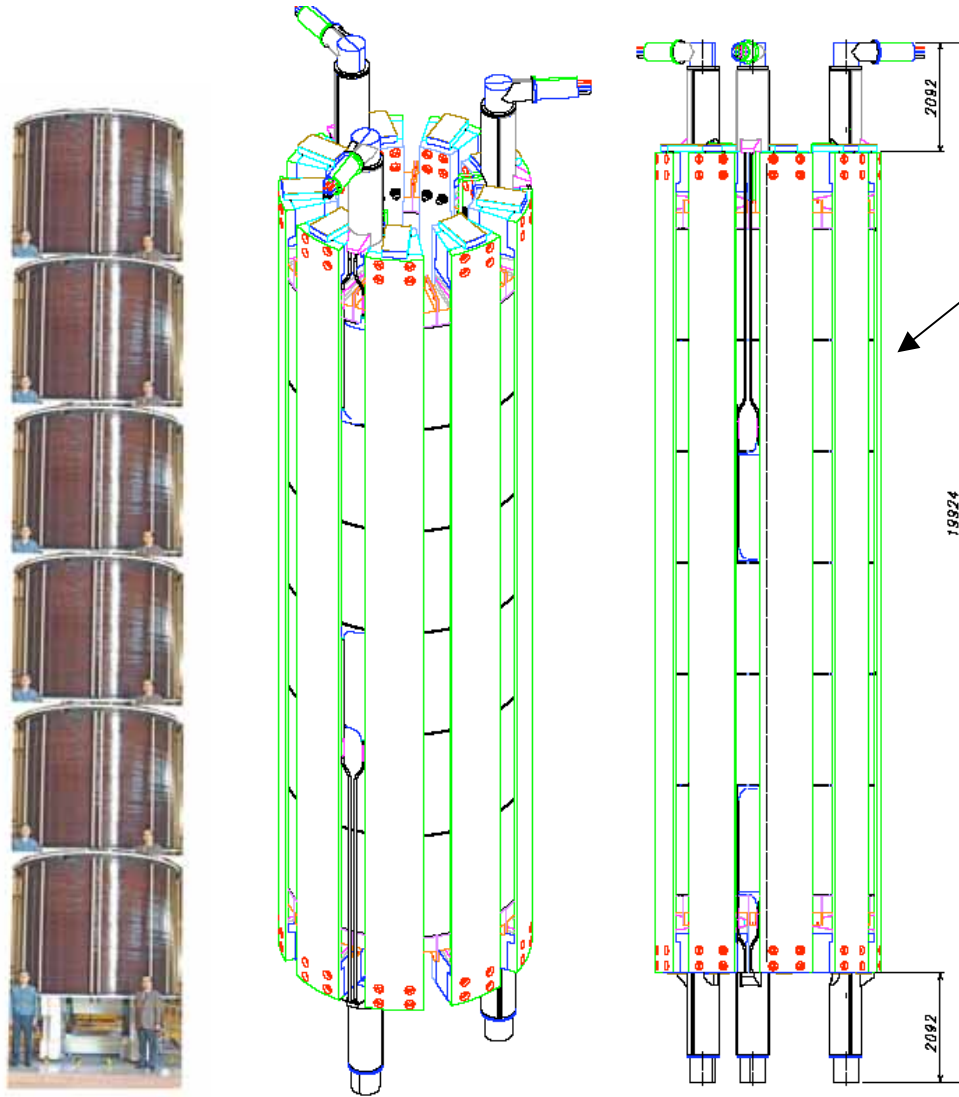
Technical Activities: ***addressing risk in US in-kind contributions and the project***

- **The International Team is updating the design documentation to enable an effective transition to the Central Team**
- **The US team is focusing on mitigating areas of risk in its provisionally-allocated in-kind contributions**
 - in partnership with the VLT in areas of mutual benefit
 - with ITER-Direct funding for industrial procurements, secondees, project staff
- **The US is acting on its position that management and tools are key to project success**

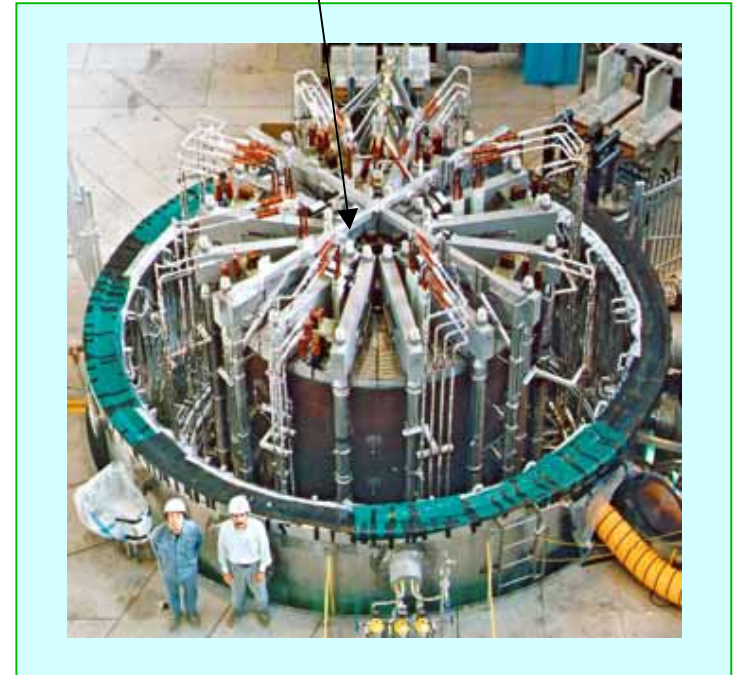
US In-kind Contributions to ITER



The US is provisionally responsible for 4 of 7 Central Solenoid Modules

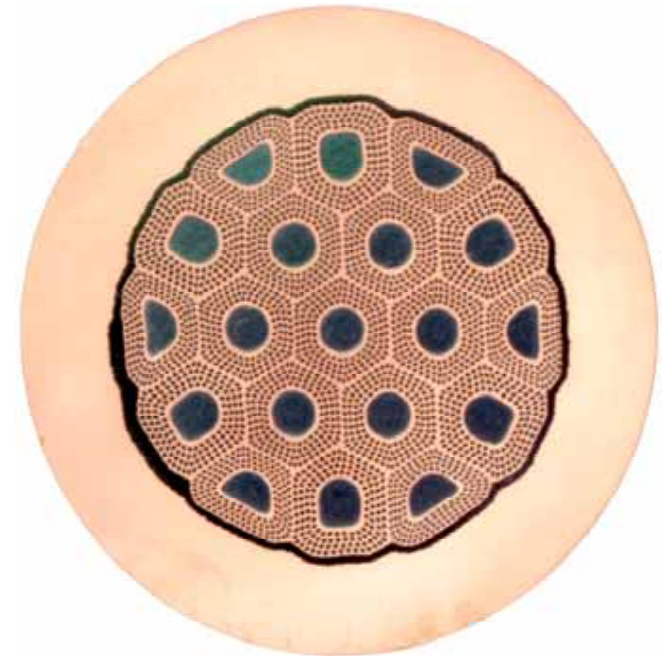


Each Module is slightly larger than the complete CS Model Coil



Qualification of industrial suppliers of Nb₃Sn strands with increased value of J_c (ITA 11-18)

- The US has placed contracts with several US strand vendors for the development and qualification of >100kg of superconducting strand meeting a US-proposed CS specification.
- Products are due in May 2005



Typical strand layout as proposed by OST. Diameter is ~0.8 mm.

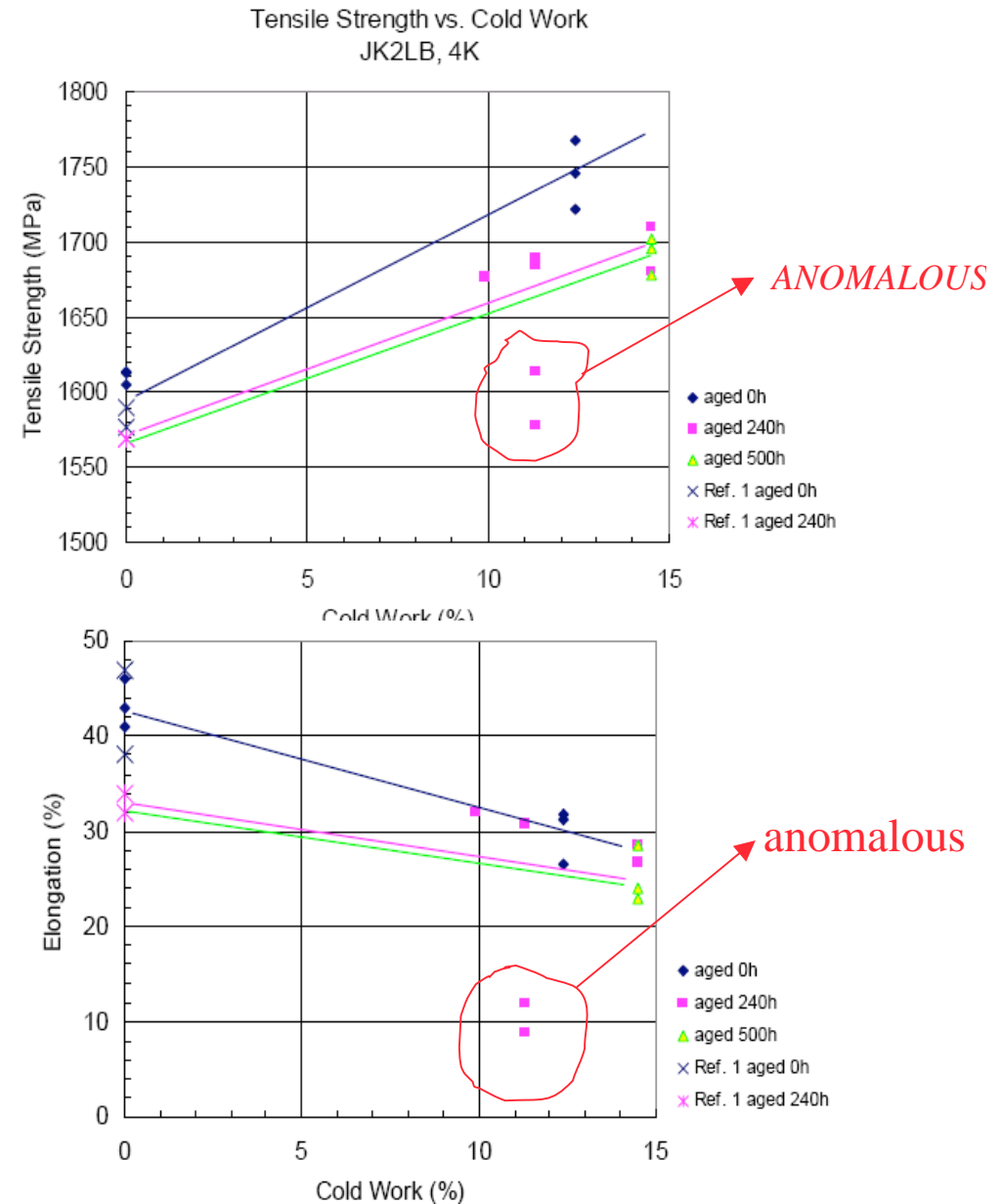
Conductor Performance and Design Criteria (ITA 11-22)

- Both SS- and Ti-jacketed samples are included to help understand effects of expansion-mismatch on conductor performance.
- Cable samples are undergoing testing in the Sultan facility.

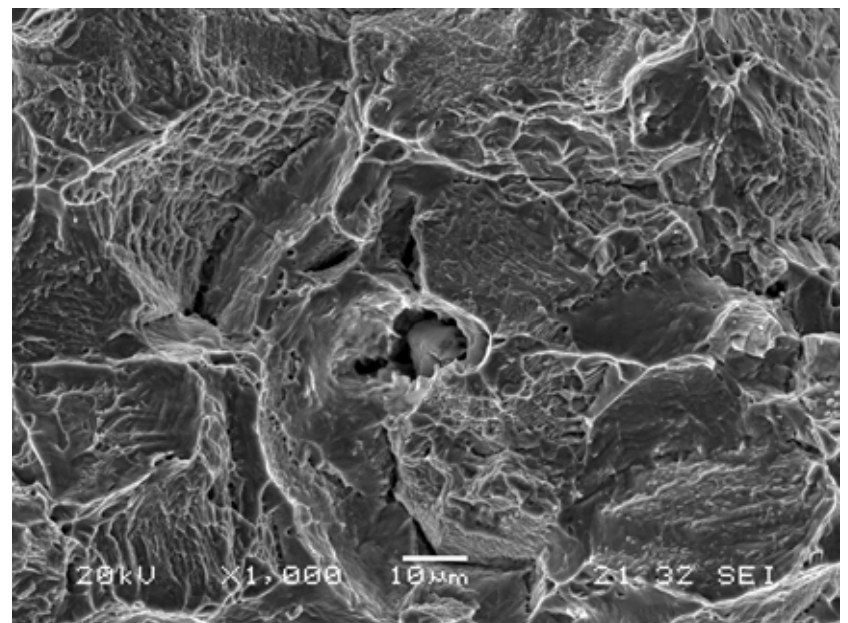
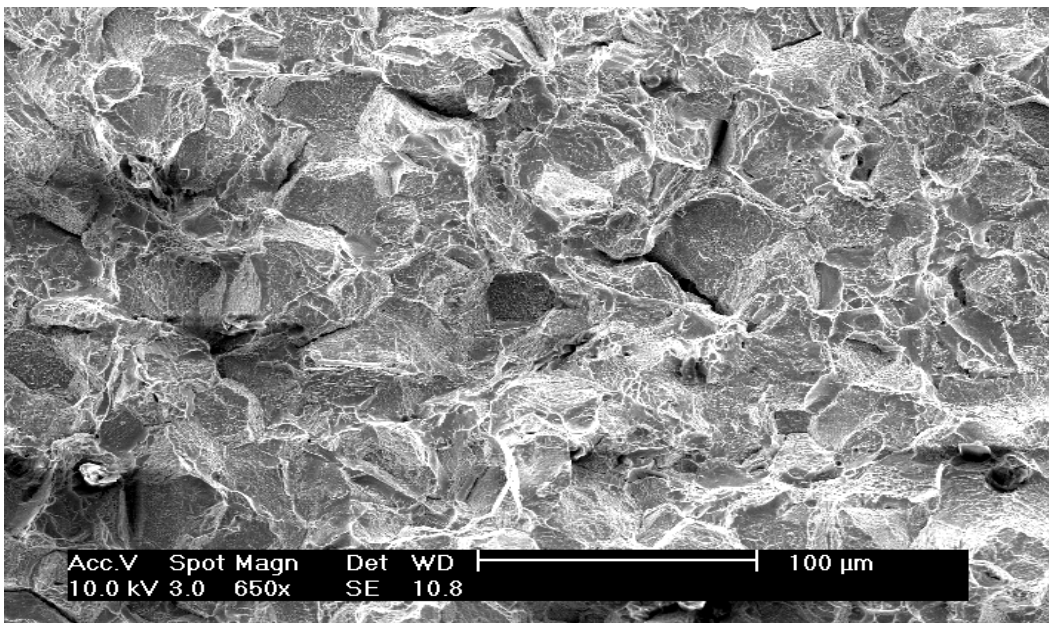
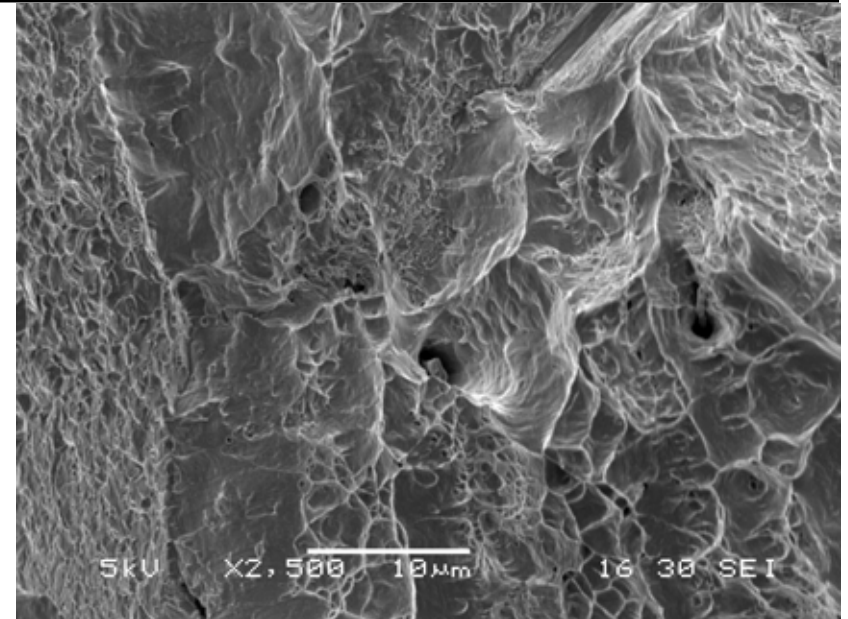
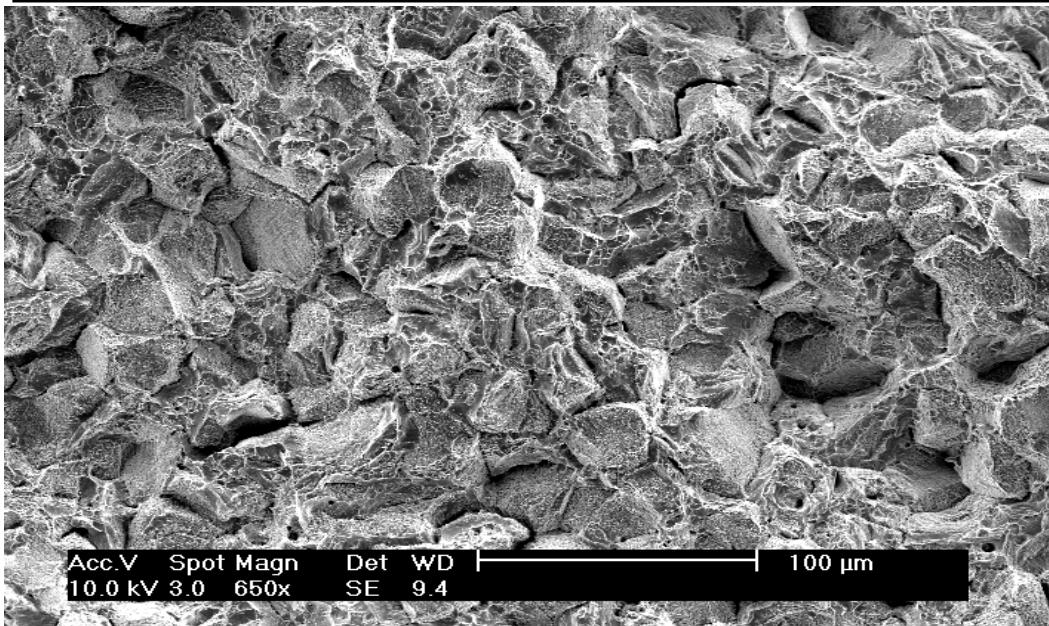


Recent studies of some stainless steels jacket materials

- **Tests underway:**
 - Tensile test at 4°K
 - Fatigue crack growth test at 4°K
 - Fracture toughness test at 4°K
- **JK2LB Exhibits Wide Variability in Mechanical Behavior: Tensile Ductility, Fracture Toughness and Extreme Notch Sensitivity-Toughness**
- **Unpredictability of Properties will Result in Unpredictable Behavior**
 - Crack Initiation
 - Crack Growth
 - (Appears to be a “Threshold” Effect Which Depends on Orientation and Constraint)
- **Extensive Characterization Is Required for Qualification**



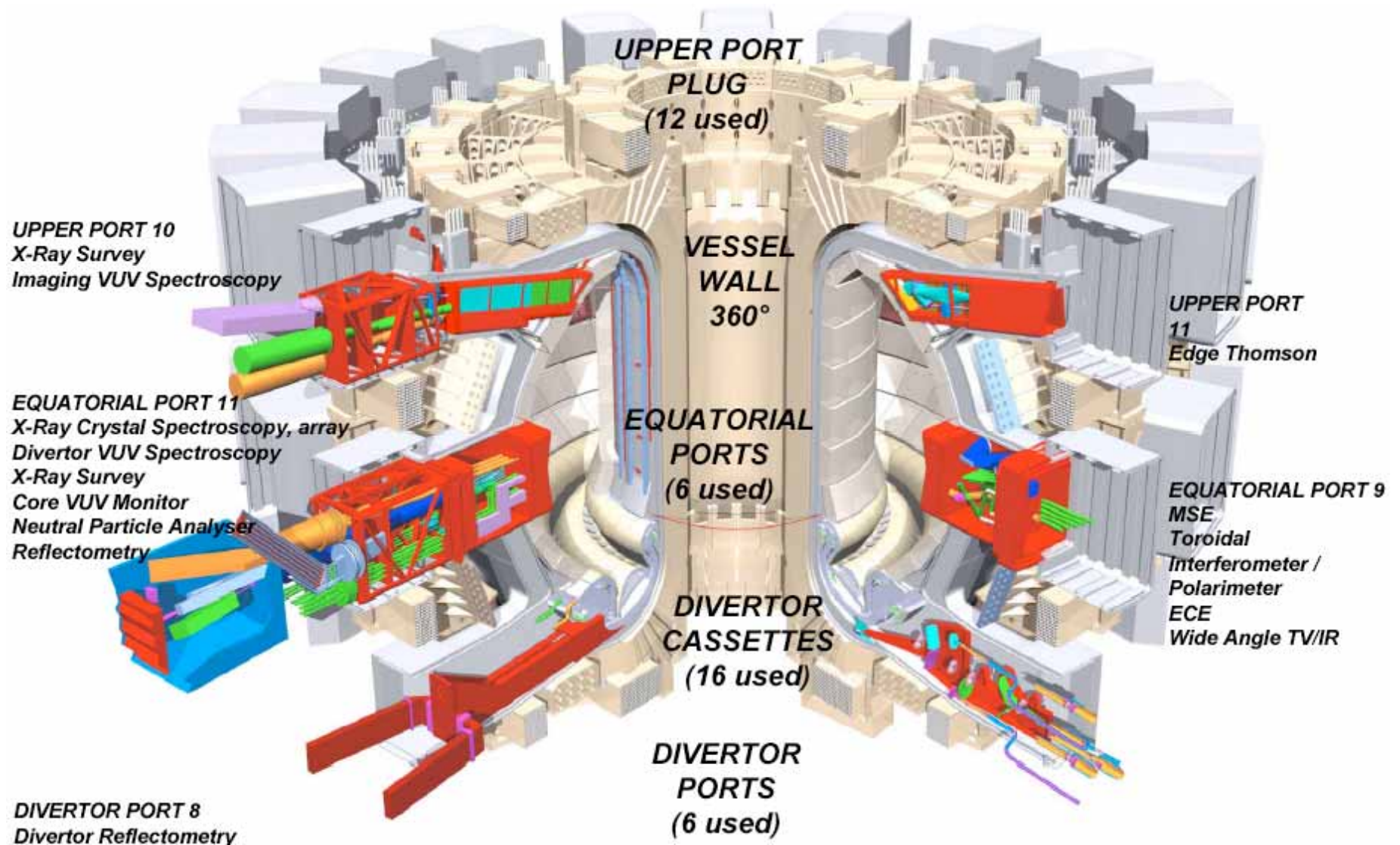
Fractographic studies of JK2LB to determine the mechanism (Ballinger et al. [MIT])



US First Wall Activity

- **Domestic R&D and Design (led by Sandia)**
 - Qualification of the FW panel fabrication methods and to establish the NDT method for the FW panel.
 - EM Analysis of modules and dynamic analysis of the key.
 - Detailed design of blanket modules and thermal hydraulic analysis of the shield block and the total blanket system.
 - Development of the welded joint for the first wall leg, suited for cut and re-welding in the Hot Cell
 - Analysis of erosion of the ITER first wall due to plasma impingement
- **Secondees for design**
 - Richard Nygren (Sandia), Tom Lutz (Sandia)

The US is expected to provide 2 Midplane-ports, 2 Upper-Ports, and 1 Divertor-port



Diagnosics

- **Diagnostic Working Group**

- Completed its recommendation on packaging of diagnostic allocations
- Port-based allocation was accepted by the International Team/Participant Team Leaders

- **Port-Plug Task Force**

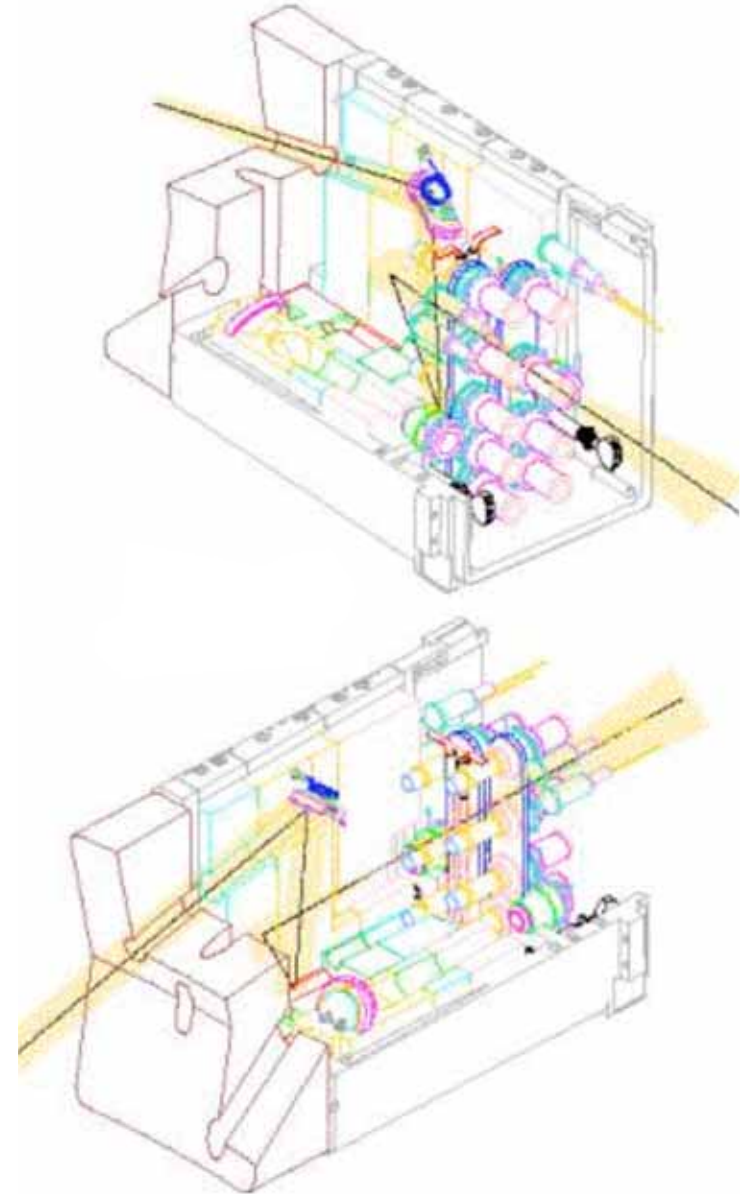
- Developing approaches to the design and integration of port-plugs

- **Diagnostic Design**

- Specifications of the diagnostic
- Integrated design of the instrument
- Component selection
- Integration in the Port-Plug

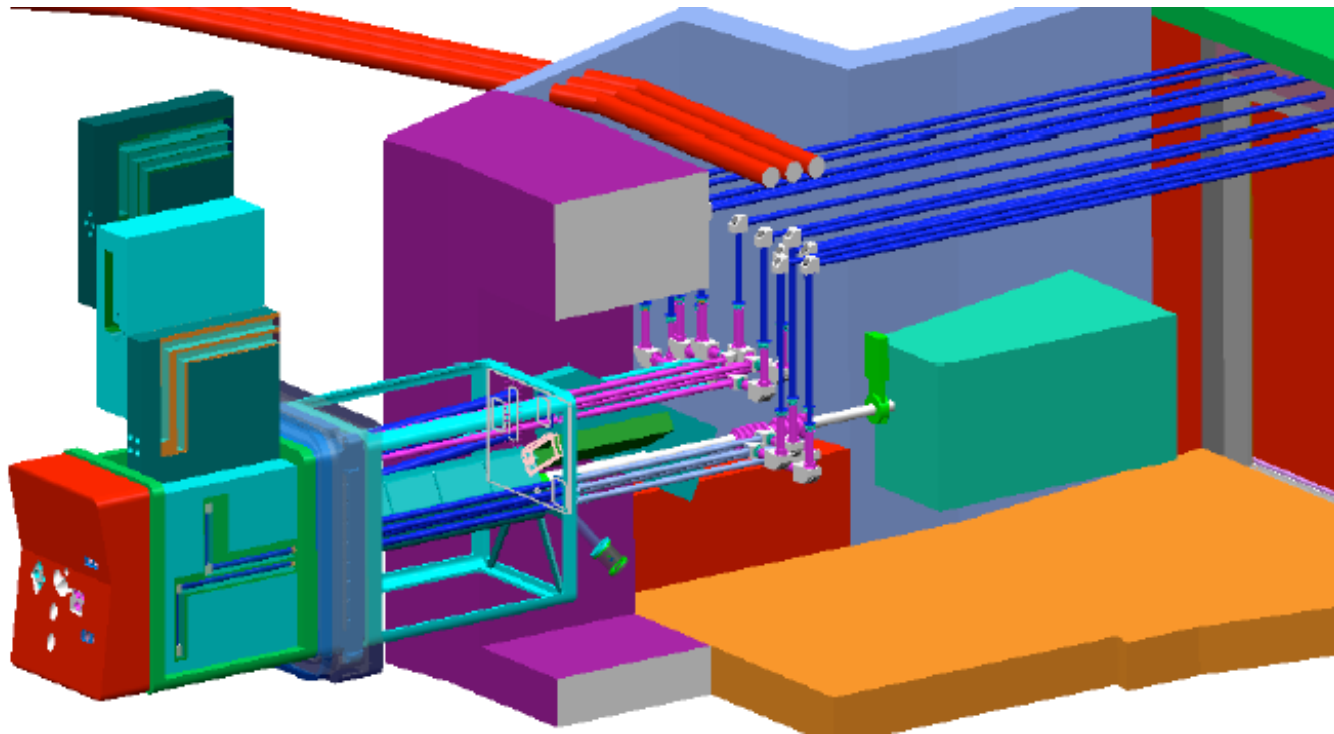
US-assigned Diagnostics (16% of total diagnostics)

- Visible/IR Cameras (upper)
- Reflectometer (main plasma – LFS)
- MSE
- ECE (main plasma)
- Interferometer (divertor)
- RGA



Main Plasma Reflectometer (LFS)

- X and O mode launchers provide SOL and pedestal density profiles, MHD mode information and density fluctuation measurements.
- Mature design, microwave system robust in ITER environment.



US Secondees

- **Magnets:**
 - Nicolai Martovetsky (LLNL), Philip Michael (MIT)
- **Blanket/First Wall:**
 - Richard Nygren (Sandia), Tom Lutz (Sandia)
- **Ion Cyclotron [IT Coordinators for IC]:**
 - David Swain (ORNL), Richard Goulding (ORNL)
- **Diagnostic Port Plug Design:**
 - Douglas Loesser (PPPL)
- **QA [Head of QA on the ITER International Team]:**
 - W. K. Sowder (INEEL)
- **Project Management:**
 - To be solicited

US Participation in ITER Working Groups

- **Magnet working groups**
 - CS Specification Committee: Timothy Antaya (MIT)
 - TF Structure Specification Committee: Peter Titus (MIT)
 - PF Insert Test Committee: Nicolai Martovetsky(LLNL)
- **Diagnostic Port-Plug Task Force (following Diagnostic Working Group)**
 - Réjean Boivin (GA)
 - Mike Cole (ORNL)
 - Steve Allen, Douglas Dobie (LLNL)
- **Tritium Plant Integration Group**
 - Scott Willms (LANL)
- **Materials Properties Handbook special working group**
 - Arthur Rowcliffe, Steve Zinkle (ORNL)
- **Test Blanket Working Group**
 - Mohamed Abdou (UCLA)
 - Dai-Kai Sze (UCSD)
 - Michael Ulrickson (SANDIA)

Key Topics in this Preparatory Phase

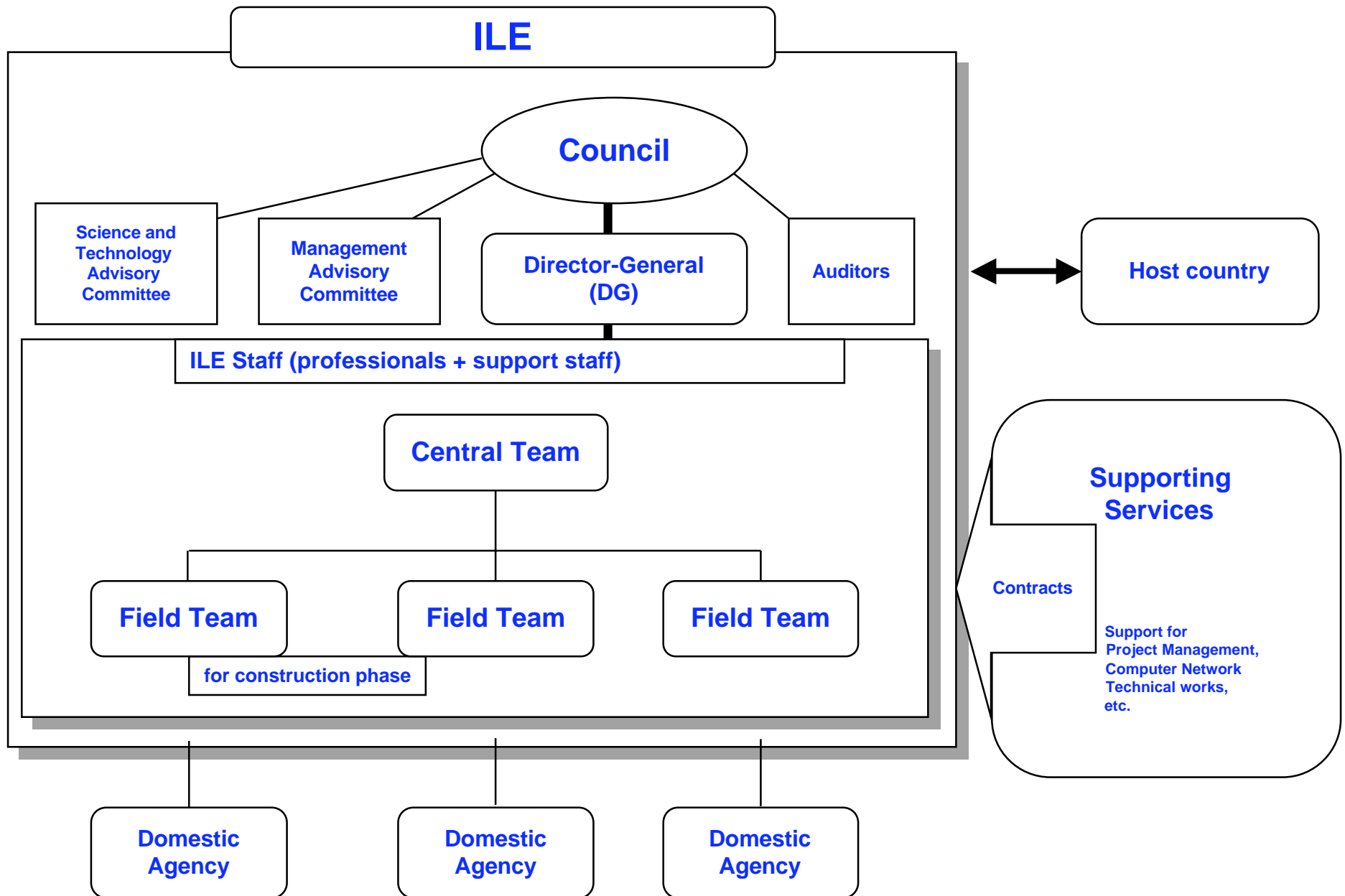
- **Technical activities**
 - Addressing risk in US in-kind contributions and the project
- **International Project Organization**
 - Preparing for the ITER Organization's Construction Phase
- **US Domestic Agency**
 - Preparing to start US fabrication activities
- **US Burning plasma Program**
 - Linking with the US Science and Technology Research Programs to enable effective design and research

International Project Organization

Preparing the integrated Central Team / Domestic Agencies for the Construction Phase

- **NSSG meetings during 2003 fleshed out initial understandings on the management structure, procurement arrangements, etc.**
- **Further discussions await the appointment of the Director General**
- **Some areas for further technical/project management discussion:**
 - Completion and refinement of the procurement allocations
 - Change control and associated resource management
 - Roles:
 - of the Central Team and the Domestic Agencies in R&D, design and procurement (centralization versus de-centralization)
 - of industry in the Teams

Conceptual ITER Organizational Structure



Key Topics in this Preparatory Phase

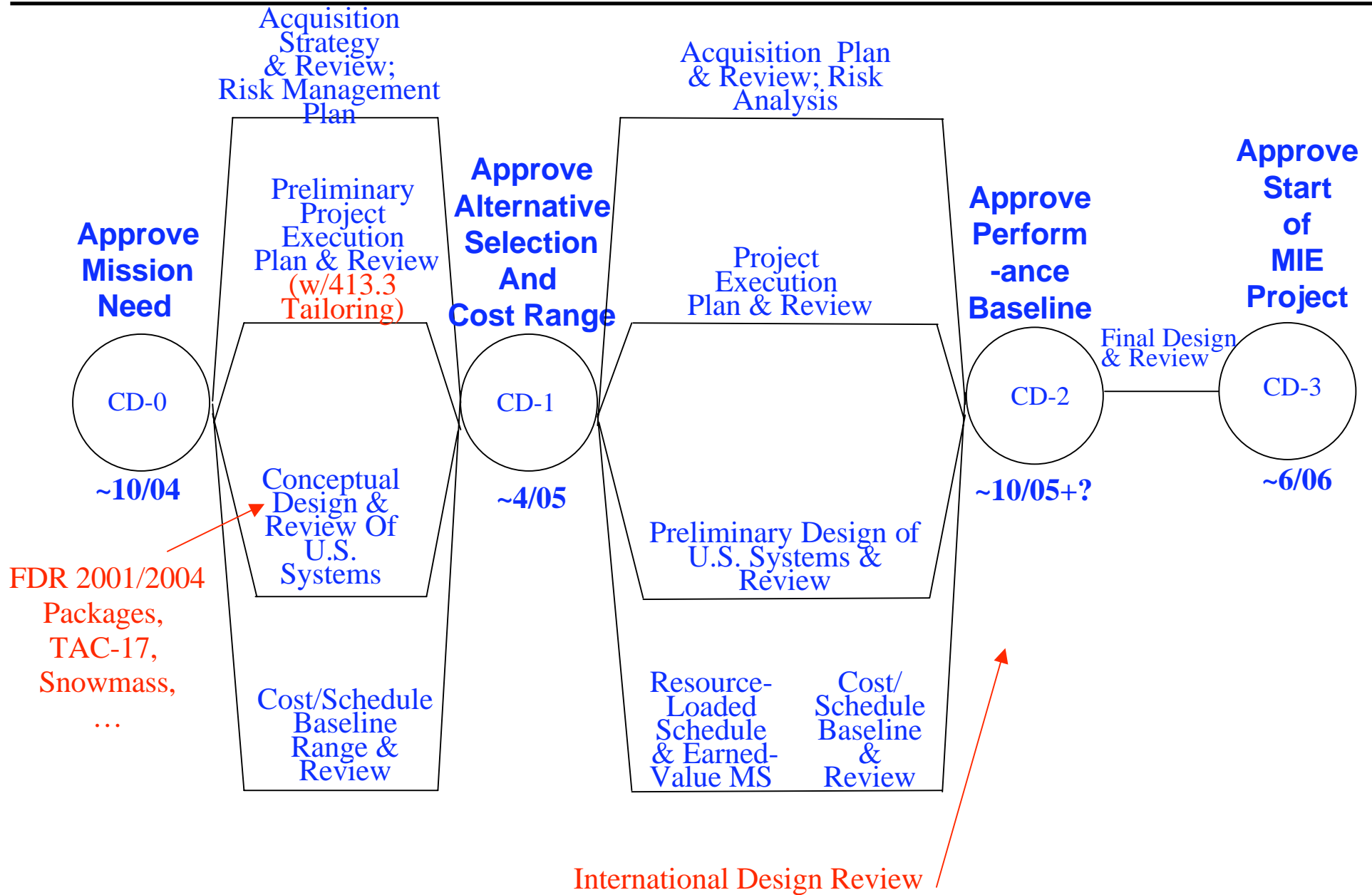
- **Technical activities**
 - Addressing risk in US in-kind contributions and the project
- **International Project Organization**
 - Preparing for the ITER Organization's Construction Phase
- **US Domestic Agency**
 - Preparing to start US fabrication activities
- **US Burning plasma Program**
 - Linking with the US Science and Technology Research Programs to enable effective design and research

US Domestic Agency

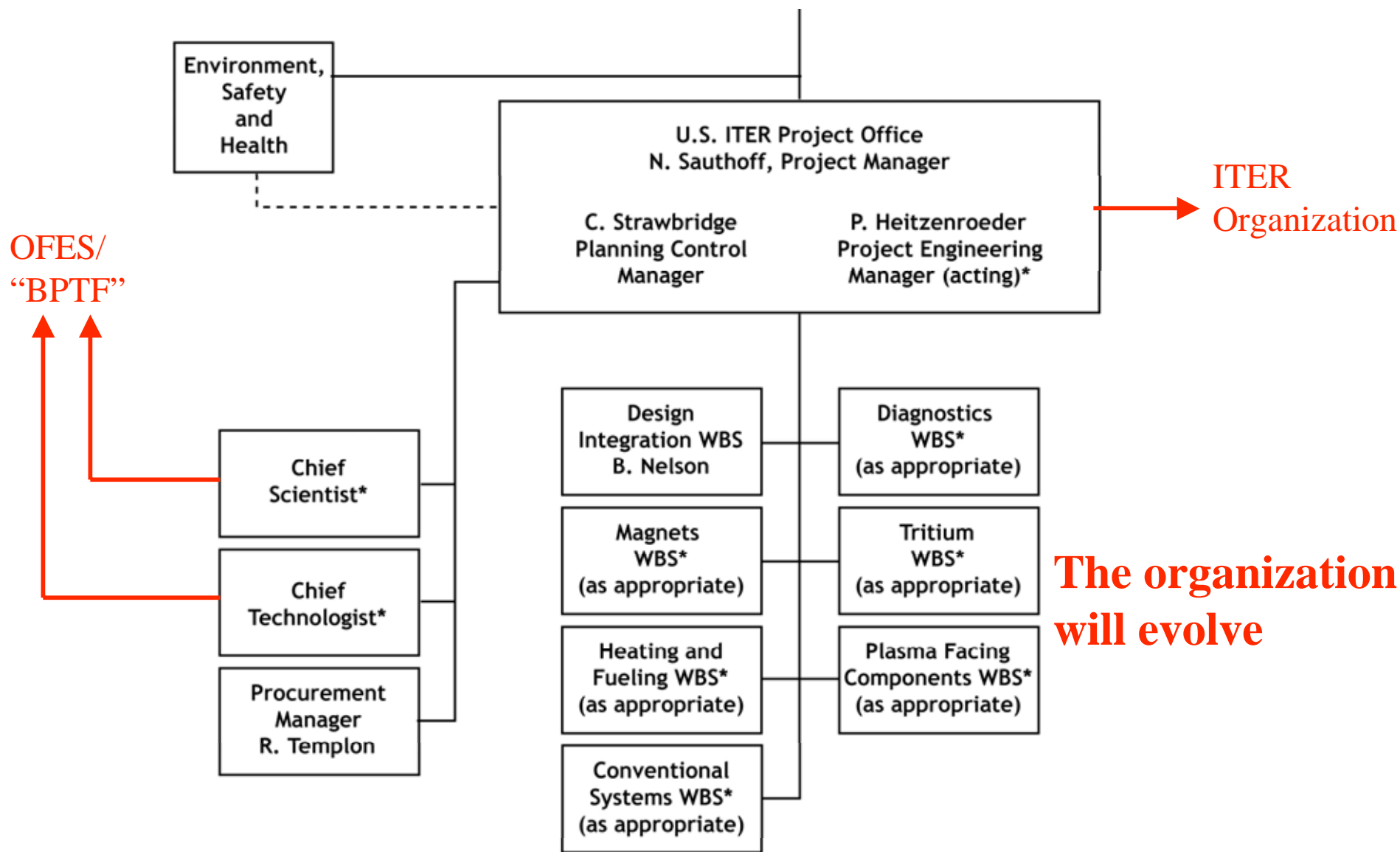
Preparing to start US fabrication activities

- **ITER is sometimes portrayed as a paradigm for large-scale science and technology projects in the future**
- **Developing the management structures in the US to enable such a project is both important and challenging**
- **Mission Need has been approved by Dr. Orbach (ESAAB and S-2 remain)!**
- **The US ITER Project Office is now preparing materials for the CD-1 package:**
 - Project Execution Plan
 - Acquisition Strategy
 - Conceptual Design / Review Package (much more extensive for CD-2)
 - Cost Estimate / Range

US ITER PROJECT CRITICAL DECISIONS



U.S. ITER Project Office



* National search will be conducted to assure best qualified individual is available to the project.

US ITER Project Advisory Committee

- **Harold Forsen (Chair)**
- **Project Management / Procurement:**
 - Jay Marx (LBNL)
 - Jim Yeck (U Wisconsin)
 - Robert Iotti (CH2M-Hill)
 - Eugene Desaulniers (consultant)
- **Universities:**
 - Stewart Prager (U Wisc)
 - Jerry Navratil (Columbia) [invited]
 - Neville Luhmann (UC Davis)
 - Herb Berk (UTexas)
- **Major Facilities / Labs:**
 - Earl Marmor (MIT)
 - Ron Stambaugh (GA) [invited]
 - Mike Zarnstorff
 - Lee Berry (ORNL)
 - Dave Hill (LLNL)
 - Kathy McCarthy (INEEL)

Key Topics in this Preparatory Phase

- **Technical activities**
 - Addressing risk in US in-kind contributions and the project
- **International Project Organization**
 - Preparing for the ITER Organization's Construction Phase
- **US Domestic Agency**
 - Preparing to start US fabrication activities
- **US Burning plasma Program**
 - Linking with the US Science and Technology Research Programs to enable effective design and research

The U.S. Burning Plasma Program

- **The primary goal of US participation in ITER is the performance of research on the science and technology of sustained burning plasmas**
- **ITER activities should be conducted as a key part of an integrated US burning plasma research program**
 - Focused on burning plasma issues involving existing facilities, future facilities (ITER), theory, simulation, diagnostic R&D, and enabling technology
 - Coupled with topical groups
 - Engaging interested US participants in a wide range of roles
 - As a part of the international community
 - Linked to the international and domestic project activity
- **We look forward to continued discussion and planning with the community and DOE to develop an effective US Burning Plasma Program**

Bottom Line

- **We are addressing areas of technical and project management risk by domestic and secondary activity**
- **We are examining models for international and domestic project management, with a view to a model for large-scale scientific partnership**
- **We are preparing project plans in the context of DOE orders**
- **We look forward to working with the community and DOE in the U.S. Burning Plasma Program**