Programmatic Status of ITER

Charles Baker
APS-DPP Meeting
November 18, 2008

Thanks to Kaname Ikeda and the IO staff and Ned Sauthoff and the US IPO staff
ITER Organization

ITER Council
- Director-General: Kaname Ikeda
- Senior Advisor: Norbert Holtkamp
- Two Senior Advisors

Management Advisory Committee
- DDG for Safety & Security: Carlos Alejandre
  - Safety Control
  - Quality Assurance

Science and Technology Advisory Committee
- Principal DDG
- Two Senior Advisors

Financial Audit Board
- Office of the Director-General: H. Matsumoto
- ITER Council Secretary: S. Ishizaka
- Legal Office: P. Tuinder
- Communication: N. Calder
- Office of Audit Service

Project Office (E. Tada)
- Design Integration & Configuration Control
- Project Management
- Technical Co-ordination
- System Analysis
- Environment, Safety & Health

Domestic Agencies
- China
- EU
- India
- Japan
- Korea
- Russia
- USA

Civil Construction and Site Support Office (J. Sovka)
- Building System
- Site Layout
- Nuclear Buildings
- Steel Frame Buildings

Dept. for CODAC & IT, Heating & CD, Diagnostics
- CODAC and IT
- Heating and Current Drive
- Diagnostics

Dept. for Fusion Science and Technology
- Science
- Technology

Dept. for Fusion Engineering & Plant Support
- Plant Engineering
- Fuel Cycle Engineering
- Electrical Engineering
- Design Office

Dept. for Tokamak
- Magnet
- Vessel
- Internal Components
- Assembly & Maintenance

Field Teams
- Field Team Leader
- Staff (QA, C&S, Audits, etc.)
- Technical Support

Revised on 15 May 2008
Office Buildings

CEA site

- JWS-1: Building 519
- Extension-1
- Extension-2

ITER site

- JWS-2
- Future Annex Office Building
Licensing Process

- On 31 January 2008, the files for “Demande d’Autorisation de Creation”, including the Preliminary Safety Report, were sent to the French Nuclear Authorities;

- In July, the French Authorities asked questions and requested additional documentation from IO;

- IO will provide further information and documentation by February 2009;

- Public Enquiry is expected by Summer 2009;

- An ITER CLI (Commission Locale d’information), including international experts is being set up and will hold its 1st meeting before the end of this year.
Status of IPS

• The Integrated Project Schedule (IPS) endorsed by the IC-2 for planning purposes has been placed under configuration control.

• Analysis of the current state of the schedule shows variances on a number of milestones, all related to progress on design requirements, design reviews and the signatures of Procurement Arrangements.
Staffing Status
by the end of 30 September 2008

- As of 30 September 2008, IO has a total of 276 staff, including 207 professional staff and 69 technical support staff;
- 104 posts were in the recruitment process (80 new and the rest replacement or reposted positions).

<table>
<thead>
<tr>
<th>Country</th>
<th>Count</th>
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<tbody>
<tr>
<td>CN</td>
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<td>EU</td>
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<td>IN</td>
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<tr>
<td>RF</td>
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<td>US</td>
<td>14</td>
<td>6.5%</td>
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Design Review and STAC issues

• Design Review
  – Completed September 2007
  – U.S. provided roughly 25% of the professional person years provided by the parties

• Resolution of issues identified by the Science and Technology Advisory Committee
  – U.S. provided 36% of the professional person years provided by the parties
Procurement Sharing

How the overall costs are shared:
EU 5/11, other six parties 1/11 each. Overall contingency of 10% of total. Total amount: 3577 kIUA (5.365 Mil € / 2008)

A unique feature of ITER is that almost all of the machine will be constructed through *in kind* procurement from the Parties
Areas of On-going Advancement

• IO-DA project refinements
  – cost-estimate
  – schedule
  – project management tools/systems

• IO-DA completion of the design
  – distributed design (including DA responsibility)
  – integrated Product Teams
  – integrated decision-making and reviews
U.S. Contributions to ITER Project

Oak Ridge National Laboratory
UT-Battelle, LLC

U.S. ITER Project
Ned Sauthoff
Project Manager

Executive Secretary
Tonia McPeters

Chief Technologist
Stan Milora
Chief Scientist
James Van Dam

Deputy Project Manager
Carl Strawbridge

Chief Engineer
Brad Nelson

Procurement Manager
Jeff Geouque, M

ESH&Q Manager
Richard Hislop, S/C

Communications and Human Resources
Bonnie Hébert, M

Computing Integration
Information Systems
Dan Carlette

Project Office
Carl Strawbridge

Magnet Systems
John Miller
WBS Manager, ORNL

Cooling Water Systems
Jan Berry
WBS Manager, ORNL

Electric Power Systems
Charles Neumeyer, M
WBS Manager, PPPL

Diagnostics
David Johnson, M
WBS Manager, PPPL

Support to ITER International Team/ Business Office
Jama Hill
WBS Manager, ORNL

Blanket Shielding and Port Limiter Systems
Mike Hechler
WBS Manager, ORNL

Vacuum Pumping and Fueling,
ECH & ICH Systems
David Rasmussen
WBS Manager, ORNL

Tokamak Plant Exhaust Processing
Bernice Rogers
Acting WBS Manager, SRNL

Project Controls
Suzanne Herron
WBS Manager, ORNL
U.S. Contributions to ITER Project

<table>
<thead>
<tr>
<th>U.S. ITER Project Advisory Board</th>
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<tr>
<td>Harold K. Forsen, Chair</td>
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<tr>
<td>Charles C. Baker</td>
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<tr>
<td>Robert C. Iotti</td>
</tr>
<tr>
<td>Milton Johnson</td>
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<tr>
<td>David G. McAleees</td>
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<tr>
<td>Edward I. Moses</td>
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<tr>
<td>Satoshi Ozaki</td>
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<tr>
<td>James R. (J. R.) Thompson</td>
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<th>U.S. ITER Technical Advisory Committee</th>
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<tr>
<td>Charles C. Baker, Chair</td>
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<tr>
<td>Lee Berry</td>
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<tr>
<td>Eugene (Gene) R. Desaulniers</td>
</tr>
<tr>
<td>Kathryn A. McCarthy</td>
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<tr>
<td>Gerald A. Navratil</td>
</tr>
<tr>
<td>Miklos Porkolab</td>
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<tr>
<td>Stewart C. Prager</td>
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<tr>
<td>Bruce E. Warner</td>
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<tr>
<td>M. C. Zarnstorff</td>
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USIPO is prepared to proceed….

- Project Execution Plan
- Resource-loaded schedule
- Cost-estimate range
  - Cited in the President’s Budget Request
  - Includes Risk-based contingency
- Project Control tools built on Spallation Neutron Source set
  - Work Breakdown Structure
  - Configuration Control
  - Quality Assurance and Safety Plans
  - Risk Management,….
- Contracts, Business and other capabilities from ORNL, but co-located
US ITER In-kind Hardware Contributions

- **100% Ion Cyclotron transmission lines**
- **100% Electron Cyclotron transmission lines**
- **15% of port-based diagnostics**
- **7 Central Solenoid windings**
- **75% Cooling for divertor, vacuum vessel, ...**
- **8% of Toroidal Field conductor**
- **100% Ion Cyclotron transmission lines**
- **100% Electron Cyclotron transmission lines**
- **20% Blanket/Shield Roughing pumps, standard components**
- **Tokamak exhaust processing system**
- **Pellet injector**
- **Steady-state power supplies**

**Contributors:**
- ORNL
- PPPL
- SRNL
Toroidal Field Coil Conductor

U.S. supplies 40 tons of Niobium-tin superconducting wire
Sultan Test Samples

• SULTAN facility continues to be key facility for QC. EU dipole and may be CSMC (or KO) facility will be used in the future too.

• All superconducting strands for the Toroidal Field Coils (TF) have to pass a Qualification Procedure.

• These tests are performed at the Superconductor Test Facility SULTAN, Located at the Paul Scherrer Institute in Villigen, Switzerland.

Sultan Test Facility
*Photo courtesy CRPP/PSI*
TFUS1 Testing

Minimal, if any, degradation

Evolution of $T_{cs}$ and $T_o$

$T_{cs}(11T,68kA) = 5.7K$
Blanket, Port Limiter and Divertor Systems
FWQM Test Facility - SNL

US FWQM Mockup
EU FWQM Mockup

Plasma Test Facility Fixture

4 FWQM Test Mockups
ICH Transmission lines and Tuning/Matching System

5 MW transmission air cooled lines from the sources to the antenna
3 dB ELM tolerant matching connected to 24 strap antenna array

Long pulse; High power resonant ring tests components to > 5 MWs (ORNL)
WBS 1.5.2. Scope - ECH Transmission line and Mode Control

1-2 MW water cooled T-lines from the gyrotrons to the launchers
24 lines to the equatorial launchers
32 lines to the upper launchers
Mode and polarization control are major technical challenges
Pellet Injector R&D to develop extruder, gas recirculation and injector reliability

- Technical challenges
  - Extruder throughput and reliability (FY07-10)
  - Propellant gas recirculation to minimize impact on tritium plant (FY09-10)
  - Gas gun prototype (FY09-11)
  - Pellet survivability in guide tubes and guide tube selector (FY09-11)
Next Steps

• Engage US industry in design completion and optimization
  – Incorporate industrial experience
  – Assure ITER design is compatible with US manufacturing methods
  – Focus on early-delivery / high-risk systems
    • superconducting magnets
    • plasma-facing components
    • power handling
    • diagnostic instrumentation

• Place long-lead procurements for materials for early-systems
  – Superconducting strand (for schedule reasons)
  – Stainless steel (as a cost-risk mitigation measure)