Description of document:	Monthly reports for the US International Thermonuclear Experimental Reactor (ITER) Project, April-June 2015
Requested date:	25-July-2015
Released date:	08-February-2016
Posted date:	01-August-2016
Source of document:	FOIA Request Acting FOIA Officer U.S. Department of Energy Integrated Support Center - Oak Ridge P.O. Box 2001 Oak Ridge, TN 37831 Fax: (865) 576-1556 Email: linda.chapman@science.doe.gov

Department of Energy

Oak Ridge Office
P.O. Box 2001
Oak Ridge, Tennessee 37831

February 8, 2016

FREEDOM OF INFORMATION ACT REQUEST ORO-2015-01700-F

This letter and the enclosure complete our response to your July 25, 2015, Freedom of Information Act (FOIA) request for copies of "1) the most recent three weekly internal status reports of the US ITER program, and 2) a copy of the most recent three monthly internal status reports of the US ITER program, and 3) a copy of the most recent two internal quarterly status reports of the US ITER program."

In response to your request, the enclosed compact disc contains the April 2015, May 2015, and June 2015 monthly reports for the US ITER project. Deletions have been made of information pertaining to project budget data, vendor names, and locations of the fabrication facilities in accordance with 5 United States Code Section 552(b)(5) (Exemption 5).

Exemption 5 protects from mandatory disclosure "inter-agency or intra-agency memorandums or letters which would not be available by law to a party other than an agency in litigation with the agency." The three principal privileges that have been held to be incorporated into Exemption 5 are the deliberative process privilege, the attorney-client privilege, and the attorney work-product privilege. The deliberative process privilege protects recommendations, advice, and opinions that are part of the process by which agency decisions and policies are formulated.

The U.S. Department of Energy (DOE) is withholding the deleted information under the deliberative process privilege of Exemption 5. The budget data is shared internally in order to determine if costs are within the projected budget and to be used for formulating future project budgets. Vendor names and fabrication facilities are also shared internally due to the sensitive nature of the products used on the ITER project. Release of the vendor names could jeopardize the future of DOE's commercial relationships with these companies and the project itself.

The quality of agency decisions would be adversely affected if frank and independent recommendations were inhibited by the knowledge that the content of such recommendations might be made public. Therefore, we find that such disclosure is not in the public interest.

FREEDOM OF INFORMATION ACT REQUEST ORO-2015-01700-F

With respect to items 1) and 3) of your request, weekly and quarterly reports are not prepared for the ITER project.

As Acting Manager of the Oak Ridge Office, I am the person responsible for the above determination. DOE regulations at 10 Code of Federal Regulations Section 1004.8 provide that the denial of information and the adequacy of the search performed may be appealed by writing to the Director, Office of Hearings and Appeals, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, D.C. 20585, within thirty (30) days of your receipt of this letter. Please include a copy of your original request and this determination letter. Both the envelope and the letter must be clearly marked "Freedom of Information Appeal." You may also submit your appeal by e-mail to OHA.filings@hq.doe.gov, including the phrase "Freedom of Information Appeal" in the subject line.

Thereafter, judicial review will be available to you in the federal district court either (1) in the district where you reside, (2) where you have your principal place of business, (3) where the Department's records are situated, or (4) in the District of Columbia.

There is no charge for processing this request.

Sincerely,

D_J JL

Don F. Thress, Jr.
Acting Manager

Enclosure:
Compact Disc

Department of Energy
ORNL Site Office
P.O. Box 2008
Oak Ridge, Tennessee 37831-6269

June 3, 2015

MEMORANDUM FOR DISTRIBUTION

FROM: DAVID K. ARAKAWA
FEDERAL PROJECT DIRECTOR
U.S. CONTRIBUTIONS TO ITER PROJECT

SUBJECT: U.S. ITER PROJECT MONTHLY REPORT – APRIL 2015

Attached for your information is a copy of the project's Monthly Report for April 2015. Cumulative cost and schedule earned value performance indices for the month were 0.99 and 1.0, respectively. Five Project Change Requests (PCRs) were processed during April and these PCRs are summarized in Appendix B of this report. There was one Level 1 milestone (Delivery of the Five Cooling Water Drain Tanks to Port in France Complete) due in April, which was partially completed. Two tanks arrived in France on April 26, 2015. The remaining tanks are expected to be shipped during June and arrive in France during July.

Key activities in April included the continued installation of equipment for the remaining Central Solenoid (CS) fabrication stations, fabrication of first article CS Structure tie plates, and pre-fabrication activities (preparation of Quality Plans, etc.) for CS Structure Lower Key Block components. Research and development and design activities continued for the Pellet Injection System, the Disruption Mitigation System, Diagnostics, and Ion Cyclotron and Electron Cyclotron Transmission Lines. Finally, a partnered (joint Department of Energy and UT-Battelle, LLC) quality assurance audit of the U.S. ITER Project Office was performed during April, with no Findings and two Observations.

If there are any questions or additional information is required, please contact me at (865) 576-2667 or David Myers at (865) 576-5629.

Attachment

SUBJECT: U.S. ITER PROJECT MONTHLY REPORT – APRIL 2015

Distribution w/attachment:
J. Steve Binkley, SC-21
Kin K. Chao, SC-28
Casey R. Clark, SC-28
Patricia M. Dehmer, SC-2
Michael L. Knotek, S-4
Joseph J. May, SC-24.1
Stephen W. Meador, SC-28
Edward J. Stevens, SC-24.2
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Sotirios Thomas, S-4
Thomas J. Vanek, SC-24.1
Brian D. Huizenga, MA-50
Scott Cannon, NNSA
Jeffrey Makiel, PPPL
David K. Arakawa, SC-OSO
Michele G. Branton, SC-OSO
William J. Cahill, SC-OSO
Daniel K. Hoag, SC-OSO
Johnny O. Moore, SC-OSO

Distribution w/o attachment:
Dina O. Clark, ORNL
Suzanne A. Herron, ORNL
Ned R. Sauthoff, ORNL

US Contributions to ITER

Monthly Report – April 2015

Two HV substation transformers en route to ITER site

Two 61,000 gallon drain tanks at the port in France

Suzanne A. Herron
US ITER Deputy Project Manager

5/28/15
Date

Prepared by
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6283
managed by
UT-BATTELLE, LLC
for the
US DEPARTMENT OF ENERGY
under contract DE-AC05-00OR22725

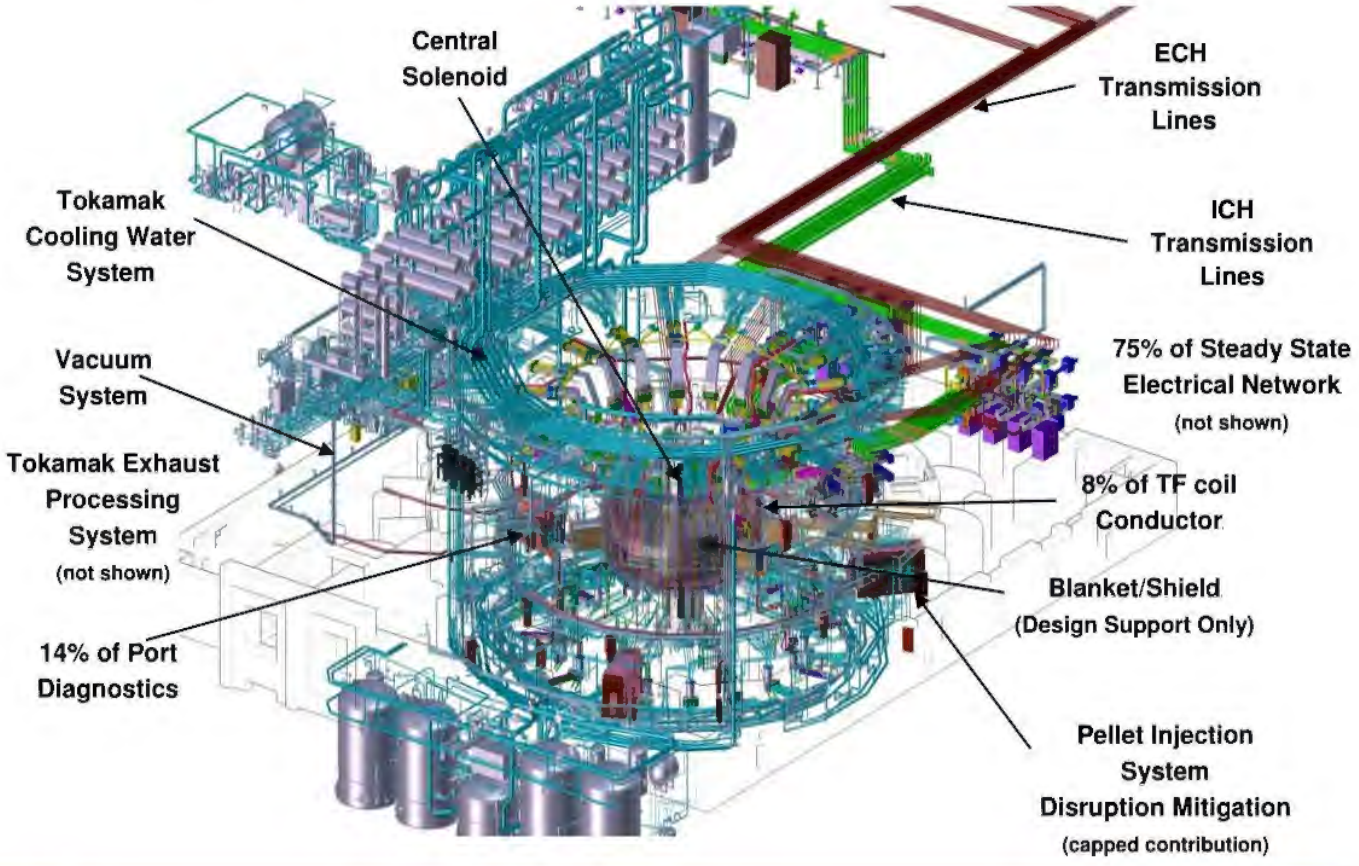
United States (US) Contributions to ITER

ITER is a unique international scientific collaboration representing more than half of the world's population. The ITER Members will design, build, and operate a first-of-a-kind international research facility in Cadarache, France aimed at demonstrating the scientific feasibility of fusion energy. This is the next step in establishing fusion as a practical long-term energy source, with acceptable environmental characteristics (no greenhouse gas emissions and no long-lived radioactive waste) and using abundant, readily available fuel (deuterium from water).

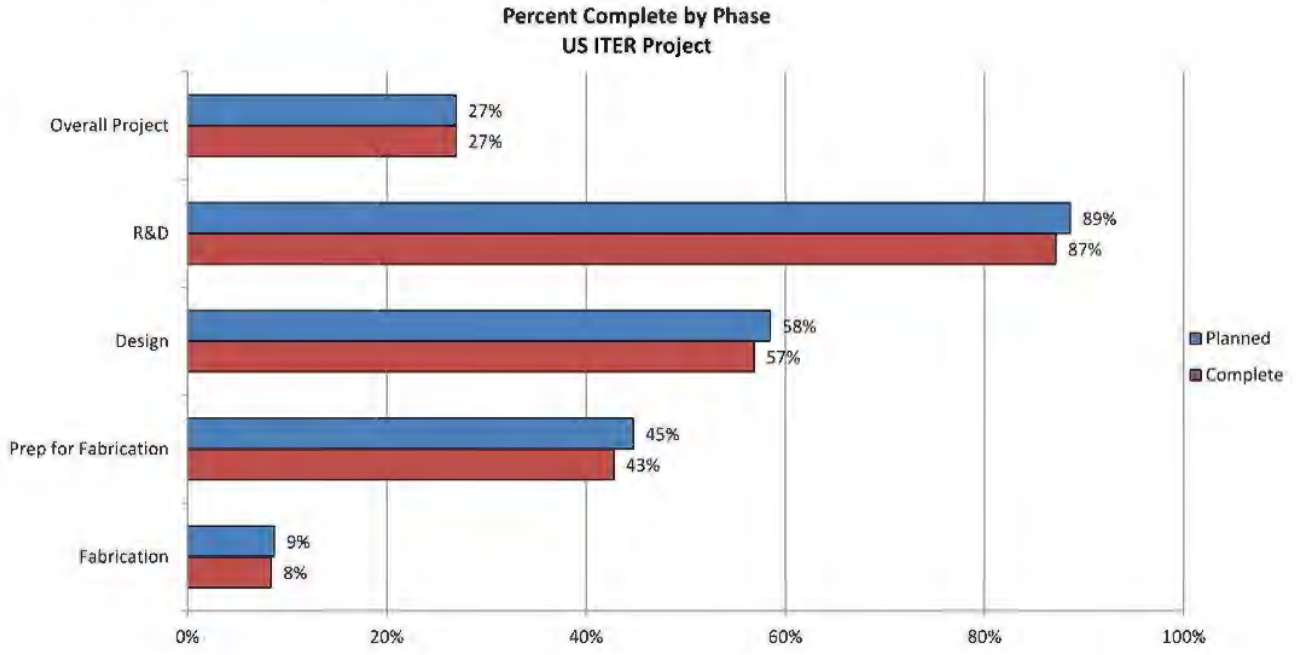
The US is to provide 9.09% of the ITER hardware components (by value) and cash equivalent to 9.09% of the international organization budget (for common expenses such as hardware assembly and installation). ~80% of US funding will be utilized for the hardware components. This funding will not only contribute to state and regional economies, but will enable US industry, universities, and labs to remain at the forefront of fusion technology and engineering. The US industries also benefit from the ITER Project by securing contracts from other ITER domestic agencies (DAs). Additionally, for its 9.09% contribution, the US will have access to all the scientific data and the right to propose and carryout experiments, which will enable the US to achieve its ITER-related goals in fusion science and fusion technology.

The ITER Members are China (CN), the European Union (EU), India (IN), Japan (JA), South Korea (KO), the Russian Federation (RF), and the US. The legal framework for construction, operation, deactivation, and decommissioning is contained in the ITER Joint Implementation Agreement (JIA), which entered into force in October 2007. The US ITER Project is a collaboration of US Department of Energy (DOE) laboratories, Oak Ridge National Laboratory (ORNL), Princeton Plasma Physics Laboratory (PPPL), Savannah River National Laboratory (SRNL) assisted by universities and industries around the country.

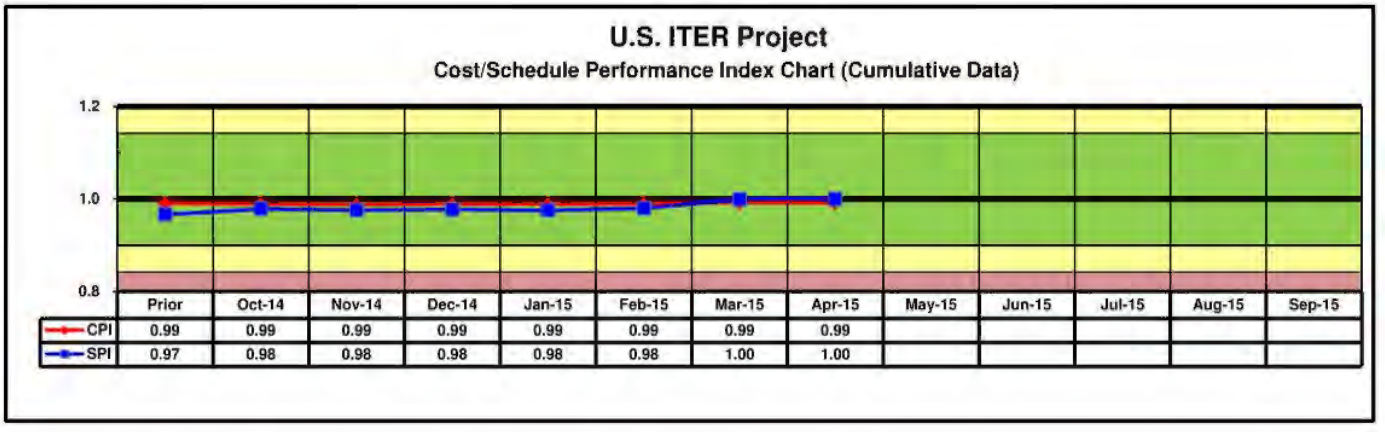
As shown below, the US Hardware contributions are highly integrated around the Tokamak Core.



Project progress as of April 2015 is shown below:



The following graph shows the Cost/Schedule Performance Indices based on earned value (against the early finish schedule). The cumulative Schedule Performance Index (SPI) for the overall Project is 1.00 and the cumulative Cost Performance Index (CPI) is 0.99. Each index is well within the accepted range.



	Prior	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
CPI	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99					
SPI	0.97	0.98	0.98	0.98	0.98	0.98	1.00	1.00					

The Project's actual costs and commitments through April 2015 compared to the obligation plan are provided in the following graph.

(b)(5)

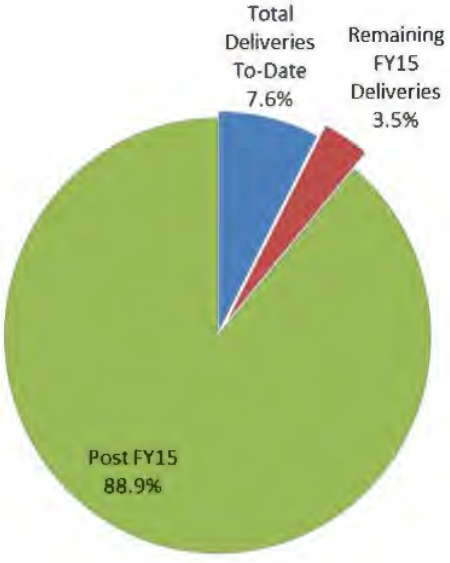
Completed Deliveries of US ITER Hardware

~8% of total planned deliveries (343)

Completed En route

FY13
VAS, 12 Vacuum Test Stand Components
FY14
TF Conductor, 800m Dummy
TF Conductor, 100m Active (Oxford)
SSEN, HV Surge Arrestors
SSEN, HV Potential Transformers
SSEN, HV Switches
SSEN, HV Circuit Breakers and Earthing Switches
SSEN, HV Substation Hardware
SSEN, HV Control and Protection I&C cubicles (Lot 1)

FY15
VAS, Portable RGA Station: Oct-14 A
SSEN, Earthing Resistors (Lot 1): Oct-14 A
SSEN, HV Substation Transformers (Lot 2): Jan-15 A
TF Conductor, Conductor 1 of 9: Jan-15 A
SSEN, HV Control and Protection (Lot 2): Apr-15 A
SSEN, HV Substation Transformers (Lot 1)
SSEN, HV Substation Transformers (Lot 3)
SSEN, HV Substation Transformers (Lot 4)
TCWS, Drain Tanks 1st Shipment (2 tanks)
VAS, UHV Pumping Cart (Vac Test Equip 14 of 16) READY TO SHIP
TF Conductor, 100m Active (Luvata) READY TO SHIP
TF Conductor, Conductor 2 of 9 PACKAGING FOR SHIPMENT
SSEN, 22kV Switchgear (Lot 1)
SSEN, 22kV Switchgear (Lot 2)
TCWS, Delivery of the remaining cooling water drain tanks (3 tanks)
SSEN, 6.6kV Switchgear (Lot 1)
SSEN, 6.6kV Switchgear (Lot 2)



343 U.S. Hardware Deliveries

US was the 1st Member to deliver ITER Hardware to the site

Key Activities This Month

Central Solenoid (CS) Modules and Structures

- Manufacturing readiness reviews and commissioning of the workstations at General Atomics (GA) for CS module fabrication continue.
- Pre-fabrication activities for the CS structure lower key block components are underway at Petersen, Inc.
- Fabrication of first article tie plates for the CS structure is underway at Major Tool and Machining and Precision Custom Components.

Stack and Join / Helium Penetration Station during commissioning at GA

Lower key block component after rounding at Scot Forge

TF Conductor

- Final testing of the second production conductor was complete at High Performance Magnetics. The conductor is being packaged for shipment to the European Union (EU).

Project Management

- A DOE Office of Project Assessment (OPA) review was held April 28-29. The review team concluded "yes" to all the review charge questions and noted that "US ITER is making good progress" and "doing the right things given the uncertainties on the international front".
- A DOE audit of US ITER Quality Assurance (QA) Program was also held in April. The review team noted that the Project had "rigorous process controls for integration of quality principles in all aspects of procurement, design, fabrication and inspection/acceptance testing".
- The US ITER Risk Management Information System was reviewed by Fermilab staff and selected as a project control tool to meet their risk management needs. The software was distributed by US ITER and has been successfully installed at Fermilab.

Milestone Status

Thirty-three milestones were selected and approved for incorporation into the US ITER FY15 Performance Plan. The Plan was reviewed/concurred by the Federal Project Director (FPD) and has been reviewed and approved by DOE-FES.

Seventeen of the remaining 23 milestones are forecast to complete on or ahead of schedule. Of the 6 forecast late or missed, three are due to the resolution of the ITER water activation issue and all but two are forecast to be complete before the end of the FY.

The following table provides an overview of the milestone status by Level.

	FY15 Performance Plan			
	Total	**L1**	**L2**	**L3**
Completed	**10**	2	2	6
On Schedule	**17**	1	5	11
Forecasted Late	**4**	-	3	1
Late	**2**	1	-	1
TOTAL	**33**	**4**	**10**	**19**

L1: DOE FES milestone
L2: DOE FPD milestone
L3: ORNL Project Manager milestone

CONTENTS

WBS 1.1.1 Magnet Systems – Oak Ridge National Laboratory (ORNL)

Central Solenoid (CS) Modules and Structure – Required for ITER 1st Plasma

The US is responsible for the CS magnet, including design, R&D, and fabrication of six CS modules (coils) and a spare module using supplied cable-in-conduit superconducting conductor (from JA), the vertical pre-compression structure, Assembly Tooling (AT), bus extensions, and cooling connections.

The CS serves as the backbone of the ITER magnet system. The CS induces the majority of the magnetic flux change needed to initiate the plasma, generate the plasma current, and maintain this current during the burn time.

General Atomics (GA) in San Diego, California, has been awarded a major contract to fabricate the modules of the CS.

Preparations for CS Modules , CS Structure and Assembly Tooling fabrication continue

WBS 1.1.1.1 – CS Modules

The first manufacturing readiness review (MRR) for Station 3 (joint and terminal prep) was held and processing of the mock-up coil at this station has begun. Commissioning activities continue for Station 4 (stack and join and helium penetrations). A splice joint has been welded and leak checked. The commissioning coil has been sent to the reaction heat treatment station (Station 5). Once the commissioning work is completed at the reaction heat treatment station, the coil can be used for the MRR of Station 6, Turn Insulation (a Level 2 Performance Plan milestone).

CS Modules

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Begin winding the first central solenoid module	1	14-Apr-15	23-Mar-15 A	
Conduct Turn Insulation MRR	2	02-Jul-15	24-Aug-15	

= Completed | = On-Schedule | = Forecast to Miss PP Date | =Missed PP Date

WBS 1.1.1.2 – CS Structures

Scot Forge's new recipe for heat treatment and solution anneal appears to have solved the grain size issue. The most recent forging passed the inter-granular corrosion test and the grain size measurement meets the specification requirement of ASME #4. Samples will be sent to National High Magnetic Field Laboratory (NHMFL) for 4K testing but previous forging samples have passed with significant margin.

Pre-fabrication activities continued at Petersen, Inc. for manufacturing the lower key block components. Petersen's lower key block assembly quality plan and manufacturing and inspection plan (MIP) were approved by the International Organization (IO).

Two fabricators, Major Tool and Machine and Precision Custom Components (PCC), are now underway with the fabrication of first article outer tie plates. Major Tool and Machine is contracted to produce two first article one piece outer tie plates. One of Major Tool's tie plates will be machined from a forging produced by Kind GmbH, in Gummersbach, Germany. The second Major Tool tie plate will be machined from a forging produced by Scot Forge in Spring Grove, IL.

A PCC Quality Plan (QP) has been submitted and approved. A weld procedure plan was submitted addressing the weld qualification for welding cooling pipe to the tie plate. PCC submitted a Manufacturing

and Inspection Plan (MIP) which is under review at the US ITER Project Office (USIPO).

A Request for Proposal (RFP) was issued for the next major CS structures procurement. This package titled "CS Structure – Upper Components" contains all of the components at the top of the CS structure. Proposals have been received and evaluated, requests for clarifications have been sent to the bidders.

CS Structures

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Award contract for the CS structures tie plates first articles	**2**	**31-Jan-15**	**30-Jan-15 A**	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

WBS 1.1.1.4 - CS Assembly Tooling (AT)

Procurement placed the Assembly Platform solicitation and associated documents on a Contracts website on March 20, 2015, and sent an email announcing the Solicitation is posted along with the closing date. Questions were submitted by vendors throughout the month, which were answered and provided in the form of amendments to the solicitation.

Toroidal Field (TF) Coil Conductor – Required for ITER 1st Plasma

The US will contribute 8% of the TF coil conductors. The IO is responsible for the conductor design which is released for fabrication. JA, EU, RF, KO, and CN are also contributing TF conductor.

The 18 TF coils produce a magnetic field around the ITER tokamak torus to confine the plasma particles. The US is responsible for enough conductors to wind slightly over one TF coil.

The coils will be made of cable-in-conduit superconductors, in which a bundle of superconducting strands is cabled together, compacted into a stainless steel conduit, and cooled by supercritical helium.

Luvata Waterbury (Waterbury, Connecticut) and Oxford Superconducting Technologies (Carteret, New Jersey) have been awarded major contracts to produce TF strand. New England Wire Technologies (Lisbon, New Hampshire) received the contract for cabling the strand and High Performance Magnetics (Tallahassee, Florida) will perform the conductor integration/jacketing.

Fabrication of TF Conductor continues

WBS 1.1.1.3 – TF Coil Conductor

Final testing of the second Oxford (OST) production conductor (OST B) was completed at High Performance Magnetics (HPM). The conductor has been aligned and flipped, and is being packaged for shipment to the EU. Jacket assembly for the third OST production conductor (OST C) was started. At NEWT, 4th and 5th stage cabling of 110m active cable is delayed until June due to delays with the new payoff tension monitoring system.

A view of OST B production conductor at High Performance Magnetics after alignment and flipping

TF Conductors

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Packaged and ready to ship first 760m conductor to EU	1	10-Jan-15	20-Oct-14 A	
Packaged and ready to ship Luvata 100m to EU	2	17-May-15	12-Mar-15 A	
2nd 760m Conductor packaged	2	22-Sep-15	01-Jul-15	

= Completed | = On-Schedule | = Forecast to Miss PP Date | =Missed PP Date

WBS 1.2.1 Tokamak Cooling Water Systems (TCWS) – ORNL

TCWS – Portions of the system required for ITER 1st Plasma

The US is responsible for the design, engineering, and procurement of TCWS.

ITER's fusion power will reach 500 MW during the deuterium-tritium inductive plasma operation with an energy input of only 50 MW, yielding an energy multiplication factor of 10. Heat will be transferred by the TCWS from client systems to the environment through the secondary cooling system. TCWS is designed to cool client systems, such as the first wall/blanket, vacuum vessel, divertor, and neutral beam injector (NBI). Additional operations include baking of in-vessel components, chemical control of water provided to client systems, draining and drying for maintenance, and leak detection/localization.

The TCWS interfaces with the majority of ITER systems, including the secondary cooling system, which rejects this heat to the environment. Plasma operations are inherently safe because a functioning cooling water system is not required to ensure safe shutdown.

System Design and Fabrication of the remaining three (of five) Drain Tanks continue

Design

Resolution of the high gamma radiation doses and fast neutrons continues to be a major focus of TCWS personnel from the IO and US ITER. The IO Director General concurred with the technical team recommendation to route piping between the bioshield and the cryostat to shield activated water below Level 3 in Building 11. This decision, during a Unique ITER Team (UIT) Meeting, coupled with the decision made during the Design Integration Review on March 20, 2015, reduces personnel and electronics and instrumentation dose rates significantly. Based on this decision, the US/IO TCWS team identified design activities needed to close Project Change Request (PCR-662) and meet F4E demands for component load data to support the building design schedule. Planning began for a TCWS Simplified Design Review to recover the TCWS design status to the final design level, which had been achieved before the activated water issue was identified.

Progress continued on meeting the DOE Performance Plan milestone: "Develop a resource-loaded schedule for completion of the final design, incorporating the design solution for the gamma radiation issue." This milestone is being accomplished by establishing a Design Plan to close PCR-662, ensuring that the IO covers the cost of performing these activities, and linking the Design Plan schedule activities to IO-TCWS Arrangement activities to establish the delay in the design. In addition, earned value (EVMS) reporting is corrected to include only those activities that are within the original scope of the Arrangements.

Integrated Blanket, Edge Localized Mode and Divertor (IBED) Primary Heat Transfer System (PHTS) piping and shielding 3D layout continues as authorized by PCR-662, with focus on the relocation of IBED PHTS equipment previously on Level L4 to Level L3 and the routing of piping in the space between the cryostat and the bioshield.

Progress was achieved on other portions of the TCWS design including optimization of the Vacuum Vessel Primary Heat Transfer System (VV PHTS) using Fathom fluid modelling. The previous VV PHTS design removed 10 MW while the current designed thermal load has been determined to be 32 MW.

Fabrication of Piping

Proposals from various vendors for the Piping and Fittings Contract have been reviewed by the IO-TCWS with technical expert advice from US ITER.

Fabrication of Drain Tanks

Normal Drain Tanks 2A (NDT2A) and 2B (NDT2B) arrived at the dock in Fos-sur-Mer, near Marseille, on April 26, 2015. Fabrication of the remaining tanks is nearing completion with preparation for transportation expected by June 2015. The status as of late April is:

- Neutral Beam Injection Tank (NBI3) – Tensile testing and dye penetrant testing completed.
- Safety Drain Tank 1A (SDT1A) – Surface passivation is in progress.
- Safety Drain Tank 1B (SDT1B) – Skirt fit-up and root pass welding completed.

Drain tank arrival and off-loading at the port of Fos-sur-Mer, France

TCWS

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Delivery of the five cooling water drain tanks to port in France complete	1	30-Apr-15	15-Jul-15	
Develop a resource-loaded schedule for completion of the Final Design, incorporating the design solution for the gamma radiation issue.	2	31-May-15	29-May-15	
IO Awards Framework contract for TCWS Pipings & Fittings	2	31-Jul-15	20-Oct-15	

= Completed | = On-Schedule | = Forecast to Miss PP Date | =Missed PP Date

WBS 1.3.1 Vacuum Pumping & Fueling Systems – ORNL

Roughing Pump Sets - A portion of the components required for ITER 1st Plasma

The US will contribute 100% of the ITER roughing pumps.

The ITER tokamak, cryostat, and auxiliary vacuum chambers must be evacuated prior to and during operations. The roughing pump system exhausts the torus and NBI cryopumps, service vacuum, and cryostat. This system will utilize a matrix of pump trains with various technologies to match specific vacuum system requirements, including tritium-compatible backing pumps for torus and neutral beam cryopumps.

Support to the IO for Conceptual Design continues

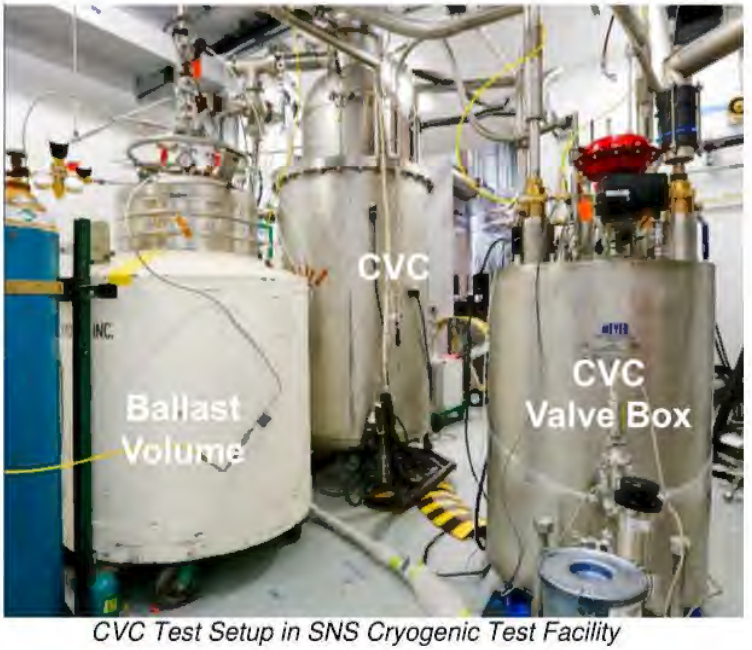
WBS 1.3.1.1 – Roughing Pump Sets

R&D

The Roughing Pump System (RPS) Conceptual design is the responsibility of the IO. A series of Task Agreements (TA)s to the US delineates the R&D support provided to the IO by the US ITER Team.

The initial round of cryogenic viscous compressor (CVC) performance testing in the Spallation Neutron Source (SNS) cryogenic test facility (CTF) was successfully completed. The test data will be analyzed and plans for any equipment adjustments and subsequent testing formulated over the next month.

The final test report on the performance testing of the tritium compatible prototype roots and screw pump will be issued mid-May. The test stand was disassembled and the components stored at ORNL. The IO has subsequently expressed an interest in acquiring the test stand and is in the process of revising the TA. The pumps were packaged for shipment to the IO, which is now expected to occur in mid-May.



CVC Test Setup in SNS Cryogenic Test Facility

Vacuum Auxiliary System (VAS) - A portion of the system required for ITER 1st Plasma

The US will design and procure the ITER vacuum auxiliary system.

The vacuum auxiliary system consists of valves, pipe manifolds, auxiliary pumps, sensors, and controls. The torus and NBI vacuum manifolds of this system need to be tritium compatible.

The Vacuum Auxiliary System Procurement Arrangement 3.1.P4.US.01 (designated as **VAS-01**) scope includes the design and procurement of those components associated with the vacuum piping which serve as the manifolds providing vacuum service throughout the Tokamak Building.

The Vacuum Auxiliary System Procurement Arrangement 3.1.P4.US.02 (designated as **VAS-02**) scope includes the design and procurement of those vacuum components which connect the vacuum manifolds provided in VAS-01 to the clients (ITER technical systems) requiring vacuum service throughout the Tokamak Building.

Design continues

WBS 1.3.1.2 – Vacuum Auxiliary Systems (VAS)

Design

VAS-01 Scope:

The closeout report for the final design review for the VAS-01 Tokamak and Cryostat vacuum piping system on Levels B2 and B1 was completed and submitted to the IO for approval. Final design and analysis of the VAS-01 piping systems on levels L1 and L2 has progressed well, while the design of the piping systems on levels L3 is on hold pending the results of PCR-662, the TCWS redesign for the water activation issue.

VAS-02 Scope:

A weeklong workshop was conducted at the USIPO on the final detailed design of the VAS-02 Service Vacuum System.

Fabrication

VAS-01 Scope

A Certificate of Final Acceptance was received on the Portable Residual Gas Analyzer (RGA) for transferring ownership to the IO.

VAS

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Complete VAS-01 FDR (L1-L4)	2	30-Sep-15	29-Mar-16	

= Completed | = On-Schedule | = Forecast to Miss PP Date | =Missed PP Date

Pellet Injector (PI) System – A portion of the system required for building integration prior to ITER 1st Plasma

The US will design and procure the PI system.

PI provides efficient core and edge fueling and will deliver hydrogen, deuterium, or a deuterium/tritium mixture as required by plasma operations. Delivering fuel pellets to the plasma edge mitigates ELM (edge localized mode) instabilities.

R&D and Preliminary Design Activities continue

WBS 1.3.1.3 – Pellet Injection

The pellet injection flight tubes Preliminary Design Review (PDR) is scheduled for late June. US ITER is reviewing the load analysis of the flight tubes and updating for the PDR. The IO is performing an electromagnetic (EM) analysis to determine the loads on the flight tubes due to EM transients (expected completion end of May). These loads are needed to complete the analysis of the flight tubes for the PDR.

Fabrication is nearing completion on the updated twin screw extruder. Fabrication is scheduled to complete in May with testing to resume in June.

An effort is underway to validate the pellet survivability through the ITER pellet flight tubes. A mockup of the ITER geometry of the high field side injection location was fabricated with initial testing performed. Results from the initial testing, although preliminary, show pellets are likely to survive up to speeds of ~300 m/s, which is the nominal required speed for the ITER geometry. Testing will continue to fully characterize the flight tubes.

Disruption Mitigation – System not required for ITER 1st Plasma

The US will contribute up to a capped value for the Disruption Mitigation System (DMS). The system has two functions, 1) limiting the impacts of plasma current disruptions to the tokamak vacuum vessel, first wall blankets and other in-vessel components and, 2) suppressing the formation and deleterious effects of high-energy runaway electrons. Out of port plug installation of shattered pellet injection (SPI) units at four port locations that are designed to also function as massive gas injection (MGI) units is the current plan for the DMS. In addition, an option for an MGI unit within a port plug is included. This unit is to be designed to function during non-nuclear operations only to provide operational experience of a fast acting MGI unit close to the plasma.

Preliminary Design Activities continue

WBS 1.3.1.4 – Disruption Mitigation

A service panel designed to operate the test MGI valve over many repetitions was designed and is under fabrication. The panel will be used to monitor the gas pressures and to remotely operate the valve for extended durability testing. Fabrication is expected to complete in June, with testing to resume afterwards.

Several options for testing an MGI valve in a high magnetic field are being explored. Facilities have been identified at Los Alamos National Laboratory capable of performing the testing.

Preliminary level modeling of a valve for an ITER SPI system has been completed. The valve is designed to operate in the challenging ITER environment while producing the necessary pellet speeds.

Significant design effort is being expended integrating the SPI design into the Upper Port Plugs in partnership with the Port Plug Integrators. As the area is very congested and used by several ITER groups, this effort is expected to continue for the foreseeable future.

WBS 1.3.2 Tokamak Exhaust Processing (TEP) – Savannah River National Laboratory (SRNL)

TEP – System not required for ITER 1st Plasma

The US is responsible for the Final Design (FD), fabrication, assembly, testing, and shipment of the TEP system.

ITER will require the processing of an unprecedented rate of hydrogen isotopes. To facilitate environmental responsibility and economic application of fusion technology, the reuse of hydrogen isotopes is vital. The TEP system must separate the exhaust gases into a stream containing only hydrogen isotopes and a stream containing only non-hydrogen gases. The implementation of the TEP system will provide a technically mature, robust, and cost-effective separation solution.

The TEP system consists of a series of filters, catalysts, and permeators (PM) to separate the hydrogen isotopes, which are then sent to an isotope separation system (furnished by the EU) to deliver deuterium and tritium for continuous reinjection into the reactor.

Support for Preliminary Design Activities continues

Preliminary design is the responsibility of the IO. A Task Agreement (TA) to the US delineates the part of the design to be performed by US ITER TEP Team. The team continued activities for the design studies for Subtask-2 of the TA (Functions, Requirements, Interfaces and Scenarios).

Currently, the US TEP design team is approximately 35% complete with Subtask-2 TEP Process Studies. Results of the studies will remain as 'draft' until the final input documentation is received by the IO. Receipt of the final input from the IO is currently scheduled in May.

WBS 1.4.1 Steady State Electrical Network (SSEN) – Princeton Plasma Physics Laboratory (PPPL)

SSEN - Hardware required for ITER 1st Plasma

The US contributes 75% of the equipment required for the SSEN, excluding cables and emergency power. The EU contributes the remaining equipment and is also responsible for the design and installation of the system as well as all cabling and all emergency (diesel generator) power systems.

The SSEN is an alternating current (AC) power substation and distribution system that supplies electrical power to all ITER conventional systems and facilities. A separate system delivers power to the pulsed systems, including the magnet and heating power supplies.

The SSEN is rated at 120 MW and is similar to the auxiliary power distribution system in a nuclear fission power plant, except that it is about twice the size. The equipment to be contributed by the US is typical of a large AC power distribution system, consisting of transformers and switchgear at the high-voltage (400 kV) and medium-voltage (22 kV) levels.

Hardware Procurements and Shipments continue

Twelve of 16 contracts have been signed and/or executed. Procurement of another contract is underway and the remaining 3 are on hold. A total of, 15 of 31 the shipments have been completed. Status of the 16 SSEN procurements is as follows:

- The HV Substation Transformers (b)(5) Industries, Ulsan, Korea) Unit #2 has been (b)(5)
- The HV Circuit Breakers, HV Switches, HV Current Transformers, HV Potential Transformers, HV Surge Arresters, HV Substation Hardware, Earthing Resistors, and the HV Control & Protection have all been delivered to the ITER site. The final Delivery Reports are being processed for these items, after which ITER credit will be requested.
- The 22kV Switchgear (b)(5) (b)(5)

(b)(5)

- The 6.6kV Switchgear (b)(5) (b)(5)
- The Power Transformers (b)(5) (b)(5)
- US ITER authorized the procurement of the Reactive Power Compensators in FY15 so a Subcontract Proposal Evaluation Board (SPEB) was formed and preparations started on the Request for Proposal (RFP) package.
- DC Distribution, UPS, and LV Distribution & Sub-distribution Panels procurement activities are postponed due to funding constraints.

SSEN

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
IPL> Delivery of HV Substation Transformers (Lot 4) by US-DA to ITER Site	1	27-May-15	12-May-15	
Packaged and ready to ship - 6.6kV Switchgear (Lot 1)	2	28-Jun-15	01-Jun-15	
Packaged and ready to ship - 22kV Switchgear (Lot 2)	2	16-Jul-15	06-May-15	

= Completed | = On-Schedule | = Forecast to Miss PP Date | =Missed PP Date

WBS 1.5.1.1 Ion Cyclotron Heating (ICH) Transmission Lines – ORNL

IC Transmission Lines– A portion of the system is required for building integration prior to ITER 1st Plasma

The US is responsible for the IC transmission lines, including R&D, design, fabrication, and interfaces. The IO is responsible for installing the IC transmission lines.

The IC system heats the ions in the plasma with a high-intensity beam of electromagnetic (EM) radiation. Generators produce high-power radio frequency waves that are carried along multiple transmission lines to antennas located in the vacuum vessel, sending the waves into the plasma. The US IC transmission lines will provide efficient power transfer from 40–55 MHz radio frequency sources to the plasma heating antennas. The system will include coaxial transmission lines and a matching/tuning system to minimize power transfer losses. The pressurized lines can transmit up to 6 MW per line. In total, approximately 1.5 km of line connects 8 sources to 16 antenna feeds, with 14 types of transmission line and matching system components. The main interfaces include sources, launchers, buildings, port cells, and water cooling. The short coaxial line also provides secondary tritium confinement.

Preliminary Design Activities continue

Design kickoff meetings were held with the vendor teams that are in the first phase of developing designs of 3-meter-long stub tuners. These tuners are an important component of the ICH tuning/matching system.

The radiofrequency resonant line test stand was used to perform multiple successful, 1-hour pulse length, high-voltage tests on a 4-port ICH transmission line switch test article. Similar switches will be installed in the ITER Radio Frequency (RF) building, where they allow the flexibility to connect each of the nine RF transmitters to power loads for testing or to the main transmission lines for plasma heating.

WBS 1.5.2.1 Electron Cyclotron Heating (ECH) Transmission Lines – ORNL

EC Transmission Lines – A portion of the system is required for ITER 1st Plasma

The US is responsible for the EC transmission lines, including R&D, design, fabrication, and interfaces. The IO is responsible for installing the EC transmission lines.

The EC system heats the electrons in the plasma with a high-intensity beam of electromagnetic radiation. This system is also used to deposit heat in very specific places in the plasma. Power will be provided by powerful, high-frequency gyrotrons. The US transmission line design will provide efficient power transfer from 170 GHz gyrotron sources to plasma heating power launchers (20 MW).

The transmission lines feature multiple lines of evacuated aluminum waveguides with internal corrugations that can transmit 1.5 MW per line for 3000 seconds, while minimizing power transfer losses to ≤ 10%. Approximately 4 km of transmission line will be part of this system, connecting 24 sources to 56 feeds with 10 types of waveguide components. The main interfaces include sources, launchers, buildings, port cells, water cooling, and auxiliary vacuum. The waveguide also provides secondary tritium confinement.

Final Design Activities continue

A pre-bid meeting was held with four potential bidders for a Basic Ordering Agreement (BOA) for "Process Development and Manufacture of 4.2 m Waveguide and Associated Components". The initial task for vendors will be to evaluate manufacturing options.

A deviation request for the ECH credit allocation schedule (CAS) revision was approved by the IO and incorporated into the project scheme. The request included the revised US schedule for design reviews and an optimized sequence for the hardware delivery packages.

WBS 1.5.3 Diagnostics – PPPL

Diagnostics – Only a few instruments (RGA & LFSR) needed for ITER 1st Plasma

The US is responsible for 14% of port-based diagnostic systems, including integration of 4 diagnostic port plugs, plus 7 instrumentation systems out of a total of approximately 40 individual diagnostic systems. The EU, RF, CN, KO, and IN are also contributing to ITER diagnostics.

ITER diagnostic systems provide measurements to aid understanding of plasma behavior and optimize fusion performance. Because of the harsh environment inside the tokamak vacuum vessel, these systems must cope with a range of conditions not previously encountered by diagnostic technology, all while performing with high reliability. US Diagnostics will include microwave, laser, x-ray, and optical systems. The US will provide design, fabrication, assembly, and testing of US port plugs, specifically the Upper Ports (U11, U17) and Equatorial Ports (E3, E9). In addition, the US will support the integration into these plugs of multiple diagnostics, including some from other DAs.

The US will also be responsible for the following instrumentation systems: Upper IR/Visible Cameras, Low Field Side Reflectometry (LFSR), Motional Stark Effect (MSE), Electron Cyclotron Emission (ECE), Toroidal Interferometer/Polarimeter (TIP), Core Imaging X-ray Spectrometer, and Residual Gas Analyzer (RGA).

R&D and Design Continue

The Low Field Side Reflectometry (LFSR) diagnostic team published a technical memo strongly advocating for an all-monostatic front-end antenna design. LFSR is part of Equatorial Port 11, a Russian Federation Domestic Agency early delivery port plug. The US LFSR team with participation from GA, UCLA, ORNL and PPPL has performed numerous ITER scenario simulations as well as laboratory testing and monostatic antenna testing on DIII-D.

Martinez and Turek (M&T) completed the Diagnostic Shield Module (DSM) costing and fabrication design improvement consulting contract. The final DSM designs are still under development.

Engineers from Fusion for Energy (F4E), the European DA, and IDOM, a Spanish engineering firm, visited PPPL to work on DSM analysis and engineering and to discuss port integration strategies. The US is also providing two diagnostic systems to F4E that IDOM will be integrating.

PPPL engineers started a series of Structural Design Criteria for In-Vessel Components (SDC-IC) training sessions with the diagnostic systems sub-contractors.

Diagnostics

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
PPPL - Motional Stark Effect - Award Phase 1 Design Contract	2	30-Sep-15	02-Sep-15	

= Completed | = On-Schedule | = Forecast to Miss PP Date | =Missed PP Date

WBS 1.6 Project Support – ORNL

Procurement

To date, contract awards for hardware procurements have been within 2% of the original estimate.

Key procurement actions for April included the following:

- Award for Transport of CS Conductor 900m (1.1.1.1.6) was made to Transproject.
- Award for Transport of 22kV Switchgear/Lots 1 & 2 (1.4.1.1.9) was made to Transproject.
- A third award for ICH Tuning Stub and Drive Mechanism Test Article (1.5.1) was made to Dielectric.

Human Resources

Three postings closed for the ITER Organization in April and 18 US candidates were nominated for review. Six US candidates were selected to interview for the Cryogenic System Engineer, Project Analyst, Electrical Engineer and Project Control Office Head positions. A new position was posted for the Quality Assurance & Assessment Division Head for which the Human Resources team continues to review applicants.

Category of staff	*European Union*	*India*	*Japan*	*China*	*Korea*	*Russian Federation*	*United States*	*Total*
DES	*228*	*13*	*19*	*27*	*25*	*20*	*16*	*348*
SEC	*11*							*11*
Total	***239***	***13***	***19***	***27***	***25***	***20***	***16***	***359***
Post Doc	*3*			*1*	*1*			*5*
VRs		*1*		*1*	*1*			*3*
	66.6%	*3.6%*	*5.3%*	*7.5%*	*7.0%*	*5.6%*	*4.5%*	

DES: directly employed staff by the IO;
SEC: Secondees to the IO;
VRs: Visiting Researchers at the IO

Quality Assurance (QA)

- Inspections by Bureau Véritas (under contract to IO) of TCWS drain tanks fabrication activities at Joseph Oat Corporation continued. Five reports received for April inspections; all statused as SATISFACTORY.
- DOE audit of US ITER conducted the week of April 6, 2015. No findings and two observations reported by the audit team at the closeout on April 15.
- Follow-up assessments were performed at HPM and NHMFL.

WBS 1.7 International Organization Support (Secondees and Cash Contributions) – ORNL

Per the JIA, the US is obligated to contribute 9.09% of the value estimate of the construction of ITER. The contributions are measured in ITER kilo Units of Account (kIUA), which has been used by ITER for many years; 1 kIUA equals $1M US dollars (January 1989). The US commitment, 424.618 kIUA, includes hardware fabricated/procured by the US, cash for installation and commissioning, staff (secondees or cash for direct employees), and cash for R&D directed by the IO.

The US can also receive credit (kIUAs) for performing additional work through approved Task Agreements (TAs). The US will cover its share of the cash contributions through cash payments in current year Euros upon request by the IO. Euros are purchased with current year dollars using the current exchange rate when the payment is due. To establish the kIUA value of annual cash contributions, the Euros are de-escalated to Euros (January 1989) using proven inflation rates, and then converted to millions of dollars (January 1989) to yield kIUA.

Note: the tables below reflect a new decision not to grant credit for contributions to the IO prior to CY 2007. The Cash Payments Table contains the 2006 cash contribution but the credit does not contain this 2006 value.

Cash Payments

Calendar Year	Budgeted €	Paid €	Paid $	Remaining Obligation €
2006	409,000 €	409,000 €	$528,918.80	0
2007	3,985,000 €	3,985,026.06 €	$5,463,231.76	0
2009	15,689,630.70 €	15,689,604.64 €	$21,102,518.24	0
2010	9,567,409 €	9,567,409 €	$13,552,234.85	0
2010 Supplemental	1,577,433 €	1,577,433 €	$2,018,010.04	0
2011 Advance Payment	9,132,173 €	9,132,173 €	$11,650,826.31	0
2012	9,450,359 €	9,450,359 €	$12,133,315.92	0
2013	17,672,925 €	17,672,925 €	$23,975,973.67	0
2014	14,885,339 €	14,885,339 €	$20,280,343.91	0
2015	13,741,328 €	13,741,328 €	$14,827,218.12	0
Cumulative	*96,110,596.70 €*	*96,110,596.70 €*	*$125,532,591.62*	*0*
Estimated Credit Earned to date: 59.284 kIUA				
Average Exchange Rate realized for cash paid = 1.306				

Secondees/Employees

U.S. Secondees	Credit Earned: 1.531 kIUAs
	Current Number of Secondees: 0
U.S. Direct Hires	Current Number of U.S. Direct Hires: 37

Total Credit Earned (~20% of total planned)

Allocation	Total Planned Credit (kIUA)	Actual Credit Received (kIUA)	Change in Actual	Remaining Credit (kIUA)
Secondees	1.531	1.531		-
HW	207.520	11.730		195.790
TA	15.193	12.685		2.508
Cash	202.986	59.284		143.702
Total	427.230	85.230		342.000

	2007	2008	2009	2010	2011	2012	2013
Cash	2.711	0	10.138	13.063	0	5.835	10.645
Secondees	.629	.274	.277	.246	.105	0	0
TAs	0	.300	.048	2.284	4.611	2.497	1.939
PAs	0	0	0	2.500	0	5.850	0
Total	*3.340*	*.574*	*10.463*	*18.093*	*4.716*	*14.182*	*12.486*

	2014	2015	Total
Cash	8.842	8.050	59.284
Secondees	0	0	1.531
TAs	1.006	0	12.685
PAs	3.380	0	11.730
Total	*13.228*	*8.050*	*85.230*

WBS 1.8 Supplemental Task Agreements (TA) with the IO

Task Agreements currently in-progress

TA #	Description	Agency	US Contact	Credit Amount (kIUA)	Credit Received to Date (kIUA)	TA Start	Expected Finish
TA-FC-IPT-US-RP-01	Validation of Mechanical Roughing Concepts	US-IPO	M. Hechler, Larry Baylor	0.435		01/02/2011	06/10/2015
C 74 TD 21 FU	Neutronics Analysis Support for ITER	ORNL / U. of Wisc.	B. Nelson / Mohamed Sawan	0.318		09/01/2014	07/10/2015
TA-FC-IPT-US-RP-02	ITER Roughing System Cryogenic Viscous Flow Compressor Development	US-IPO	M. Hechler, Larry Baylor	0.267		01/02/2011	09/08/2015
C 55 TD 36 FU	Generic Diagnostic First Wall Preliminary and Final Design	PPPL	Wayne Steffey, Doug Loesser	1.237	0.322	09/01/2012	03/31/2016
C 18 TD 35 FU	Development of ITER class Pellet Injector	US-IPO	D. Rasmussen	0		10/01/2008	07/28/2016
TA-FC-IPT-US-13-01	Preliminary Design Tasks associated with PBS 32.EP Plant System	SRNL	Bernice Rogers	0.571		10/17/2013	06/30/2017
TA-FC-IPT-US-RP-03	Validation of Piston Pump for ITER Roughing System	US-IPO	Dave Rasmussen, Larry Baylor	0.002		10/17/2012	11/30/2017
			Total kIUA	2.830	0.322		
			Approx. $	$ 6,248,000	$ 711,000		

WBS 1.9 Instrumentation and Controls (I&C)

Centralized Instrumentation and Controls Support. Required for ITER 1st Plasma

The US is responsible to provide I&C for all Procurement Arrangements (except Magnets and SSEN). Work scope includes: conceptual, preliminary, and final I&C design; I&C software design; I&C hardware and software procurement; I&C equipment fabrication; and I&C qualification and testing. The WBS 1.9 work scope definition includes the majority of US DA I&C work scope, but the details will be defined on a WBS-by-WBS basis. (e.g. Some major equipment procurements will include I&C content; some engineering services contracts such as for Diagnostics will include I&C content; etc. so this work scope will remain in the other WBS areas). Benefits of a centralized I&C support include: sharing of specialized engineering resources; the promotion of standard designs, standard software components, and standard equipment; and the provision of commonly-required services including technical and qualification support.

Assembling I&C team and starting Conceptual and Preliminary Designs

WBS 1.9.2.1 TCWS I&C

The initial analysis was completed of expected instruments that will be exposed to high level of neutron flux. This will help determine if passive equivalents are available as a mitigation. Six instruments have been identified that cannot be exposed to neutron or gamma radiation above alert thresholds.

WBS 1.9.3.3 Pellet Injector I&C

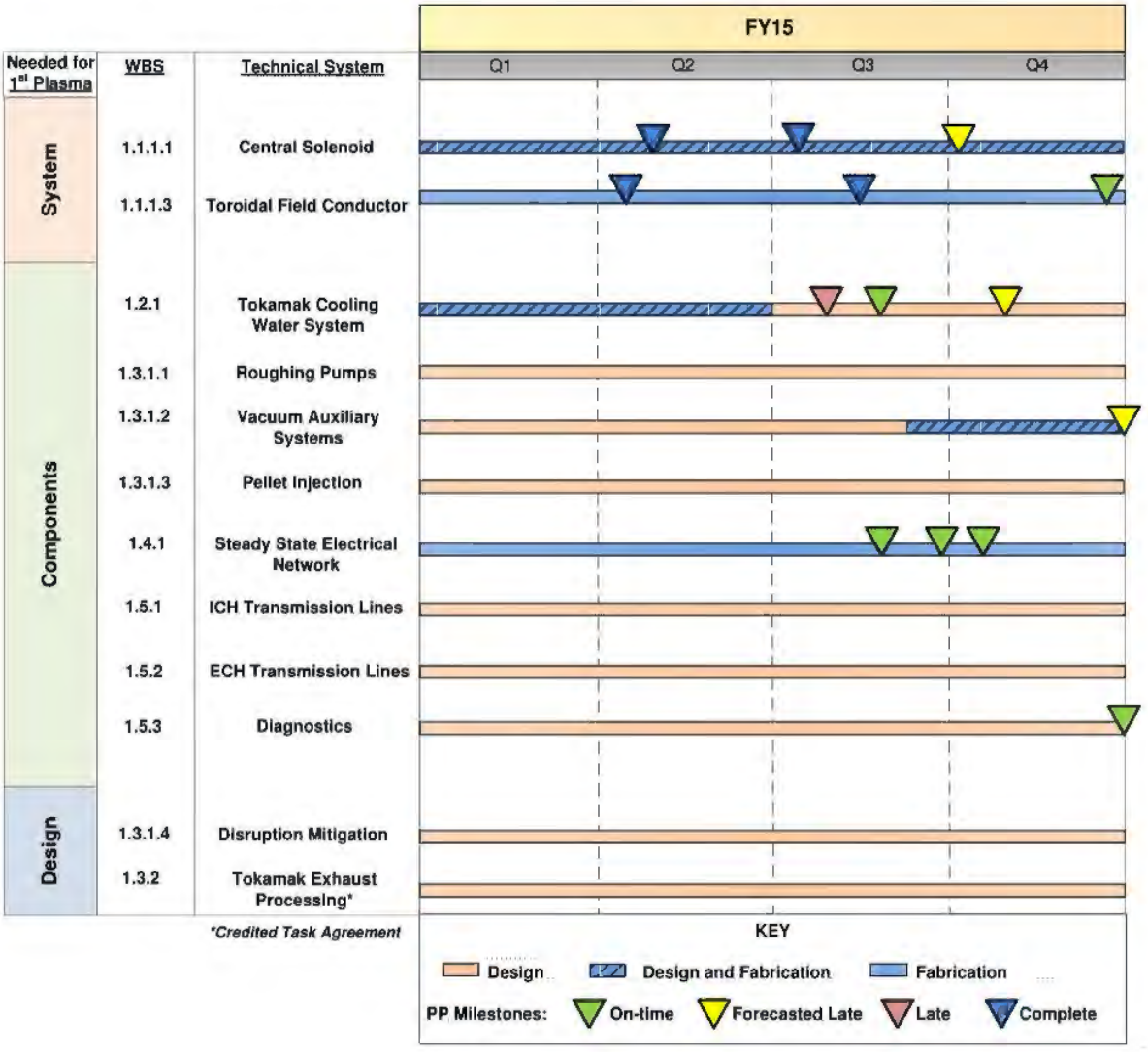
An initial assessment of the updated cost estimate was conducted.

WBS 1.9.3.2 Vacuum Auxiliary Systems I&C

An updated cost estimate for VAS.02 I&C was developed.

Appendix A
US ITER Project Schedule
(L1/L2 Milestones)

Shown below is the summary schedule for the Project's planned activities in FY15. The schedule is aligned with the revised funding provided by the DOE Office of Fusion Energy Science which assumes funding of $150M in FY15 and $150M in FY16.



Appendix B

Project Change Requests processed this month

There were five Project Change Requests (PCRs) processed in April. All PCRs were reviewed against the contingency guidance to determine the applicable usage of Management Reserve and DOE-held contingency.

All PCRs were Level 3 (Project).

				Impact ($M)	
Month	PCR #	Description	WBS	Management Reserve	DOE Contingency
Apr	CS-2015-16	Additional 4K Mechanical Properties Testing at NHMFL	1.1.1.1	(0.037)	
Apr	CT-2015-13	Move Diagnostics Design Support Budget to new L4 WBS	1.9.7	-	
Apr	US-2015-13	WBS Dictionary Update - change project from MIE to Line Item	1	-	
Apr	CS-2015-17	Replan of General Atomics BCWS	1.1.1.1	-	
Apr	CW-2015-9	Drain Tanks Budget Reallocated	1.2.1	-	

Appendix C

Level 3 (Project Manager) FY15 Milestones

WBS	System	Milestone Description	MS Level	Performance Plan Date	Forecast Date
1.1.1.1	CS Modules	Conduct Heat Treatment MRR	3	02-Jun-15	26-May-15
1.1.1.1	CS Modules	Conduct Ground Insulation MRR	3	24-Sep-15	23-Sep-15
1.1.1.2	CS Structures	Award contract for Upper keyblock, load distribution plate, pre-compression components.	3	30-Sep-15	15-May-15
1.1.1.3	TF Conductor	Cable 3 fabrication complete	3	11-Mar-15	09-Jan-15 A
1.1.1.3	TF Conductor	Cable 4 fabrication complete	3	08-Jul-15	31-Jul-15
1.1.1.4	CS Assembly Tooling	Award contract for Assembly Platform	3	30-Sep-15	24-Jun-15
1.1.1.4	CS Assembly Tooling	Award contract for Lifting Fixture	3	30-Sep-15	09-Sep-15
1.2.1	Tokamak Cooling Water	IO contract in-place for Analysis and Calculation (Mechanical Eng) for Captive Piping Design	3	04-Mar-15	31-Jul-15
1.2.1	Tokamak Cooling Water	IO completes implementation of the staffing plan to manage and oversee work done under the TCWS Arrangements	3	30-Sep-15	29-May-15
1.3.1.3	Pellet Injection	Begin Procurement of Initial Cask and Piping Design Integration	3	27-Feb-15	13-Feb-15 A
1.3.1.3	Pellet Injection	Complete Pellet Injection Systems Level Preliminary Design Review Meeting	3	13-Jun-15	11-May-15
1.3.1.4	Disruption Mitigation	Complete Disruption Mitigation System Preliminary Design Review Meeting (with IO)	3	07-Jan-15	07-Nov-14 A
1.5.1	ICH	Award contract for DC Breaks Test Article	3	02-Sep-15	29-Jul-15
1.5.1	ICH	Award contract for Tuning Stub and Drive Mechanism Test Article Design and Fabrication	3	30-Sep-15	27-Mar-15 A
1.5.2	ECH	Complete Development of Waveguide Interior Visual Inspection Tool	3	25-Feb-15	15-Dec-14 A
1.5.2	ECH	Award Contract - 4.2 M Waveguide Manufacturing Process	3	30-Sep-15	22-Jun-15
1.5.2	ECH	Technical Pkg to Procurement - Polarizer Pair Test Article Design	3	30-Sep-15	20-Jul-15
1.5.3	Diagnostics	PPPL - Diagnostic Shield Module - Contract Award Manufacturing Design Studies	3	01-May-15	20-Feb-15 A
1.5.3	Diagnostics	PPPL - Visible/Infrared Cameras (Sensors & DAQ) UPP - Award Phase 2 Contract	3	30-Sep-15	31-Aug-15
	2014 Carryover				
1.1.1.1	CS Modules	Complete Stack and Join, He Penetrations MRR Meeting	3	30-Jul-14	15-May-15
1.1.1.1	CS Modules	Complete Joint and Terminal Prep MRR Meeting	3	30-Jul-14	08-Apr-15 A
1.3.1.1	Roughing Pumps	Complete Testing of Roots & Screw Prototype Pumps	3	23-Sep-14	09-Mar-15 A

= Completed

Department of Energy
ORNL Site Office
P.O. Box 2008
Oak Ridge, Tennessee 37831-6269

July 1, 2015

MEMORANDUM FOR DISTRIBUTION

FROM: DAVID K. ARAKAWA
FEDERAL PROJECT DIRECTOR
U.S. CONTRIBUTIONS TO ITER PROJECT

SUBJECT: U.S. ITER PROJECT MONTHLY REPORT – MAY 2015

Attached for your information is a copy of the project's Monthly Report for May 2015. Cumulative cost and schedule earned value performance indices for the month were 0.99 and 1.0, respectively. Thirteen Project Change Requests (PCRs) were processed during May and these PCRs are summarized in Appendix B of this report. There was one Level 1 milestone (Delivery of High Voltage [HV] Substation Transformers [Lot 4] by US-DA to ITER Site) and one Level 3 milestone (Complete Pellet Injection Systems Level Preliminary Design Review Meeting), which were completed early during May.

Key activities in May included the continued installation of equipment, manufacturing readiness reviews, and commissioning activities for the remaining Central Solenoid (CS) fabrication stations at General Atomics. Fabrication of first article CS Structure tie plates continued, as well as pre-fabrication activities for CS Structure Lower Key Block components. In addition to the deliveries of HV transformers, two of the transformers were installed at the ITER site, representing the first installation of key components from any Domestic Agency. Fabrication of Toroidal Field Conductor and Tokamak Cooling Water System Drain Tanks continued. Research and development and design activities continued for the Pellet Injection System, the Disruption Mitigation System, Diagnostics, and Ion Cyclotron and Electron Cyclotron Transmission Lines.

If there are any questions or additional information is required, please contact me at (865) 576-2667 or David Myers at (865) 576-5629.

SUBJECT: U.S. ITER PROJECT MONTHLY REPORT – MAY 2015

Attachment

Distribution w/attachment:
J. Steve Binkley, SC-21
Kin K. Chao, SC-28
Casey R. Clark, SC-28
Patricia M. Dehmer, 5C-2
Michael L. Knotek, S-4
Joseph J. May, SC-24.1
Stephen W. Meador, SC-28
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Sotirios Thomas, S-4
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Jeffrey Makiel, PPPL
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Michele G. Branton, SC-OSO
William C. Cahill, SC-OSO
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Johnny O. Moore, SC-OSO

Distribution w/o attachment:
Dina O. Clark, ORNL
Suzanne A. Herron, ORNL
Ned R. Sauthoff, ORNL

US Contributions to ITER

Monthly Report – May 2015

The first plant components, two HV substation transformers procured by the US, were installed at the ITER site on May 21, 2015.

SAHerron

Suzanne A. Herron
US ITER Deputy Project Manager

6/29/15

Date

Prepared by
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6283
managed by
UT-BATTELLE, LLC
for the
US DEPARTMENT OF ENERGY
under contract DE-AC05-00OR22725

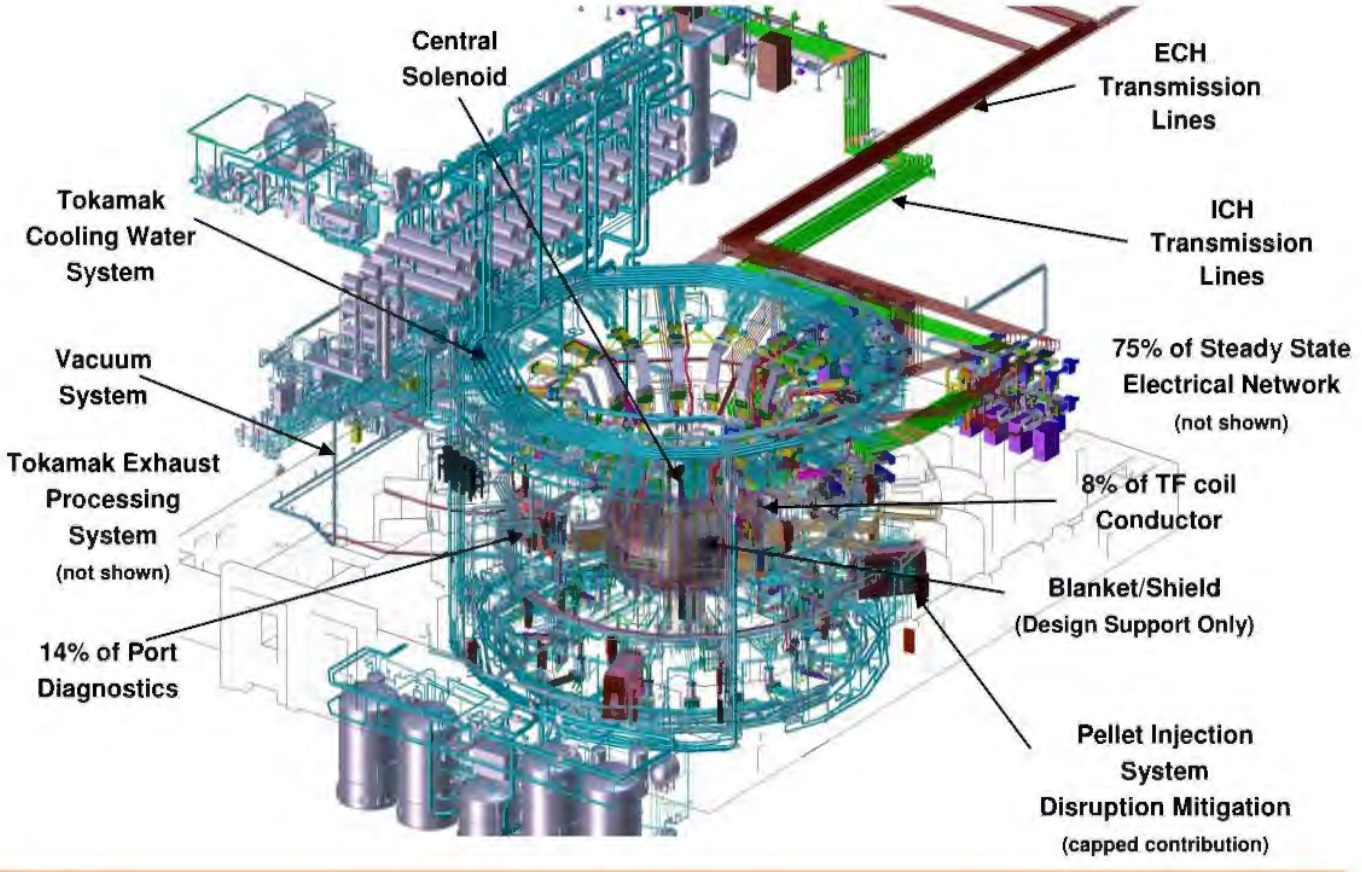
United States (US) Contributions to ITER

ITER is a unique international scientific collaboration representing more than half of the world's population. The ITER Members will design, build, and operate a first-of-a-kind international research facility in Cadarache, France aimed at demonstrating the scientific feasibility of fusion energy. This is the next step in establishing fusion as a practical long-term energy source, with acceptable environmental characteristics (no greenhouse gas emissions and no long-lived radioactive waste) and using abundant, readily available fuel (deuterium from water).

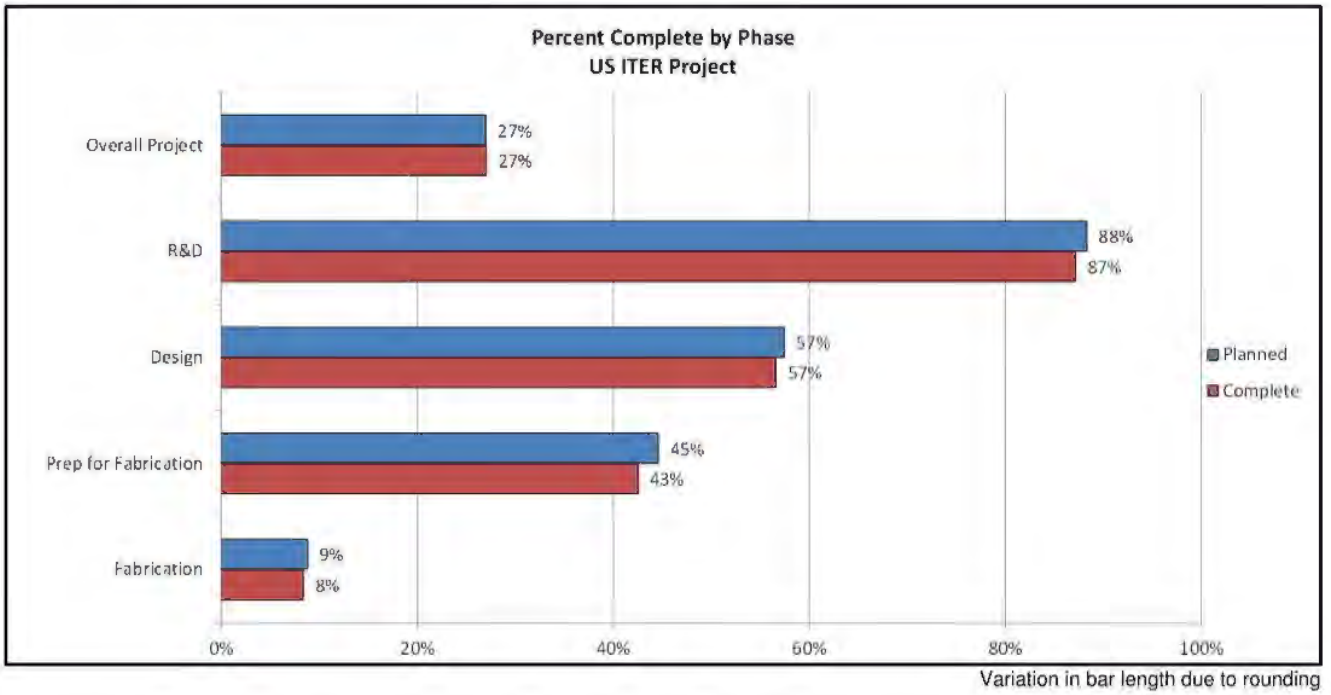
The US is to provide 9.09% of the ITER hardware components (by value) and cash equivalent to 9.09% of the international organization budget (for common expenses such as hardware assembly and installation). ~80% of US funding will be utilized for the hardware components. This funding will not only contribute to state and regional economies, but will enable US industry, universities, and labs to remain at the forefront of fusion technology and engineering. The US industries also benefit from the ITER Project by securing contracts from other ITER domestic agencies (DAs). Additionally, for its 9.09% contribution, the US will have access to all the scientific data and the right to propose and carryout experiments, which will enable the US to achieve its ITER-related goals in fusion science and fusion technology.

The ITER Members are China (CN), the European Union (EU), India (IN), Japan (JA), South Korea (KO), the Russian Federation (RF), and the US. The legal framework for construction, operation, deactivation, and decommissioning is contained in the ITER Joint Implementation Agreement (JIA), which entered into force in October 2007. The US ITER Project is a collaboration of US Department of Energy (DOE) laboratories, Oak Ridge National Laboratory (ORNL), Princeton Plasma Physics Laboratory (PPPL), Savannah River National Laboratory (SRNL) assisted by universities and industries around the country.

As shown below, the US Hardware contributions are highly integrated around the Tokamak Core.

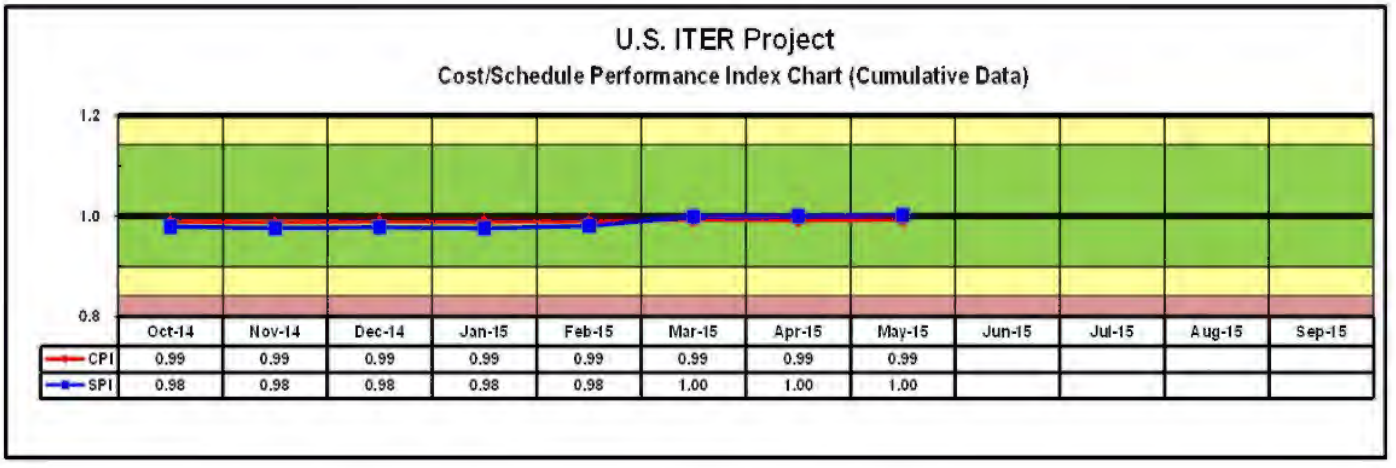


Project progress as of May 2015 is shown below:



Variation in bar length due to rounding

The following graph shows the Cost/Schedule Performance Indices based on earned value (against the early finish schedule). The overall performance indices remain steady as the cumulative Schedule Performance Index (SPI) for the Project is 1.00 and the cumulative Cost Performance Index (CPI) is 0.99. Each index is well within the accepted range.



	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
CPI	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99				
SPI	0.98	0.98	0.98	0.98	0.98	1.00	1.00	1.00				

The Project's actual costs and commitments through May 2015 compared to the obligation plan are provided in the following graph.

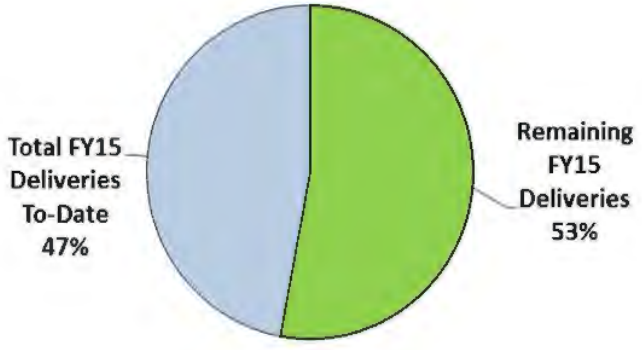
(b)(5)

Completed Deliveries of US ITER Hardware

~9% of total planned deliveries (343)

Completed En route

FY15 Deliveries
VAS, Portable RGA Station: Oct-14 A
SSEN, Earthing Resistors (Lot 1): Oct-14 A
SSEN, HV Substation Transformers (Lot 2): Jan-15 A
SSEN, HV Control and Protection (Lot 2): Apr-15 A
TF Conductor, Conductor 1 of 9: May-15 A
SSEN, HV Substation Transformers (Lot 1): May-15 A
SSEN, HV Substation Transformers (Lot 3): May-15 A
SSEN, HV Substation Transformers (Lot 4): May-15 A
VAS, UHV Pumping Cart (Vacuum Test Equip 14 of 16) : Jun-15 (pending VAT resolution)
TCWS, Drain Tanks 1st Shipment: Jun-15
SSEN, 22kV Switchgear (Lot 1): Jun-15
SSEN, 22kV Switchgear (Lot 2): Jun-15
SSEN, 6.6kV Switchgear (Lot 1): Jul-15
TCWS, Delivery of the five cooling water drain tanks: Aug-15
TF Conductor, Conductor 2 of 9: Aug-15
TF Conductor, 100m Active (Luvata): Sep-15
SSEN, 6.6kV Switchgear (Lot 2): Sep-15



US was the 1st Member to deliver ITER Hardware to the site

Key Activities This Month

Steady State Electrical Network (SSEN)

The remaining three (of four) SSEN High Voltage (HV) transformers were delivered to the ITER site. Two main bodies of SSEN HV transformers were installed at the ITER site. These represent the first installation of key components coming from any Domestic Agency.

Central Solenoid (CS) Modules and Structures

Manufacturing readiness reviews and commissioning of the workstations at General Atomics (GA) for CS module fabrication continue.

Pre-fabrication activities for the CS structure lower key block components are underway at Petersen, Inc.

Fabrication of first article tie plates for the CS structure is underway at Major Tool and Machining and Precision Custom Components.

Toroidal Field (TF) Conductor

Packaging of the second Oxford Superconductor Technology production conductor is underway and the jacket assembly for the third production conductor is complete.

Tokamak Cooling Water Systems (TCWS)

Fabrication of the remaining three drain tanks continues.

Project Management

The US ITER Project Change Request (PCR) System was reviewed by Fermilab staff and selected as a project control tool to meet their change control requirements. This represents the second software project controls tool distributed by US ITER and successfully installed at Fermilab.

Milestone Status

Thirty-three milestones were selected and approved for incorporation into the US ITER FY15 Performance Plan. The Plan was reviewed/concurred by the Federal Project Director (FPD) and has been reviewed and approved by DOE-FES.

One level 1 milestone (last delivery of the SSEN HV transformers) and one level 3 milestone (Pellet Injector system preliminary design review meeting) were completed this month.Twelve of the remaining 21 milestones are forecast to complete on or ahead of schedule.

Of the 6 DOE milestones (2 late, 4 forecast late), three are due to the resolution of the ITER water activation issue and all but one are forecast to complete by the end of the FY.

The following table provides an overview of the milestone status by Level.

	FY15 Performance Plan			
	Total	L1	L2	L3
Completed	12	3	2	7
On Schedule	12	-	3	9
Forecasted Late	6	-	4	2
Late	3	1	1	1
TOTAL	33	4	10	19

L1: DOE FES milestone
L2: DOE FPD milestone
L3: ORNL Project Manager milestone

CONTENTS

WBS 1.1.1 Magnet Systems – Oak Ridge National Laboratory (ORNL)

Central Solenoid (CS) Modules and Structure – Required for ITER 1st Plasma

The US is responsible for the CS magnet, including design, R&D, and fabrication of six CS modules (coils) and a spare module using supplied cable-in-conduit superconducting conductor (from JA), the vertical pre-compression structure, Assembly Tooling (AT), bus extensions, and cooling connections.

The CS serves as the backbone of the ITER magnet system. The CS induces the majority of the magnetic flux change needed to initiate the plasma, generate the plasma current, and maintain this current during the burn time.

General Atomics (GA) in San Diego, California, has been awarded a major contract to fabricate the modules of the CS.

Preparations for CS Modules , CS Structure and Assembly Tooling fabrication continue

WBS 1.1.1.1 – CS Modules

Testing has been underway to determine if the order of peening and heat treatment affect the residual stress in the toe of the He inlet weld. The second phase of testing was completed this month. It was found that the compressive stress at the surface of the welds remains after heat treatment. Measurement through the depth was delayed in order to test the samples at the High Flux Isotope Reactor (HFIR) at ORNL. HFIR requested that the sample welds be undisturbed for their tests to determine residual stress at shallow depths.

The final helium piping drawings have been approved by the IO. The IO has approved 58 of 72 planned drawings. 10 of the 14 remaining drawings are in the approval process. The last 4 drawings to be completed will be the top-level assembly drawings.

Module fabrication at GA is proceeding:

- **Station 3 – Joint and Terminal Prep.**
  - Work continues on the first hexapancake for the mock-up coil.
  - The splice end has the jacket removed and chrome stripping has begun.

- **Station 4 – Stack and Join.**
  - Additional commissioning activities were performed to increase confidence in preparing splice joints. These activities have concluded and the first MRR has been scheduled for June 11.
  - 26 of 31 weld samples have passed radiographic examination and test coupons are being prepared for mechanical testing at room temperature and at 4K.
  - The remaining weld samples have passed initial radiographic examination and are being heat treated.
  - All required weld qualification for mock-up processing has been accomplished.

- **Station 5 – Reaction Heat Treatment.**
  - The commissioning coil is being heat treated in preparation for completing commissioning activities.
  - The first MRR is scheduled for June 9.

- **Station 6 – Turn Insulation.**
  - Commissioning activities are continuing for Station 6. The MRR will be later than planned (forecast in August) due to issues with JK2LB supply and weld qualification.
  - Demonstration of the automated insulation wrapping head on the long lead was successful.
  - Strain gauges were installed on a conductor sample containing a T2 long lead.

- **Station 7 – Ground Insulation.**
  - Commissioning activities are continuing for Station 7.
  - The second helium penetration sample was successfully tested at 150kV for approximately 30 seconds before an electrical breakdown occurred.

CS Modules

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Begin winding the first central solenoid module	1	14-Apr-15	23-Mar-15 A	
Conduct Turn Insulation MRR	2	02-Jul-15	24-Aug-15	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

WBS 1.1.1.2 – CS Structures

Pre-fabrication activities continued at Petersen, Inc. for manufacturing the lower key block components.

Two fabricators, Major Tool and Machine and Precision Custom Components, are now fabricating first article outer tie plates. Award of the fabrication contract for upper components is expected in June.

CS Structures

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Award contract for the CS structures tie plates first articles	2	31-Jan-15	30-Jan-15 A	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

WBS 1.1.1.4 - CS Assembly Tooling (AT)

The Lifting Fixture follow-up FDR is now scheduled for June 15-16, 2015.

- The design analysis and calculations (DAC) was completed and is under review.
- All drawings (42) have been submitted.
- All models and drawings have been drafted and replicated for IO review, which has begun.

Toroidal Field (TF) Coil Conductor – Required for ITER 1st Plasma

The US will contribute 8% of the TF coil conductors. The IO is responsible for the conductor design which is released for fabrication. JA, EU, RF, KO, and CN are also contributing TF conductor.

The 18 TF coils produce a magnetic field around the ITER tokamak torus to confine the plasma particles. The US is responsible for enough conductors to wind slightly over one TF coil.

The coils will be made of cable-in-conduit superconductors, in which a bundle of superconducting strands is cabled together, compacted into a stainless steel conduit, and cooled by supercritical helium.

Luvata Waterbury (Waterbury, Connecticut) and Oxford Superconducting Technologies (Carteret, New Jersey) have been awarded major contracts to produce TF strand. New England Wire Technologies (Lisbon, New Hampshire) received the contract for cabling the strand and High Performance Magnetics (Tallahassee, Florida) will perform the conductor integration/jacketing.

Fabrication of TF Conductor continues

WBS 1.1.1.3 – TF Coil Conductor

A new payoff tension monitoring system and alcohol lubrication system for the fifth stage forming die has been installed at New England Wire Technologies.

Fourth stage cabling of the second 100 m Luvata cable is underway and fifth stage cabling is scheduled for June 16.

Packaging of the second Oxford Superconductor Technology production conductor (OST B) is 90% complete.

Jacket assembly for the third OST production conductor (OST C) has also been completed.

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Packaged and ready to ship first 760m conductor to EU	1	10-Jan-15	20-Oct-14 A	
Packaged and ready to ship Luvata 100m to EU	2	17-May-15	12-Mar-15 A	
2nd 760m Conductor packaged	2	22-Sep-15	01-Jul-15	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

WBS 1.2.1 Tokamak Cooling Water Systems (TCWS) – ORNL

TCWS – Portions of the system required for ITER 1st Plasma

The US is responsible for the design, engineering, and procurement of TCWS.

ITER's fusion power will reach 500 MW during the deuterium-tritium inductive plasma operation with an energy input of only 50 MW, yielding an energy multiplication factor of 10. Heat will be transferred by the TCWS from client systems to the environment through the secondary cooling system. TCWS is designed to cool client systems, such as the first wall/blanket, vacuum vessel, divertor, and neutral beam injector (NBI). Additional operations include baking of in-vessel components, chemical control of water provided to client systems, draining and drying for maintenance, and leak detection/localization.

The TCWS interfaces with the majority of ITER systems, including the secondary cooling system, which rejects this heat to the environment. Plasma operations are inherently safe because a functioning cooling water system is not required to ensure safe shutdown.

System Design and Fabrication of the remaining three (of five) Drain Tanks continue

Design

Integrated Blanket Edge Localized Mode Divertor (IBED) Primary Heat Transfer System (PHTS) piping and shielding 3D layout continues, as authorized under PCR-662, with focus on the relocation of IBED PHTS equipment previously on Level L4 to Level L3 and the routing of piping in the space between the cryostat and the bioshield.

The DOE Performance Plan milestone, "Develop a resource-loaded schedule for completion of the final design, incorporating the design solution for the gamma radiation issue", is forecast to be completed on June 1, 2015 by establishing a Design Plan to close PCR-662.This will ensure that the IO covers the cost of performing these activities, and linking the Design Plan schedule activities to IO-TCWS Arrangement activities to establish the delay in the design.

The IO initiated an evaluation of the fiber optical sensors for resolving issues associated with exposure to radiation and magnetic fields.

Fabrication of Drain Tanks

Normal Drain Tanks 2A and 2B were delivered to the ITER site. Issues associated with the resolution of rust spots found during receipt inspection, as well as accelerometer readings during transport, are being resolved.

Fabrication of the remaining three tanks is nearing completion with preparation for transportation expected by late June 2015. The status as of late May is:

- Neutral Beam Injection Tank – Nozzle N7 found out of tolerance and is being documented and approved with QA documentation (i.e., Non-Conformance Report). Hydrostatic leak testing is scheduled for early June.
- Safety Drain Tank 1A – Shrink Wrapping complete with final inspections scheduled.
- Safety Drain Tank 2A – External Inspection in progress with additional grinding to occur, if needed, followed by completion of ANB visual inspections of external surfaces.

Fabrication of TCWS Piping

The award of the ITER organization's framework contract for TCWS pipings and fittings remains on hold until resolution of the water activation issue.

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Delivery of the five cooling water drain tanks to port in France complete	1	30-Apr-15	29-Jul-15	
Develop a resource-loaded schedule for completion of the Final Design, incorporating the design solution for the gamma radiation issue.	2	31-May-15	01-Jun-15	
IO Awards Framework contract for TCWS Pipings & Fittings	2	31-Jul-15	25-Sep-15	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

WBS 1.3.1 Vacuum Pumping & Fueling Systems – ORNL

Roughing Pump Sets - A portion of the components required for ITER 1st Plasma

The US will contribute 100% of the ITER roughing pumps.

The ITER tokamak, cryostat, and auxiliary vacuum chambers must be evacuated prior to and during operations. The roughing pump system exhausts the torus and NBI cryopumps, service vacuum, and cryostat. This system will utilize a matrix of pump trains with various technologies to match specific vacuum system requirements, including tritium-compatible backing pumps for torus and neutral beam cryopumps.

Support to the IO for Conceptual Design continues

WBS 1.3.1.1 – Roughing Pump Sets

The test data from the initial round of cryogenic viscous compressor (CVC) performance testing in the ORNL Spallation Neutron Source (SNS) Cryogenic Test Facility (CTF) is being analyzed to determine what equipment adjustments will be required to achieve the desired performance and when such subsequent testing can be performed.

The final test report on the performance testing of the tritium compatible prototype roots and screw vacuum pump train was submitted to the IO.

Discussions were initiated with the IO on the revision of the associated Task Agreement for the inclusion of the test stand as a deliverable. The repackaging of the pumps for shipment to the IO was initiated.

The initial results of the performance testing of an alternative tritium compatible roots pump stack being conducted at Oerlikon/Leybold were evaluated.

Vacuum Auxiliary System (VAS) - A portion of the system required for ITER 1st Plasma

The US will design and procure the ITER vacuum auxiliary system.

The vacuum auxiliary system consists of valves, pipe manifolds, auxiliary pumps, sensors, and controls. The torus and NBI vacuum manifolds of this system need to be tritium compatible.

The Vacuum Auxiliary System Procurement Arrangement 3.1.P4.US.01 (designated as **VAS-01**) scope includes the design and procurement of those components associated with the vacuum piping which serve as the manifolds providing vacuum service throughout the Tokamak Building.

The Vacuum Auxiliary System Procurement Arrangement 3.1.P4.US.02 (designated as **VAS-02**) scope includes the design and procurement of those vacuum components which connect the vacuum manifolds provided in VAS-01 to the clients (ITER technical systems) requiring vacuum service throughout the Tokamak Building.

Design continues and preparations for fabrication have begun

WBS 1.3.1.2 – Vacuum Auxiliary Systems (VAS)

Design

VAS-01 Scope:

Final design and analysis of the VAS-01 piping systems on levels L1 and L2 continues to progress while the design of the piping systems on levels L3, L4 and L5 remain on hold pending the finalization of changes associated with PCR-662 (ITER water activation issue).

VAS-02 Scope:

Continued development of the VAS-02 Cryogenic Guard Vacuum System (CGVS), Service Vacuum System (SVS) and Type 2 Diagnostic Vacuum Pumping Systems (T2DVPS) final design details.

Fabrication

VAS-01 Scope:

Procurement related documentation associated with the supply of the piping vacuum flanges, custom pipe supports and Clamshell leak test fixtures was initiated.

VAS

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Complete VAS-01 FDR (L1-L4)	2	30-Sep-15	30-Mar-16	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

Pellet Injector (PI) System – A portion of the system required for building integration prior to ITER 1st Plasma

The US will design and procure the PI system.

PI provides efficient core and edge fueling and will deliver hydrogen, deuterium, or a deuterium/tritium mixture as required by plasma operations. Delivering fuel pellets to the plasma edge mitigates ELM (edge localized mode) instabilities.

R&D and Preliminary Design Activities continue

WBS 1.3.1.3 – Pellet Injection

A load specification for the flight tubes preliminary design review (PDR) was completed and transmitted to the IO. All changes in the flight tube design from the April visit were incorporated in preparation for the PDR in June.

The pellet injection Systems Level PDR with the IO was conducted on May 13th.

Difficulty with leaks on the twin screw extruder test unit has delayed the completion of fabrication. The problematic leaks are at the brazed joints in the extruder body. The issues are being addressed with the supplier and completion is expected in June with testing resuming shortly after.

Disruption Mitigation – System not required for ITER 1st Plasma

The US will contribute up to a capped value for the Disruption Mitigation System (DMS). The system has two functions, 1) limiting the impacts of plasma current disruptions to the tokamak vacuum vessel, first wall blankets and other in-vessel components and, 2) suppressing the formation and deleterious effects of high-energy runaway electrons. Out of port plug installation of shattered pellet injection (SPI) units at four port locations that are designed to also function as massive gas injection (MGI) units is the current plan for the DMS. In addition, an option for an MGI unit within a port plug is included. This unit is to be designed to function during non-nuclear operations only to provide operational experience of a fast acting MGI unit close to the plasma.

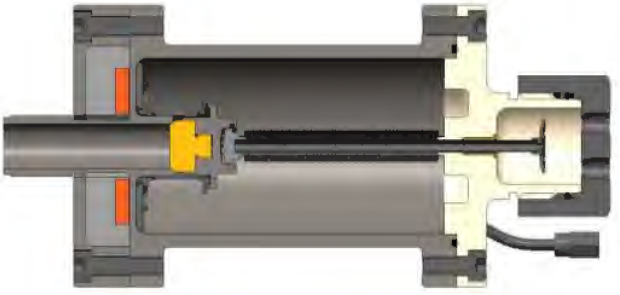
Preliminary Design Activities continue

WBS 1.3.1.4 – Disruption Mitigation

A service panel designed to operate the test massive gas injection (MGI) valve over many repetitions was designed and is under fabrication. The panel will be used to monitor the gas pressures and to remotely operate the valve for extended durability testing. Fabrication is expected to complete in June, with testing to resume afterwards.

Several options for testing an MGI valve in a high magnetic field are being explored. To date, two possible locations, the University of Minnesota and Los Alamos National Laboratory, are identified as possible facilities with the capabilities of testing the valve in ITER-like magnetic fields.

Design is underway of a flyer-plate driven shattered pellet injector (SPI) valve for ITER. The new design incorporates features to improve manufacturability, maintainability, and performance. The flyer plate has been relocated from typical valves to the discharge end of the valve, simplifying construction and improving performance, and the coil has been moved outside of the pressure boundaries.



CAD rendering of the SPI flyer plate driven valve. The coils (orange) have been moved outside of the pressure boundary.

WBS 1.3.2 Tokamak Exhaust Processing (TEP) – Savannah River National Laboratory (SRNL)

TEP – System not required for ITER 1st Plasma

The US is responsible for the Final Design (FD), fabrication, assembly, testing, and shipment of the TEP system.

ITER will require the processing of an unprecedented rate of hydrogen isotopes. To facilitate environmental responsibility and economic application of fusion technology, the reuse of hydrogen isotopes is vital. The TEP system must separate the exhaust gases into a stream containing only hydrogen isotopes and a stream containing only non-hydrogen gases. The implementation of the TEP system will provide a technically mature, robust, and cost-effective separation solution.

The TEP system consists of a series of filters, catalysts, and permeators (PM) to separate the hydrogen isotopes, which are then sent to an isotope separation system (furnished by the EU) to deliver deuterium and tritium for continuous reinjection into the reactor.

Support for Preliminary Design Activities continues

Preliminary design is the responsibility of the IO. A Task Agreement (TA) to the US delineates the part of the design to be performed by the US ITER TEP team. The US TEP design team has completed approximately 50% of Subtask-2 TEP Process Studies. All studies have been started and five of the studies are drafted. A set of reference documents, initial assumptions and a request for additional reference information was developed and sent to IO. Results of the studies will remain as 'draft' until the input information receives IO concurrence. Receipt of the final input from the IO is now scheduled for June.

WBS 1.4.1 Steady State Electrical Network (SSEN) – Princeton Plasma Physics Laboratory (PPPL)

SSEN - Hardware required for ITER 1st Plasma

The US contributes 75% of the equipment required for the SSEN, excluding cables and emergency power. The EU contributes the remaining equipment and is also responsible for the design and installation of the system as well as all cabling and all emergency (diesel generator) power systems.

The SSEN is an alternating current (AC) power substation and distribution system that supplies electrical power to all ITER conventional systems and facilities. A separate system delivers power to the pulsed systems, including the magnet and heating power supplies.

The SSEN is rated at 120 MW and is similar to the auxiliary power distribution system in a nuclear fission power plant, except that it is about twice the size. The equipment to be contributed by the US is typical of a large AC power distribution system, consisting of transformers and switchgear at the high-voltage (400 kV) and medium-voltage (22 kV) levels.

Hardware Procurements and Shipments continue

Twelve of 16 contracts have been signed and/or executed. Procurement of another contract is underway and the remaining 3 are on hold due to funding constraints. A total of 18 of 31 shipments have been completed. Status of the 16 SSEN procurements is as follows:

- The HV Substation Transformers (b)(5) (b)(5) have all been successfully delivered to the ITER site. Processing of Delivery Reports is underway, after which ownership of site support and warranty can be transferred to ITER and credit can be requested.

- The HV Circuit Breakers, HV Switches, HV Current Transformers, HV Potential Transformers, HV Surge Arresters, HV Substation Hardware, Earthing Resistors, and the HV Control & Protection have all been delivered to the ITER site. The final Delivery Reports and transfer ownership of site support and warranty are being processed for these items, after which ITER credit will be requested.

- The 22kV Switchgear (b)(5) (b)(5) (b)(5) Release for Shipping (RFS) documentation package review is underway, and shipping is planned to take place in June.

- The 6.6kV Switchgear (b)(5) (b)(5) was started. Lot 1 was completed and successfully factory acceptance tested.

- The Power Transformers (b)(5) (b)(5) Design Review was successfully conducted in April and chit resolution is underway. The next step will be to issue a Release for Manufacturing.

- US ITER authorized the procurement of the Reactive Power Compensators in FY15 so a Subcontract Proposal Evaluation Board (SPEB) was formed and preparations started on the Request for Proposal (RFP) package.

- DC Distribution, UPS, and LV Distribution & Sub-distribution Panels procurement activities are on hold due to funding constraints.

SSEN

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
IPL> Delivery of HV Substation Transformers (Lot 4) by US-DA to ITER Site	1	27-May-15	21-May-15 A	
Packaged and ready to ship - 6.6kV Switchgear (Lot 1)	2	28-Jun-15	07-Jul-15	
Packaged and ready to ship - 22kV Switchgear (Lot 2)	2	16-Jul-15	08-Jun-15	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

WBS 1.5.1.1 Ion Cyclotron Heating (ICH) Transmission Lines – ORNL

IC Transmission Lines– A portion of the system is required for building integration prior to ITER 1st Plasma

The US is responsible for the IC transmission lines, including R&D, design, fabrication, and interfaces. The IO is responsible for installing the IC transmission lines.

The IC system heats the ions in the plasma with a high-intensity beam of electromagnetic (EM) radiation. Generators produce high-power radio frequency waves that are carried along multiple transmission lines to antennas located in the vacuum vessel, sending the waves into the plasma. The US IC transmission lines will provide efficient power transfer from 40–55 MHz radio frequency sources to the plasma heating antennas. The system will include coaxial transmission lines and a matching/tuning system to minimize power transfer losses. The pressurized lines can transmit up to 6 MW per line. In total, approximately 1.5 km of line connects 8 sources to 16 antenna feeds, with 14 types of transmission line and matching system components. The main interfaces include sources, launchers, buildings, port cells, and water cooling. The short coaxial line also provides secondary tritium confinement.

Preliminary Design Activities continue

Design kickoff meetings were completed with the vendor teams that are in the first phase of developing designs of 3-meter-long stub tuners. The ICH tuning/matching system requires the use of up to ninety-six of these mechanically driven internal sliding shorts.

Issued Request for Proposal (RFP) for the design and fabrication of a rotary joint test article. The rotary joint will compensate for thermal expansion ITER vacuum vessel and length expansion of the ICH transmission lines when operating at high power.

WBS 1.5.2.1 Electron Cyclotron Heating (ECH) Transmission Lines – ORNL

EC Transmission Lines – A portion of the system is required for ITER 1st Plasma

The US is responsible for the EC transmission lines, including R&D, design, fabrication, and interfaces. The IO is responsible for installing the EC transmission lines.

The EC system heats the electrons in the plasma with a high-intensity beam of electromagnetic radiation. This system is also used to deposit heat in very specific places in the plasma. Power will be provided by powerful, high-frequency gyrotrons. The US transmission line design will provide efficient power transfer from 170 GHz gyrotron sources to plasma heating power launchers (20 MW).

The transmission lines feature multiple lines of evacuated aluminum waveguides with internal corrugations that can transmit 1.5 MW per line for 3000 seconds, while minimizing power transfer losses to ≤ 10%. Approximately 4 km of transmission line will be part of this system, connecting 24 sources to 56 feeds with 10 types of waveguide components. The main interfaces include sources, launchers, buildings, port cells, water cooling, and auxiliary vacuum. The waveguide also provides secondary tritium confinement.

Final Design Activities continue

The statement of work and technical specifications for the ECH transmission line gyrotron commissioning power loads (dummy loads) was completed. Dummy loads are devices designed to absorb the generated power from the gyrotrons during installation, commissioning, and conditioning. Each gyrotron has a switch that can direct power to either the ITER tokamak or the dedicated long pulse dummy load.

Bids from five vendors were evaluated for a Basic Ordering Agreement (BOA) for "Process Development and Manufacture of 4.2m Waveguide and Associated Components". The long straight sections of the ECH transmission line need to be manufactured with high precision in both straightness and section-to-section alignment in order to minimize power losses. Bids were also evaluated for the initial BOA task. The initial task is for BOA vendors to provide their evaluation of existing and alternative manufacturing process options. Subsequent tasks include qualification of the selected manufacturing process and the manufacture of approximately 1800, 4.2m long, ECH waveguide sections.

WBS 1.5.3 Diagnostics – PPPL

Diagnostics – Only a few instruments (RGA & LFSR) needed for ITER 1st Plasma

The US is responsible for 14% of port-based diagnostic systems, including integration of 4 diagnostic port plugs, plus 7 instrumentation systems out of a total of approximately 40 individual diagnostic systems. The EU, RF, CN, KO, and IN are also contributing to ITER diagnostics.

ITER diagnostic systems provide measurements to aid understanding of plasma behavior and optimize fusion performance. Because of the harsh environment inside the tokamak vacuum vessel, these systems must cope with a range of conditions not previously encountered by diagnostic technology, all while performing with high reliability. US Diagnostics will include microwave, laser, x-ray, and optical systems. The US will provide design, fabrication, assembly, and testing of US port plugs, specifically the Upper Ports (U11, U17) and Equatorial Ports (E3, E9). In addition, the US will support the integration into these plugs of multiple diagnostics, including some from other DAs.

The US will also be responsible for the following instrumentation systems: Upper IR/Visible Cameras, Low Field Side Reflectometry (LFSR), Motional Stark Effect (MSE), Electron Cyclotron Emission (ECE), Toroidal Interferometer/Polarimeter (TIP), Core Imaging X-ray Spectrometer, and Residual Gas Analyzer (RGA).

R&D and Design Continue

IO reflectometry experts accepted the US proposal for an All-Monostatic Low Field Side Reflectometry (LFSR) diagnostic configuration using 7 fixed microwave antennas. This configuration is optimal for satisfying the primary LFSR measurement requirements laid out in the LFSR procurement arrangement. LFSR will be integrated in the Russian Equatorial Port 11 and locking in a LFSR configuration helps to keep pace with the Russia DA integration schedule.

A team of six engineers and project managers from the EU-DA (F4E) and the company IDOM visited PPPL this month to discuss ITER diagnostic port plug engineering and integration. IDOM is the primary contractor for all EU port plug engineering and integration. The US has two diagnostic systems in EU port plugs and this meeting helped to kick off this tenant-integrator relationship and design approach parameters.

Diagnostic and Port Plug CAMs along with General Atomics staff attended a two day Value Engineering workshop conducted by Bruce Lenzer, a Value Engineering and program management expert from Jefferson Lab. The diagnostics workscope is being evaluated to determine which USITER and PPPL engineering and project control processes could be optimized in this way. Expensive engineering components are also being identified for VE analysis.

The Diagnostic RGA (DRGA) team submitted the revised Lower Port 12 DRGA Load Spec to iDOCS this month for US review. The load specification was difficult to update due to many of the supporting documents from the IO being incomplete. A key event was gaining acceptance for the US team to use the ASME piping code instead of the European RCC-MR code

Diagnostics

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
PPPL - Motional Stark Effect - Award Phase 1 Design Contract	2	30-Sep-15	29-Sep-15	

= Completed | = On-Schedule | = Forecast to Miss PP Date | =Missed PP Date

WBS 1.6 Project Support – ORNL

Procurement

Key procurement actions for May included:

- A Modification for Task Order 6 Fabrication Management Funding (1.6.3) was issued to AREVA ($78,614)
- A Modification for Transport of TF 100m Luvata Conductor (1.1.1.3.9) was issued to Transproject ($10,082)

Human Resources

One posting closed for the ITER Organization in May and two US candidates were nominated for review. Five US candidates were selected to interview for the Quality Assurance & Assessment Division Head and Communication Head positions. Also, two new positions were posted for a Structural Analysis Civil Engineer and a Construction Coordinator for which the Human Resources team continues to review applicants.

Category of staff	*European Union*	*India*	*Japan*	*China*	*Korea*	*Russian Federation*	*United States*	*Total*
DES	*228*	*13*	*20*	*26*	*25*	*20*	*16*	*348*
SEC	*11*							*11*
Total	***239***	***13***	***20***	***26***	***25***	***20***	***16***	***359***
Post Doc	*3*			*1*	*1*			*5*
VRs		*1*		*1*				*2*
	66.6%	*3.6%*	*5.6%*	*7.2%*	*7.0%*	*5.6%*	*4.5%*	

DES: directly employed staff by the IO;
SEC: Secondees to the IO;
VRs: Visiting Researchers at the IO

Quality Assurance (QA)

Inspections by Bureau Véritas (under contract to IO) of TCWS drain tanks fabrication activities at Joseph Oat Corporation continued. One report received for May inspections was statused as SATISFACTORY.

PPPL quality inspector completed eight visits to Joseph Oat Corporation in May to assess and report on fabrication progress for the NBI and Safety drain tanks.

Follow-up assessments were performed at High Performance Magnetics (HPM) and National High Magnetic Field Laboratory (NHMFL) during May:

- HPM follow up surveillance and witnessing of 770m cable insertion/compaction.
- NHMFL surveillance, sampl heat treating capabilities.

WBS 1.7 International Organization Support (Secondees and Cash Contributions) – ORNL

Per the JIA, the US is obligated to contribute 9.09% of the value estimate of the construction of ITER. The contributions are measured in ITER kilo Units of Account (kIUA), which has been used by ITER for many years; 1 kIUA equals $1M US dollars (January 1989). The US commitment, 424.618 kIUA, includes hardware fabricated/procured by the US, cash for installation and commissioning, staff (secondees or cash for direct employees), and cash for R&D directed by the IO.

The US can also receive credit (kIUAs) for performing additional work through approved Task Agreements (TAs). The US will cover its share of the cash contributions through cash payments in current year Euros upon request by the IO. Euros are purchased with current year dollars using the current exchange rate when the payment is due. To establish the kIUA value of annual cash contributions, the Euros are de-escalated to Euros (January 1989) using proven inflation rates, and then converted to millions of dollars (January 1989) to yield kIUA.

Note: the tables below reflect a new decision not to grant credit for contributions to the IO prior to CY 2007. The Cash Payments Table contains the 2006 cash contribution but the credit does not contain this 2006 value.

Cash Payments

Calendar Year	Budgeted €	Paid €	Paid $	Remaining Obligation €
2006	409,000 €	409,000 €	$528,918.80	0
2007	3,985,000 €	3,985,026.06 €	$5,463,231.76	0
2009	15,689,630.70 €	15,689,604.64 €	$21,102,518.24	0
2010	9,567,409 €	9,567,409 €	$13,552,234.85	0
2010 Supplemental	1,577,433 €	1,577,433 €	$2,018,010.04	0
2011 Advance Payment	9,132,173 €	9,132,173 €	$11,650,826.31	0
2012	9,450,359 €	9,450,359 €	$12,133,315.92	0
2013	17,672,925 €	17,672,925 €	$23,975,973.67	0
2014	14,885,339 €	14,885,339 €	$20,280,343.91	0
2015	13,741,328 €	13,741,328 €	$14,827,218.12	0
Cumulative	*96,110,596.70 €*	*96,110,596.70 €*	*$125,532,591.62*	*0*
Estimated Credit Earned to date: 59.284 kIUA				
Average Exchange Rate realized for cash paid = 1.306				

Secondees/Employees

U.S. Secondees	Credit Earned: 1.531 kIUAs
	Current Number of Secondees: 0
U.S. Direct Hires	Current Number of U.S. Direct Hires: 37
	1 New Hire starting in August 2015

Total Credit Earned (~20% of total planned)

Allocation	Total Planned Credit (kIUA)	Actual Credit Received (kIUA)	Change in Actual	Remaining Credit (kIUA)
Secondees	1.531	1.531		-
HW	207.520	11.730		195.790
TA	15.193	12.685		2.508
Cash	202.986	59.284		143.702
Total	427.230	85.230		342.000

	2007	2008	2009	2010	2011	2012	2013
Cash	2.711	0	10.138	13.063	0	5.835	10.645
Secondees	.629	.274	.277	.246	.105	0	0
TAs	0	.300	.048	2.284	4.611	2.497	1.939
PAs	0	0	0	2.500	0	5.850	0
Total	*3.340*	*.574*	*10.463*	*18.093*	*4.716*	*14.182*	*12.486*

	2014	2015	Total
Cash	8.842	8.050	59.284
Secondees	0	0	1.531
TAs	1.006	0	12.685
PAs	3.380	0	11.730
Total	*13.228*	*8.050*	*85.230*

WBS 1.8 Supplemental Task Agreements (TA) with the IO

Task Agreements currently in-progress

TA #	Description	Agency	US Contact	Credit Amount (kIUA)	Credit Received to Date (kIUA)	TA Start	Expected Finish
TA-FC-IPT-US-RP-01	Validation of Mechanical Roughing Concepts	US-IPO	M. Hechler, Larry Baylor	0.435		01/02/2011	07/15/2015
C.74 TD 21 FU	Neutronics Analysis Support for ITER	ORNL / U. of Wisc.	B. Nelson / Mohamed Sawan	0.318		09/01/2014	09/30/2015
TA-FC-IPT-US-RP-02	ITER Roughing System Cryogenic Viscous Flow Compressor Development	US-IPO	M. Hechler, Larry Baylor	0.267		01/02/2011	11/24/2015
C.55 TD 36 FU	Generic Diagnostic First Wall Preliminary and Final Design	PPPL	Wayne Steffey, Doug Loesser	1.237	0.322	09/01/2012	03/31/2016
C.18 TD 35 FU	Development of ITER class Pellet Injector	US-IPO	D. Rasmussen	0		10/01/2008	07/28/2016
TA-FC-IPT-US-13-01	Preliminary Design Tasks associated with PBS 32.EP Plant System	SRNL	Bernice Rogers	0.571		10/17/2013	06/30/2017
TA-FC-IPT-US-RP-03	Validation of Piston Pump for ITER Roughing System	US-IPO	Dave Rasmussen, Larry Baylor	0.002		10/17/2012	11/30/2017
			Total kIUA	2.830	0.322		
			Approx. $	$ 6,248,000	$ 711,000		

WBS 1.9 Instrumentation and Controls (I&C)

Centralized Instrumentation and Controls Support. Required for ITER 1st Plasma

The US is responsible to provide I&C for all Procurement Arrangements (except Magnets and SSEN). Work scope includes: conceptual, preliminary, and final I&C design; I&C software design; I&C hardware and software procurement; I&C equipment fabrication; and I&C qualification and testing. The WBS 1.9 work scope definition includes the majority of US DA I&C work scope, but the details will be defined on a WBS-by-WBS basis. (e.g. Some major equipment procurements will include I&C content; some engineering services contracts such as for Diagnostics will include I&C content; etc. so this work scope will remain in the other WBS areas). Benefits of a centralized I&C support include: sharing of specialized engineering resources; the promotion of standard designs, standard software components, and standard equipment; and the provision of commonly-required services including technical and qualification support.

Assembling I&C team and starting Conceptual and Preliminary Designs

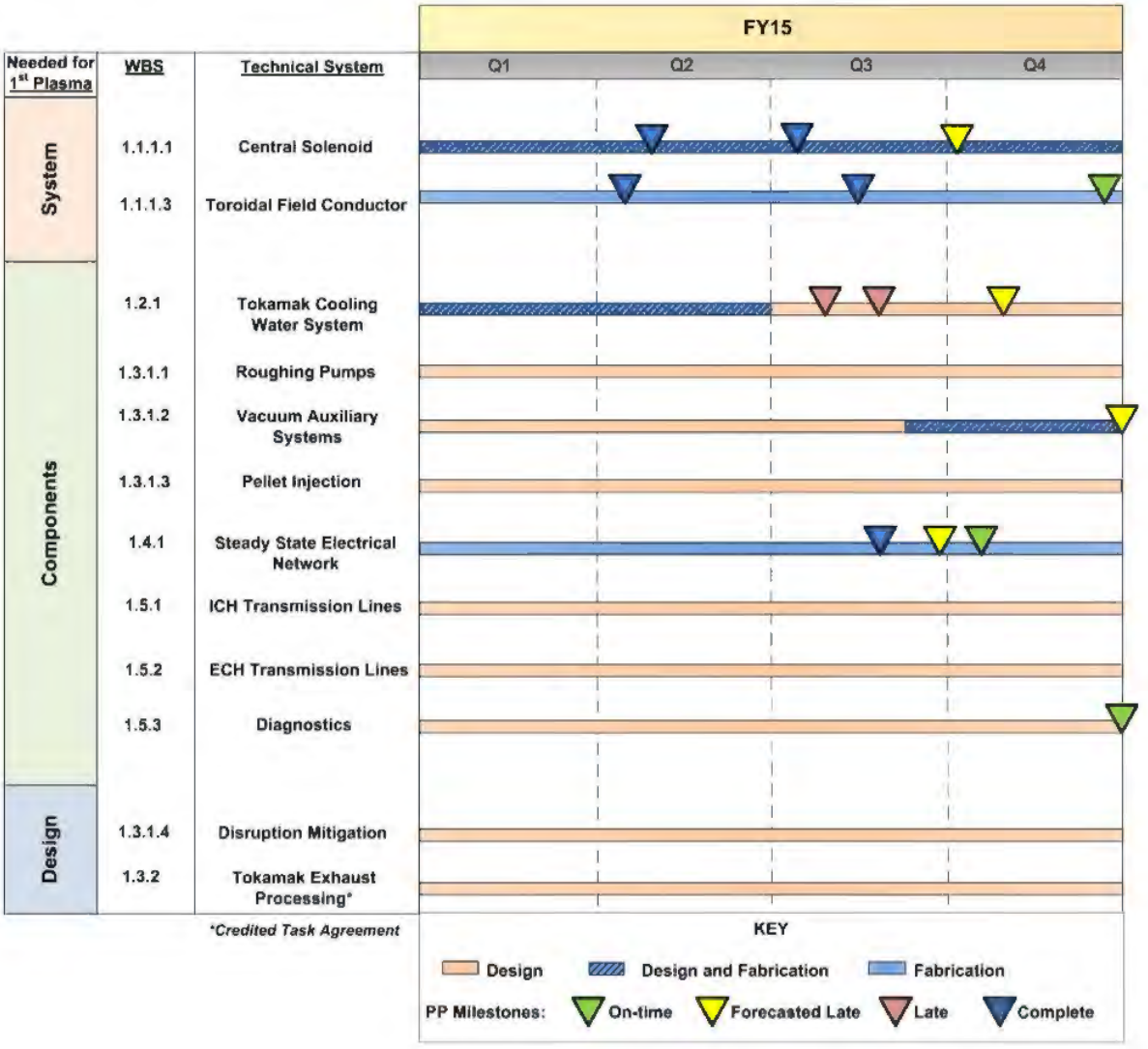
WBS 1.9 Instrumentation and Control – ORNL

The I&C WBS Team Leader visited the IO for first time and met with the Control System Division head and his staff. Meetings were conducted on radiation hardness assurance policy developments and status of neutronics simulation, as well as ICH machine protection.

A summer intern has started setting up a prototype I&C database.

Appendix A
US ITER Project Schedule
(L1/L2 Milestones)

Shown below is the summary schedule for the Project's planned activities in FY15. The schedule is aligned with the revised funding provided by the DOE Office of Fusion Energy Science which assumes funding of $150M in FY15 and $150M in FY16.



Appendix B

Project Change Requests processed this month

There were thirteen Project Change Requests (PCRs) processed in May. All PCRs were reviewed against the contingency guidance to determine the applicable usage of Management Reserve and DOE-held contingency.

All PCRs were Level 3 (Project).

				Impact ($M)	
Month	PCR #	Description	WBS	Management Reserve	DOE Contingency
May	IC-2015-3	ICH Design Review Restructure	1.5.1.1	(0.100)	
May	DA-2015-10	RGA - I&C Fabrication Missing Effort Fix	1.5.3.6	(0.670)	
May	VF-2015-5	Advance Dust Filter Procurement	1.3.1.2	0.008	
May	RP-2015-4	Advance CVC and CSS Procurements	1.3.1.1	0.088	
May	ST-2015-5	Incorporate schedules and contract values from awarded contracts for Tie Plates	1.1.1.2	(0.987)	
May	ST-2015-6	Incorporate latest vendor schedule for the Lower Keyblock Assembly contract	1.1.1.2	-	
May	CS-2015-18	Full BCWS replan for all of General Atomics	1.1.1.1	-	
May	VF-2015-6	Hood Clamshell Tools	1.3.1.2	(0.113)	
May	CS-2015-19	GA's cost fee and pending changes realignment	1.1.1.1	-	
May	CW-2015-10	Transfer of Hours to 1.5.1 & Correction of Hours	1.2.1	-	
May	DA-2015-12	Diagnostics - May 2015 - WAV Subcontract, TIP Subcontract, EP03, D-Site Operations Re-Plans	1.5.3	(11.434)	
May	ST-2015-7	Structures G-10 material property study	1.1.1.2	(0.064)	
May	TF-2015-6	TF Conductor - Delays in Cabling and 2nd Integrator	1.1.1.3	(0.311)	

Appendix C

Level 3 (Project Manager) FY15 Milestones

WBS	System	Milestone Description	MS Level	Performance Plan Date	Forecast Date
1.1.1.1	CS Modules	Conduct Heat Treatment MRR	3	02-Jun-15	09-Jun-15
1.1.1.1	CS Modules	Conduct Ground Insulation MRR	3	24-Sep-15	23-Sep-15
1.1.1.2	CS Structures	Award contract for Upper keyblock, load distribution plate, pre-compression components.	3	30-Sep-15	05-Jun-15
1.1.1.3	TF Conductor	Cable 3 fabrication complete	3	11-Mar-15	09-Jan-15 A
1.1.1.3	TF Conductor	Cable 4 fabrication complete	3	08-Jul-15	31-Jul-15
1.1.1.4	CS Assembly Tooling	Award contract for Assembly Platform	3	30-Sep-15	24-Jun-15
1.1.1.4	CS Assembly Tooling	Award contract for Lifting Fixture	3	30-Sep-15	25-Sep-15
1.2.1	Tokamak Cooling Water	IO contract in-place for Analysis and Calculation (Mechanical Eng) for Captive Piping Design	3	04-Mar-15	10-Sep-15
1.2.1	Tokamak Cooling Water	IO completes implementation of the staffing plan to manage and oversee work done under the TCWS Arrangements	3	30-Sep-15	01-Jun-15
1.3.1.3	Pellet Injection	Begin Procurement of Initial Cask and Piping Design Integration	3	27-Feb-15	13-Feb-15 A
1.3.1.3	Pellet Injection	Complete Pellet Injection Systems Level Preliminary Design Review Meeting	3	13-Jun-15	13-May-15 A
1.3.1.4	Disruption Mitigation	Complete Disruption Mitigation System Preliminary Design Review Meeting (with IO)	3	07-Jan-15	07-Nov-14 A
1.5.1	ICH	Award contract for DC Breaks Test Article	3	02-Sep-15	03-Aug-15
1.5.1	ICH	Award contract for Tuning Stub and Drive Mechanism Test Article Design and Fabrication	3	30-Sep-15	27-Mar-15 A
1.5.2	ECH	Complete Development of Waveguide Interior Visual Inspection Tool	3	25-Feb-15	15-Dec-14 A
1.5.2	ECH	Award Contract - 4.2 M Waveguide Manufacturing Process	3	30-Sep-15	22-Jun-15
1.5.2	ECH	Technical Pkg to Procurement - Polarizer Pair Test Article Design	3	30-Sep-15	24-Aug-15
1.5.3	Diagnostics	PPPL - Diagnostic Shield Module - Contract Award Manufacturing Design Studies	3	01-May-15	20-Feb-15 A
1.5.3	Diagnostics	PPPL - Visible/Infrared Cameras (Sensors & DAQ) UPP - Award Phase 2 Contract	3	30-Sep-15	02-Sep-15
	2014 Carryover				
1.1.1.1	CS Modules	Complete Stack and Join, He Penetrations MRR Meeting	3	30-Jul-14	11-Jun-15
1.1.1.1	CS Modules	Complete Joint and Terminal Prep MRR Meeting	3	30-Jul-14	08-Apr-15 A
1.3.1.1	Roughing Pumps	Complete Testing of Roots & Screw Prototype Pumps	3	23-Sep-14	09-Mar-15 A

= Completed

Department of Energy
ORNL Site Office
P.O. Box 2008
Oak Ridge, Tennessee 37831-6269

August 7, 2015

MEMORANDUM FOR DISTRIBUTION

FROM: DAVID K. ARAKAWA
FEDERAL PROJECT DIRECTOR
U.S. CONTRIBUTIONS TO ITER PROJECT

SUBJECT: U.S. ITER PROJECT MONTHLY REPORT – JUNE 2015

Attached for your information is a copy of the project's Monthly Report for June 2015. Cumulative cost and schedule earned value performance indices for the month were 0.99 and 1.0, respectively. Ten Project Change Requests (PCRs) were processed during June and these PCRs are summarized in Appendix B of this report. There were three Level 2 milestones and three Level 3 milestones, which were completed during June. Each of the completed milestones is listed with a summary of milestone status on page 8 of the report.

Key activities in June included the continued installation of equipment, manufacturing readiness reviews for the Heat Treatment Station and for the Stack & and Join/Helium Penetrations Station, and commissioning activities for the remaining Central Solenoid (CS) fabrication stations at General Atomics. Fabrication of first article CS Structure tie plates continued, as well as, pre-fabrication activities for CS Structure Lower Key Block components. In addition, a subcontract was awarded for fabrication of CS Structure Upper Components. The Steady State Electrical Network 22kV Switchgear (Lots 1 and 2) were delivered this month. Fabrication of Toroidal Field Conductor continued and an arrangement was signed with the ITER Organization for integration of the remaining production unit lengths. Research and development and design activities continued for the Pellet Injection System, the Disruption Mitigation System, Diagnostics, and Ion Cyclotron and Electron Cyclotron Transmission Lines.

If there are any questions or additional information is required, please contact me at (865) 576-2667 or David Myers at (865) 576-5629.

SUBJECT: U.S. ITER PROJECT MONTHLY REPORT – JUNE 2015

Attachment

Distribution w/attachment:
J. Steve Binkley, SC-21
Kin K. Chao, SC-28
Casey R. Clark, SC-28
Patricia M. Dehmer, SC-2
Michael L. Knotek, S-4
Joseph J. May, SC-24.1
Stephen W. Meador, SC-28
Edward J. Stevens, SC-24.2
Edmund J. Synakowski, SC-24
Sotirios Thomas, S-4
Thomas J. Vanek, SC-24.1
Brian D. Huizenga, MA-50
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Johnny O. Moore, SC-OSO

Distribution w/o attachment:
Dina O. Clark, ORNL
Suzanne A. Herron, ORNL
Ned R. Sauthoff, ORNL

US Contributions to ITER

Monthly Report – June 2015

Lower key block for the central solenoid magnet structure during forging operations at Scot Forge in Spring Grove, IL.

Suzanne A. Herron
US ITER Deputy Project Manager

Date 7/31/15

Prepared by
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6283
managed by
UT-BATTELLE, LLC
for the
US DEPARTMENT OF ENERGY
under contract DE-AC05-00OR22725

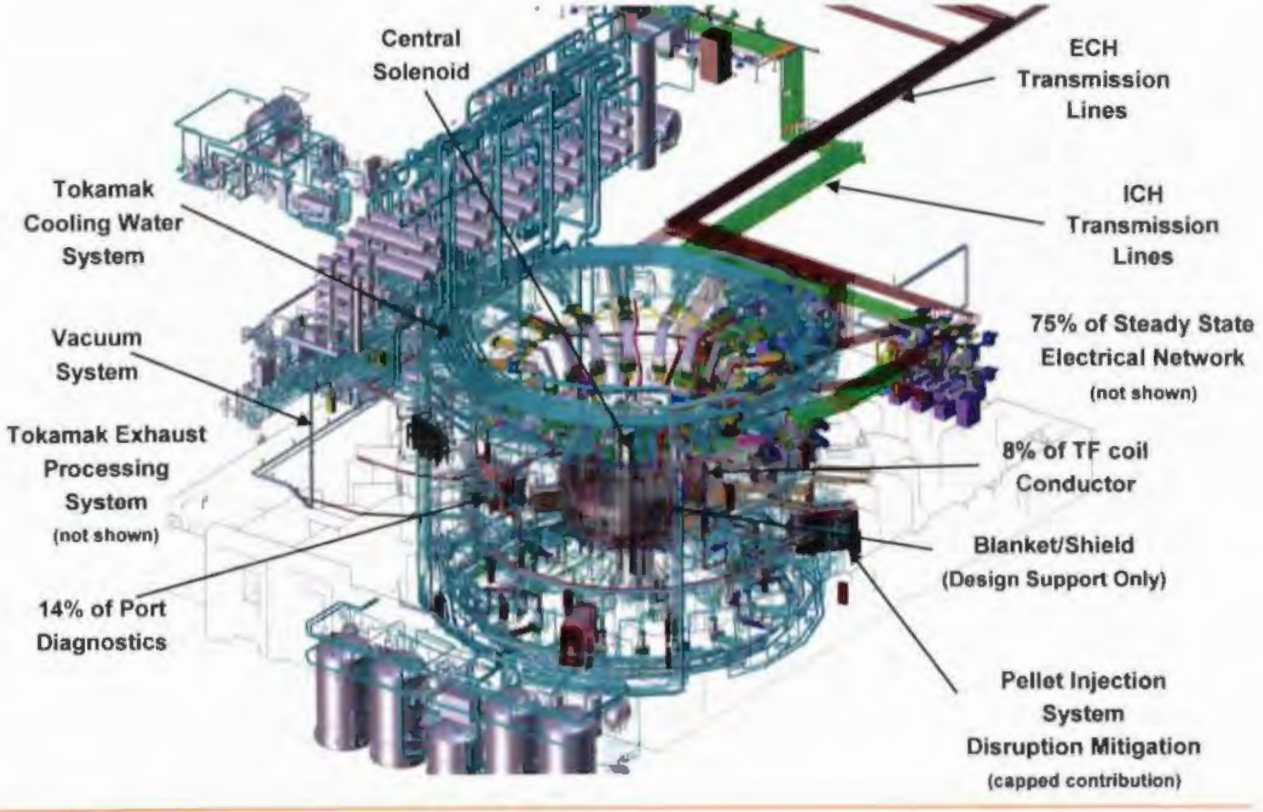
United States (US) Contributions to ITER

ITER is a unique international scientific collaboration representing more than half of the world's population. The ITER Members will design, build, and operate a first-of-a-kind international research facility in Cadarache, France aimed at demonstrating the scientific feasibility of fusion energy. This is the next step in establishing fusion as a practical long-term energy source, with acceptable environmental characteristics (no greenhouse gas emissions and no long-lived radioactive waste) and using abundant, readily available fuel (deuterium from water).

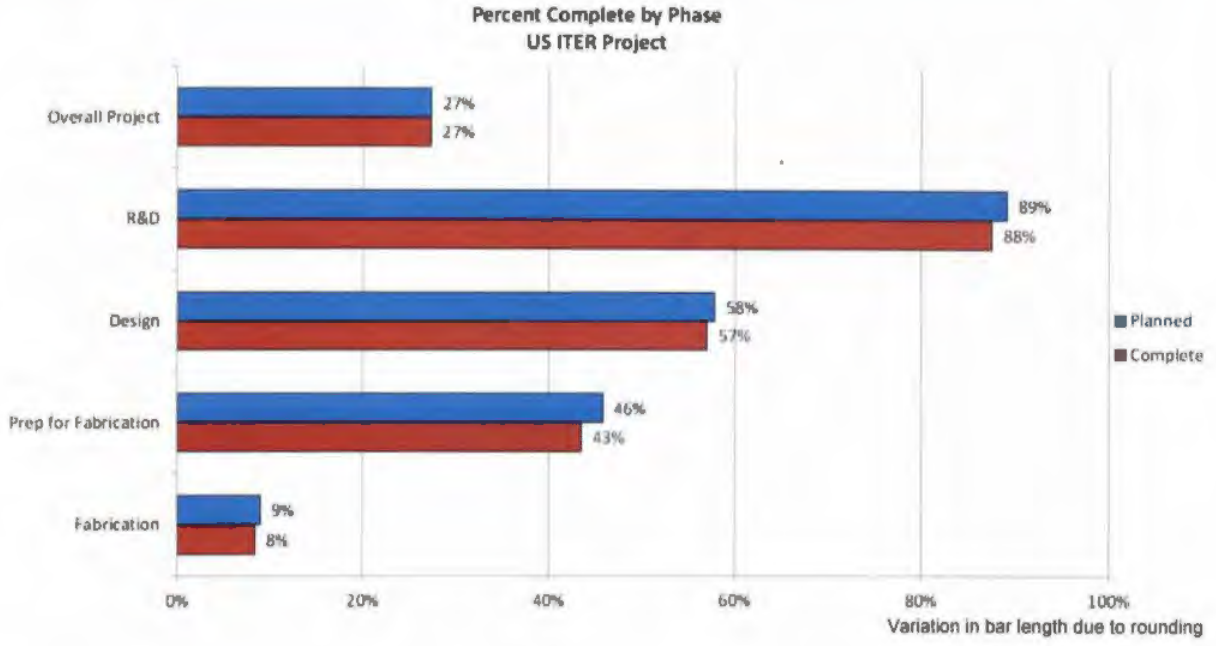
The US is to provide 9.09% of the ITER hardware components (by value) and cash equivalent to 9.09% of the international organization budget (for common expenses such as hardware assembly and installation). ~80% of US funding will be utilized for the hardware components. This funding will not only contribute to state and regional economies, but will enable US industry, universities, and labs to remain at the forefront of fusion technology and engineering. The US industries also benefit from the ITER Project by securing contracts from other ITER domestic agencies (DAs). Additionally, for its 9.09% contribution, the US will have access to all the scientific data and the right to propose and carryout experiments, which will enable the US to achieve its ITER-related goals in fusion science and fusion technology.

The ITER Members are China (CN), the European Union (EU), India (IN), Japan (JA), South Korea (KO), the Russian Federation (RF), and the US. The legal framework for construction, operation, deactivation, and decommissioning is contained in the ITER Joint Implementation Agreement (JIA), which entered into force in October 2007. The US ITER Project is a collaboration of US Department of Energy (DOE) laboratories, Oak Ridge National Laboratory (ORNL), Princeton Plasma Physics Laboratory (PPPL), Savannah River National Laboratory (SRNL) assisted by universities and industries around the country.

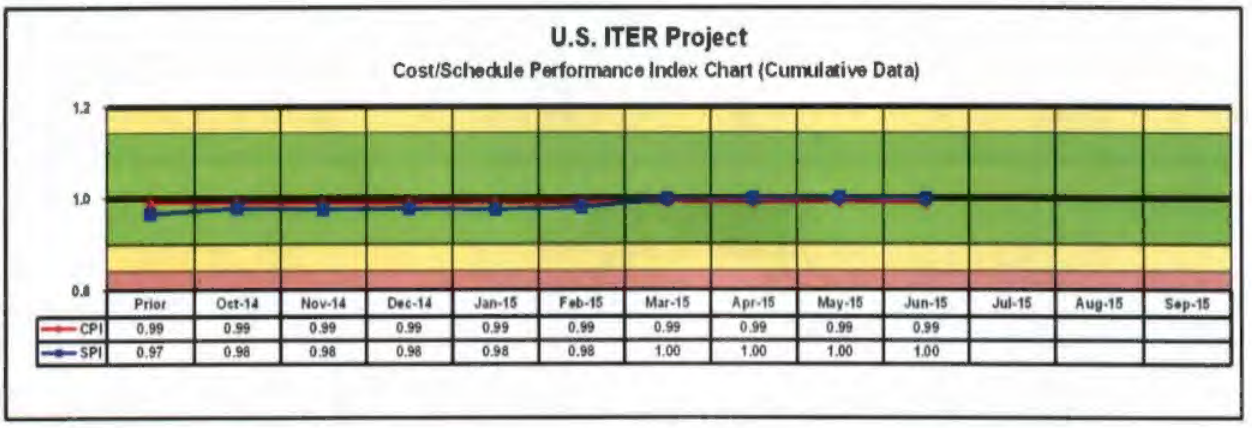
As shown below, the US Hardware contributions are highly integrated around the Tokamak Core.



Project progress as of June 2015 is shown below:



The following graph shows the Cost/Schedule Performance Indices based on earned value (against the early finish schedule). The overall performance indices remain steady as the cumulative Schedule Performance Index (SPI) for the Project is 1.00 and the cumulative Cost Performance Index (CPI) is 0.99. Each index is well within the accepted range.



	Prior	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
CPI	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99			
SPI	0.97	0.98	0.98	0.98	0.98	0.98	1.00	1.00	1.00	1.00			

The Project's actual costs and commitments through June 2015 compared to the obligation plan are provided in the following graph.

(b)(5)

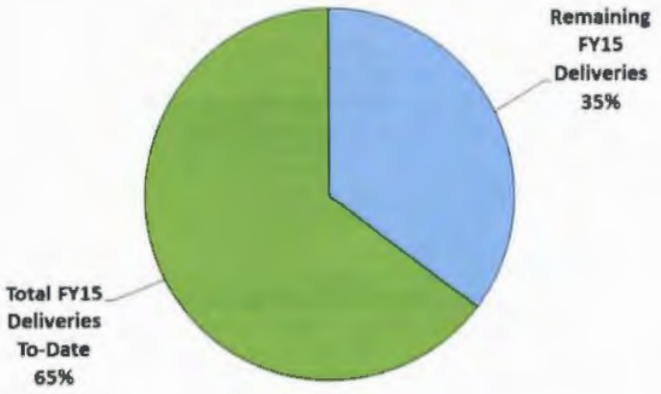
Updated Obligation Plan reflects current forecast

FY15 Deliveries of US ITER Hardware

11 of 17 Deliveries completed

Completed En route

VAS, Portable RGA Station: Oct-14 A
SSEN, Earthing Resistors (Lot 1): Oct-14 A
SSEN, HV Substation Transformers (Lot 2): Jan-15 A
TF Conductor, Conductor 1 of 9: Jan-15 A
SSEN, HV Control and Protection (Lot 2): Apr-15 A
SSEN, HV Substation Transformers (Lot 1): May-15 A
SSEN, HV Substation Transformers (Lot 3): May-15 A
SSEN, HV Substation Transformers (Lot 4): May-15 A
SSEN, 22kV Switchgear (Lot 1): Jun-15 A
SSEN, 22kV Switchgear (Lot 2): Jun-15 A
TCWS, Drain Tanks 1st Shipment: Jun-15 A
SSEN, 6.6kV Switchgear (Lot 1): Jul-15
VAS, UHV Pumping Cart (Vac Test Equip 14 of 16) : Aug-15 (pending VAT resolution)
TF Conductor, Conductor 2 of 9: Aug-15
TCWS, Delivery of the five cooling water drain tanks: Sep-15
TF Conductor, 100m Active (Luvata): Sep-15
SSEN, 6.6kV Switchgear (Lot 2): Sep-15



Approximately 9% of the total US ITER Hardware deliveries (343) are complete

Key Activities This Month

Steady State Electrical Network (SSEN)

All of the 400kV substation equipment (HV Substation Transformers, HV Circuit Breakers, HV Switches, HV Current Transformers, HV Potential Transformers, HV Surge Arresters, HV Substation Hardware, Earthing Resistors, and the HV Control & Protection) has been delivered to the ITER site.

The 22kV Switchgear (Eaton Corporation, Cleveland, OH, USA, factory in Hengelo, Netherlands) was delivered, with Lot 1 going to the ITER site and Lot 2 to a site in Spain where it will be installed into pre-fabricated substation containers by a subcontractor to the European Union (EU) Domestic Agency

Central Solenoid (CS) Modules and Structures

Manufacturing readiness reviews (MRRs) and final design reviews continue for the module workstations at General Atomics (GA) The *Heat Treatment* and *Stack & Join – He Penetrations* MRRs meetings were completed this month

A contract was awarded for the fabrication of the CS Structure Upper Components

Toroidal Field (TF) Conductor

An arrangement to transfer the scope for integrating up to six of the remaining production unit lengths to the International Organization (IO) was signed this month in order to meet the European Union (EU) Domestic Agency (DA) schedule for TF coil winding

Tokamak Cooling Water Systems (TCWS)

Fabrication of the remaining tanks is nearing completion with preparations for transportation scheduled for completion by July 24, 2015.

The IO completed implementation of the staffing plan to manage and oversee work done under the TCWS Arrangements.

Pellet Injection (PI)

A preliminary design review was held at the International Organization (IO) for the ex-vessel flight tube sections of the pellet injection system

Milestone Status

Thirty-three milestones were selected and approved for incorporation into the US ITER FY15 Performance Plan. The Plan was reviewed/concurred by the Federal Project Director (FPD) and has been reviewed and approved by DOE-FES.

Three Level 2 (DOE Federal Project Director) and three Level 3 (Project Manager) milestones were completed this month.

- **CS Modules**
  - *Conduct Heat Treatment MRR (L3)*
- **CS Structures**
  - *Award contract for Upper keyblock, load distribution plate, pre-compression components (L3)*
- ***TCWS***
  - *Develop a resource-loaded schedule for completion of the Final Design, incorporating the design solution for the gamma radiation issue (L2)*
  - *IO completes implementation of the staffing plan to manage and oversee work done under the TCWS Arrangements (L3)*
- **SSEN**
  - *Packaged and ready to ship - 6.6kV Switchgear - Lot 1 (L2)*
  - *Packaged and ready to ship - 22kV Switchgear - Lot 2 (L2)*

Nine of the remaining 15 milestones are forecast to complete on or ahead of schedule. The other six, except for one, are forecast to complete by the end of the FY.

The following table provides an overview of the milestone status by Level.

	FY15 Performance Plan			
	Total	L1	L2	L3
Completed	18	3	5	10
On Schedule	9	-	2	7
Forecasted Late	4	-	3	1
Late	2	1	-	1
TOTAL	33	4	10	19

L1: DOE FES milestone
L2: DOE FPD milestone
L3: ORNL Project Manager milestone

Contents

WBS 1.1.1 Magnet Systems – Oak Ridge National Laboratory (ORNL)

Central Solenoid (CS) Modules and Structure – Required for ITER 1st Plasma

The US is responsible for the CS magnet, including design, R&D, and fabrication of six CS modules (coils) and a spare module using supplied cable-in-conduit superconducting conductor (from JA), the vertical pre-compression structure, Assembly Tooling (AT), bus extensions, and cooling connections.

The CS serves as the backbone of the ITER magnet system. The CS induces the majority of the magnetic flux change needed to initiate the plasma, generate the plasma current, and maintain this current during the burn time.

General Atomics (GA) in San Diego, California, has been awarded a major contract to fabricate the modules of the CS.

Preparations for CS Modules, CS Structure and Assembly Tooling fabrication continue

WBS 1.1.1.1 – CS Modules

The Helium Inlet Design Analysis Calculation was approved by the IO this month. The analysis calls for peening of the toe of the weld to achieve the required cyclic fatigue life. Post-peened, heat treated weld samples were sent to the High Flux Isotope Reactor (HFIR) for nondestructive measurement of the residual stress as a function of depth using neutron spectroscopy. Results are expected next month.

Module fabrication at GA is proceeding:

- ***Station 2 - Winding***
  - Winding of the first production module hexapancake T1 has restarted.
  - As of June 30, four of the six layers have been completed.
- ***Station 3 - Joint and Terminal Prep***
  - The short lead breakout welds on the Mockup T1 hexapancake have been completed and leak checked.
  - The mockup T1 hexapancake will be moved to station 4 early in July.
- ***Station 4 - Stack and Join***
  - Commissioning of Station 4 was completed and MRR1 was conducted.
  - Documents which were in draft status at the MRR are being approved to satisfy the only category 1 chit in preparation for the start of processing the mockup.
- ***Station 5 – Heat Treatment Furnace***
  - Commissioning of Station 5 was completed and MRR1 was conducted.
  - Documents which were in draft status at the MRR are being approved to satisfy the only category 1 chit in preparation for the start of processing the mockup.
- ***Station 6 - Turn Insulation***
  - Commissioning activities are well underway for Station 6.
  - A demonstration of the conductor lowering system and the manual insulation of the first three turns was demonstrated.
  - The Ridgway wrapping heads have been installed and have been operated to apply the turn insulation integrated with the conductor lowering system.
  - The latest delivery of quench detection tape is being tested in the wrapping heads to determine tape acceptability.
- ***Station 7 - Ground Insulation***
  - A Final Design Review was conducted at the end of the month. There were no category 1 chits.
  - GA has discovered that the insulation of the quench detection 5 kV and 30 kV wires is susceptible to cracking due to two

phenomena:

- The resin can permeate between the insulation and wire over a long distance to the point that wires protruding from the ground insulation are no longer flexible and will crack easily.
- Resin that cures on the outside of surface of the insulation is brittle and will crack causing the underlying wire insulation to crack as well.

GA is working on several methods to seal the wires from contact with the resin. The T1 lead breakout VPI test is on hold until a better wire seal is developed.

- ***Station 8 – Vacuum Pressure Impregnation***
  - A second Final Design Review was conducted at the end of the month to review the design and installation of the outside diameter compression panels that are installed at this station.
  - A test of a prototype compression panel was completed.
  - Techniques for collecting metal chips and G10 debris were tested. Lessons learned were captured and improved techniques are planned.
- ***Station 9 – Helium Piping & Measurement***
  - No activity
- ***Station 10 - Final Test***
  - A final design review of the integrated Final Test Station was conducted early this month.
  - The warm bus bars have been delivered.
  - The He Gas tanks were delivered and installed on the pad adjacent to the Butler building.

Pneumatic wrapping head is supported by a beam for the turn insulation station at General Atomics

CS Modules

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Begin winding the first central solenoid module	1	14-Apr-15	23-Mar-15 A	
Conduct Turn Insulation MRR	2	02-Jul-15	24-Aug-15	Due to a delay in the receipt of parts needed to complete the Heat Treatment acceptance test, which delayed the handover of the 2 layer coil to Station 6. Commisioning time was also increased due to a higher technical complexity.

= Completed = On-Schedule = Forecast to Miss PP Date = Missed PP Date

WBS 1.1.1.2 – CS Structures

Pre-fabrication activities continued at Petersen, Inc. for manufacturing the Lower Key Block Assembly. Petersen is in the process of preparing procedures for welding, material handling, helium leak testing, and cryogenic shock testing.

Two fabricators, Major Tool and Machine (MTM) and Precision Custom Components (PCC), are now underway to fabricate first article outer tie plates.

- MTM submitted procedures for visual inspection and dimensional inspection for review and approval.
- MTM submitted a deviation request to use phased array ultrasonic testing in lieu of conventional radiographic inspection for the tie plate structural weld inspection.
- MTM continues to work on designs for tie plate tooling fixtures and will present those designs when complete.
- PCC's manufacturing and inspection plans (MIP) were reviewed and approved by both the USITER and the IO for the manufacturing of the first article tie plate and the weld qualification demonstration for attaching the cooling pipes to the tie plate.
- PCC's tie plate Nitronic 50 ingot was approved for forging.

A contract was awarded to Hamill Manufacturing for the fabrication of the CS Structure Upper Components. This fabrication effort includes most CS structure components at the top of the central solenoid.

The statement of work (SOW) and drawings have been completed for procurement of the multi-jack-bolt-tensioners (MJT) which are components of the CS structure pre-compression system.

CS Structures

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Award contract for the CS structures tie plates first articles	2	31-Jan-15	30-Jan-15 A	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

WBS 1.1.1.4 - CS Assembly Tooling (AT)

Final preparations for the Lifting Fixture follow-on Final Design Review were completed and the review was held via videoconference with the IO Review Panel.

- The revised design was well received as all Review charges were answered.
- A Final Report was received with 14 chits, none of which are Category 1.

Other work scope accomplished included:

- Work continued on remaining fixture designs in preparation for AT FDR-2.
- Design of the bus bar support fixture continued and a presentation was made at the interface meeting.
- 3D models of the drill guide fixture have been completed and will be the final remaining fixture to be presented at the interface meeting in mid-July to discuss and confirm the interface requirements between the shear pin and CS module.

Toroidal Field (TF) Coil Conductor – Required for ITER 1st Plasma

The US will contribute 8% of the TF coil conductors. The IO is responsible for the conductor design which is released for fabrication. JA, EU, RF, KO, and CN are also contributing TF conductor.

The 18 TF coils produce a magnetic field around the ITER tokamak torus to confine the plasma particles. The US is responsible for enough conductors to wind slightly over one TF coil.

The coils will be made of cable-in-conduit superconductors, in which a bundle of superconducting strands is cabled together, compacted into a stainless steel conduit, and cooled by supercritical helium.

Luvata Waterbury (Waterbury, Connecticut) and Oxford Superconducting Technologies (Carteret, New Jersey) have been awarded major contracts to produce TF strand. New England Wire Technologies (Lisbon, New Hampshire) received the contract for cabling the strand and High Performance Magnetics (Tallahassee, Florida) will perform the conductor integration/jacketing.

Fabrication of TF Conductor continues

WBS 1.1.1.3 – TF Coil Conductor

Fifth stage cabling of the second 100 m Luvata qualification length was completed at New England Wire (NEWT). Three improvements were suggested to improve the process.

At High Performance Magnetics (HPM), packaging of the second production unit length was completed (OST B). Cable insertion, compaction, and spooling of the third production unit length (OST C) were also completed.

An arrangement to transfer the scope for integrating up to six of the remaining production unit lengths to the IO was signed this month. The arrangement was necessary in order to meet delivery date commitments to the EU DA, who is responsible for TF Coil winding.

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Packaged and ready to ship first 760m conductor to EU	1	10-Jan-15	20-Oct-14 A	
Packaged and ready to ship Luvata 100m to EU	2	17-May-15	12-Mar-15 A	
2nd 760m Conductor packaged	2	22-Sep-15	01-Jul-15	

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

WBS 1.2.1 Tokamak Cooling Water Systems (TCWS) – ORNL

TCWS – Portions of the system required for ITER 1st Plasma

The US is responsible for the design, engineering, and procurement of TCWS.

ITER's fusion power will reach 500 MW during the deuterium-tritium inductive plasma operation with an energy input of only 50 MW, yielding an energy multiplication factor of 10. Heat will be transferred by the TCWS from client systems to the environment through the secondary cooling system. TCWS is designed to cool client systems, such as the first wall/blanket, vacuum vessel, divertor, and neutral beam injector (NBI). Additional operations include baking of in-vessel components, chemical control of water provided to client systems, draining and drying for maintenance, and leak detection/localization.

The TCWS interfaces with the majority of ITER systems, including the secondary cooling system, which rejects this heat to the environment. Plasma operations are inherently safe because a functioning cooling water system is not required to ensure safe shutdown.

System Design and Fabrication of the remaining three (of five) Drain Tanks continue

Design

Progress on the design of the TCWS continues while the IO also pursues the services of outside engineering service providers. These other activities include:

- Optimization of the Vacuum Vessel Primary Heat Transfer System (VV PHTS) using Fathom fluid modelling. The previous VV PHTS design removed 10 MW while the current designed thermal load has been determined to be 32 MW. The Fathom analyses report was modified to address comments from US ITER subject matter experts (SME).
- Other ITER systems, and other portions of the TCWS, are impacted by the Integrated Blanket ELM Divertor (IBED) redesign and require additional design resources to address issues such as physical clashes with other piping or equipment, available space for the conduct of maintenance, and design interfaces with systems served by the TCWS.
- TCWS completed two key Performance Plan milestones this month.
  - *Develop a resource-loaded schedule for completion of the Final Design, incorporating the design solution for the gamma radiation issue (L2)* - Detailed activities were established and resource loaded to address the gamma radiation issue and incorporate the design option approved by the DG in April 2015.
  - *IO completes implementation of the staffing plan to manage and oversee work done under the TCWS Arrangements (L3)* - The IO has successfully completed the implementation of the staffing plan with twenty three staff currently on-board and two more having accepted offers with a start date in September.

Fabrication of Drain Tanks

Normal Drain Tanks 2A (NDT2A) and 2B (NDT2B) were previously delivered to Cadarache and are currently in the storage building specifically designated for all of the TCWS Drain Tanks until installation.

Fabrication of the remaining tanks is nearing completion with preparations for transportation scheduled for completion by July 24, 2015. The status as of late June is:

- Neutral Beam Injection Tank (NBI3) – Final visual inspection after external passivation identified local areas to remediate.

- Safety Drain Tank 1A (SDT1A) – Deficiency Notice for Shrink Wrapping has been approved and final activities to occur into early July.
- Safety Drain Tank 2A (SDT1B) – Internal passivation and wet water testing completed.

Transfer of ownership from US ITER to the IO is planned when the tanks are loaded on the ship in late July or early August.

TCWS

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Delivery of the five cooling water drain tanks to port in France complete	1	30-Apr-15	11-Sep-15	The shipping schedule was originally delayed due to manufacturer not ready-to-ship. 1st drain tank shipment has been received at ITER. 2nd shipment ready-to-ship date: July 24.
Develop a resource-loaded schedule for completion of the Final Design, incorporating the design solution for the gamma radiation issue.	2	31-May-15	05-Jun-15 A	
IO Awards Framework contract for TCWS Pipings & Fittings	2	31-Jul-15	25-Sep-15	The contract cannot be placed prior to final piping configuration. Design modification of IBED PHTS to address radiation shielding issue needs updates on piping layout and thus Tech Spec.

= Completed = On-Schedule = Forecast to Miss PP Date = Missed PP Date

WBS 1.3.1 Vacuum Pumping & Fueling Systems – ORNL

Roughing Pump Sets - A portion of the components required for ITER 1st Plasma

The US will contribute 100% of the ITER roughing pumps.

The ITER tokamak, cryostat, and auxiliary vacuum chambers must be evacuated prior to and during operations. The roughing pump system exhausts the torus and NBI cryopumps, service vacuum, and cryostat. This system will utilize a matrix of pump trains with various technologies to match specific vacuum system requirements, including tritium-compatible backing pumps for torus and neutral beam cryopumps.

Support to the IO for Conceptual Design continues

WBS 1.3.1.1 – Roughing Pump Sets

The test data from the initial round of CVC performance testing in the Spallation Neutron Source (SNS) Cryogenic Test Facility (CTF) continues to be analyzed to determine what detail adjustments are needed to achieve the desired performance during the next window of opportunity for testing which is now projected to be in October – November 2015.

The revision of the Task Agreement for the tritium compatible prototype Roots and Screw Vacuum pump train to include the test stand as a deliverable was approved. The pumps were shipped to the IO this month and the test stand was packaged for shipment to the IO.

Additional results of the performance testing of an alternative tritium compatible roots pump stack at Oerlikon/Leybold were provided to the IO.

Vacuum Auxiliary System (VAS) - A portion of the system required for ITER 1st Plasma

The US will design and procure the ITER vacuum auxiliary system.

The vacuum auxiliary system consists of valves, pipe manifolds, auxiliary pumps, sensors, and controls. The torus and NBI vacuum manifolds of this system need to be tritium compatible.

The Vacuum Auxiliary System Procurement Arrangement 3.1.P4.US.01 (designated as **VAS-01**) scope includes the design and procurement of those components associated with the vacuum piping which serve as the manifolds providing vacuum service throughout the Tokamak Building.

The Vacuum Auxiliary System Procurement Arrangement 3.1.P4.US.02 (designated as **VAS-02**) scope includes the design and procurement of those vacuum components which connect the vacuum manifolds provided in VAS-01 to the clients (ITER technical systems) requiring vacuum service throughout the Tokamak Building.

Design continues and preparations for fabrication have begun

WBS 1.3.1.2 – Vacuum Auxiliary Systems (VAS)

Design
VAS-01 Scope:

The IO signed the VAS-01 Part 1 FDR Closeout Report completing the review.

Final design and analysis of the VAS-01 piping systems on levels L1 and L2 continue to progress, while the design of the piping systems on levels L3, L4 and L5 remain on-hold pending the finalization of changes associated with PCR-662 (ITER water activation issue).

Fabrication
VAS-01 Scope:

The Vacuum Piping Centralization procurement package from the IO was posted for a commercial "Call for Nominations". The procurement packages related to the supply of the piping vacuum flanges, custom pipe supports and clamshell leak test fixtures were reviewed by the IO and final comments are being addressed.

VAS

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
Complete VAS-01 FDR (L1-L4)	2	30-Sep-15	30-Mar-16	IO PCR-662 has resulted in modifications to facility and vacuum equipment configurations

= Completed = On-Schedule = Forecast to Miss PP Date =Missed PP Date

Pellet Injector (PI) System – A portion of the system required for building integration prior to ITER 1st Plasma

The US will design and procure the PI system.

PI provides efficient core and edge fueling and will deliver hydrogen, deuterium, or a deuterium/tritium mixture as required by plasma operations. Delivering fuel pellets to the plasma edge mitigates ELM (edge localized mode) instabilities.

R&D and Preliminary Design Activities continue

WBS 1.3.1.3 – Pellet Injection

A preliminary design review was held at the IO for the ex-vessel flight tube sections of the pellet injection system. The review resulted in no category 1 chits and 6 category 2 chits. The flight tubes transport the pellet injection cryogenic pellets from the Pellet Injection System into the vacuum vessel.

Manufacturing issues with vacuum leaks at brazed joints for the twin screw extruder continue to persist, which is preventing the laboratory testing of the latest iteration of the extruder design. Resolving this issue is the primary focus. It is expected the leak issues will be resolved in July with testing resuming in August.

Disruption Mitigation – System not required for ITER 1st Plasma

The US will contribute up to a capped value for the Disruption Mitigation System (DMS). The system has two functions, 1) limiting the impacts of plasma current disruptions to the tokamak vacuum vessel, first wall blankets and other in-vessel components and, 2) suppressing the formation and deleterious effects of high-energy runaway electrons. Out of port plug installation of shattered pellet injection (SPI) units at four port locations that are designed to also function as massive gas injection (MGI) units is the current plan for the DMS. In addition, an option for an MGI unit within a port plug is included. This unit is to be designed to function during non-nuclear operations only to provide operational experience of a fast acting MGI unit close to the plasma.

Preliminary Design Activities continue

WBS 1.3.1.4 – Disruption Mitigation

Studies are ongoing to characterize the performance of various valve sizes and propellant loads for accelerating a 24.4 mm diameter disruption mitigation neon cryogenic pellet. Preliminary findings are showing a lower limit of 16 mm diameter on the valve orifice before pellet speed is impacted. These results potentially allow for the minimization of the propellant valve size, which is desirable as a smaller valve orifice will have better sealing performance, reduced current required for operation, and greater operating speed. Studies continue to determine the ideal gas load to maximize pellet speed without injecting excess unwanted propellant gases.

Hardware to perform cyclic testing on the massive gas injection (MGI) valve has been received and is being assembled. The hardware allows for the continuous cycling of the MGI valve for endurance studies over an extended period of operation. Testing is expected to begin in September.

Work continues to integrate the disruption mitigation system into the port plugs. Design focus is on the penetrations through the Diagnostics First Wall and the port plug closure plate. Concepts have been developed, and are being incorporated into the 3D models and discussed with the port plug integrators.

WBS 1.3.2 Tokamak Exhaust Processing (TEP) – Savannah River National Laboratory (SRNL)

TEP – System not required for ITER 1st Plasma

The US is responsible for the Final Design (FD), fabrication, assembly, testing, and shipment of the TEP system.

ITER will require the processing of an unprecedented rate of hydrogen isotopes. To facilitate environmental responsibility and economic application of fusion technology, the reuse of hydrogen isotopes is vital. The TEP system must separate the exhaust gases into a stream containing only hydrogen isotopes and a stream containing only non-hydrogen gases. The implementation of the TEP system will provide a technically mature, robust, and cost-effective separation solution.

The TEP system consists of a series of filters, catalysts, and permeators (PM) to separate the hydrogen isotopes, which are then sent to an isotope separation system (furnished by the EU) to deliver deuterium and tritium for continuous reinjection into the reactor.

Support for Preliminary Design Activities continues

Preliminary design is the responsibility of the IO. A Task Agreement (TA) to the US delineates the part of the design to be performed by US ITER TEP Team.

The team continued activities for the design studies for Subtask-2 of the TA (Functions, Requirements, Interfaces and Scenarios) and initiated activities for Piping and Instrumentation Diagrams (P&IDs) development.

Currently, the US TEP design team is approximately 85% complete with Subtask-2 TEP Process Studies. Final input parameters for the studies were received from the IO in June. All studies were drafted and are in internal review.

Sample P&IDs were developed for 'review of concept' to enable the IO to determine the level of detail expected for TEP preliminary design P&IDs.

WBS 1.4.1 Steady State Electrical Network (SSEN) – Princeton Plasma Physics Laboratory (PPPL)

SSEN - Hardware required for ITER 1st Plasma

The US contributes 75% of the equipment required for the SSEN, excluding cables and emergency power. The EU contributes the remaining equipment and is also responsible for the design and installation of the system as well as all cabling and all emergency (diesel generator) power systems.

The SSEN is an alternating current (AC) power substation and distribution system that supplies electrical power to all ITER conventional systems and facilities. A separate system delivers power to the pulsed systems, including the magnet and heating power supplies.

The SSEN is rated at 120 MW and is similar to the auxiliary power distribution system in a nuclear fission power plant, except that it is about twice the size. The equipment to be contributed by the US is typical of a large AC power distribution system, consisting of transformers and switchgear at the high-voltage (400 kV) and medium-voltage (22 kV) levels.

Hardware Procurements and Shipments continue

All of the 400kV substation equipment (HV Substation Transformers, HV Circuit Breakers, HV Switches, HV Current Transformers, HV Potential Transformers, HV Surge Arresters, HV Substation Hardware, Earthing Resistors, and the HV Control & Protection) has been delivered to the ITER site. The final Delivery Reports and transfer ownership of site support and warranty are being processed for these items. The 400kV substation equipment amounts to 36% of the total credit for US in-kind contributions to the SSEN.

The 22kV Switchgear (b)(5) (b)(5) was shipped and delivered, with Lot 1 going to the ITER site and Lot 2 to a site in Spain where it will be installed into pre-fabricated substation containers by a subcontractor to the EU DA.

The 6.6kV Switchgear (b)(5) (b)(5) was packaged and the Release for Shipping approval was issued.

The Power Transformers (b)(5) (b)(5) Design Review chit resolution process is underway. The next step will be to issue a Release for Manufacturing.

A Request for Proposal was issued for the Reactive Power Compensators with a proposal due date in July.

DC Distribution, UPS, and LV Distribution & Sub-distribution Panels procurement activities are on hold pending availability of US ITER funding.

In summary:

- 12 of 16 contracts have been signed and/or executed.
- Procurement of another item is underway and the remaining 3 are on hold due to funding constraints.
- 20 of 31 shipments have been completed.

SSEN

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
IPL> Delivery of HV Substation Transformers (Lot 4) by US-DA to ITER Site	1	27-May-15	21-May-15 A	
Packaged and ready to ship - 6.6kV Switchgear (Lot 1)	2	28-Jun-15	26-Jun-15 A	
Packaged and ready to ship - 22kV Switchgear (Lot 2)	2	16-Jul-15	07-Jun-15 A	

= Completed = On-Schedule = Forecast to Miss PP Date = Missed PP Date

WBS 1.5.1.1 Ion Cyclotron Heating (ICH) Transmission Lines – ORNL

IC Transmission Lines– A portion of the system is required for building integration prior to ITER 1st Plasma

The US is responsible for the IC transmission lines, including R&D, design, fabrication, and interfaces. The IO is responsible for installing the IC transmission lines.

The IC system heats the ions in the plasma with a high-intensity beam of electromagnetic (EM) radiation. Generators produce high-power radio frequency waves that are carried along multiple transmission lines to antennas located in the vacuum vessel, sending the waves into the plasma. The US IC transmission lines will provide efficient power transfer from 40–55 MHz radio frequency sources to the plasma heating antennas. The system will include coaxial transmission lines and a matching/tuning system to minimize power transfer losses. The pressurized lines can transmit up to 6 MW per line. In total, approximately 1.5 km of line connects 8 sources to 16 antenna feeds, with 14 types of transmission line and matching system components. The main interfaces include sources, launchers, buildings, port cells, and water cooling. The short coaxial line also provides secondary tritium confinement.

Preliminary Design Activities continue

Intermediate design progress meetings were completed with the vendor teams that are in the first phase of developing designs of 3-meter-long stub tuners. All three vendors are making good design progress.

Multiple successful 1-hour tests of the ICH transmission line "Assembly Bellows" at high-current and at voltages up to 38 kV were conducted on the resonant line test stand at ORNL. The assembly bellows simplifies the installation/removal of multiple sections of ICH transmission line.

Multiple discussions were held with the IO ICH and remote handling teams in response to certain aspects of PCR-664 "Port Cell Rails" proposed for remote handling. As a result of those discussions, the decision to install or not install permanent port cell rails in the ICH port cells will now be assessed after a period of initial ITER operation. In parallel with those discussions, the US and IO ICH teams jointly modified layouts for both the double stub and triple stub tuner ICH pre-match options to determine if they could be compatible with reduced port cell space limitations.

A contract for procurement of vacuum variable high-voltage, high-current tuning capacitor test articles was awarded to COMET Plasma Control Technologies. A total of 36 tuning capacitors are used in the ICH system to adjust tuning and to control power flows.

WBS 1.5.2.1 Electron Cyclotron Heating (ECH) Transmission Lines – ORNL

EC Transmission Lines – A portion of the system is required for ITER 1st Plasma

The US is responsible for the EC transmission lines, including R&D, design, fabrication, and interfaces. The IO is responsible for installing the EC transmission lines.

The EC system heats the electrons in the plasma with a high-intensity beam of electromagnetic radiation. This system is also used to deposit heat in very specific places in the plasma. Power will be provided by powerful, high-frequency gyrotrons. The US transmission line design will provide efficient power transfer from 170 GHz gyrotron sources to plasma heating power launchers (20 MW).

The transmission lines feature multiple lines of evacuated aluminum waveguides with internal corrugations that can transmit 1.5 MW per line for 3000 seconds, while minimizing power transfer losses to ≤ 10%. Approximately 4 km of transmission line will be part of this system, connecting 24 sources to 56 feeds with 10 types of waveguide components. The main interfaces include sources, launchers, buildings, port cells, water cooling, and auxiliary vacuum. The waveguide also provides secondary tritium confinement.

Final Design Activities continue

The Component Cooling Water System-1 (CCWS-1), as presently designed, does not accommodate the US and other systems that have copper cooling surfaces. A visit was made to the IO to advance PCR-634 "Revision of the CCWS-1 in compliance with Client's requirements associated with Copper wetted surfaces". The US TCWS team assisted by providing detailed water quality requirements that are needed to be compatible with copper cooling surfaces. The TCWS team is working to identify the footprint and location for the equipment needed for a primary cooling loop for ECH, ICH and Diagnostic systems off of the CCWS-1 loop.

The evaluation of bids for a Basic Ordering Agreement (BOA) for "Process Development and Manufacture of 4.2m Waveguide and Associated Components" was completed.

WBS 1.5.3 Diagnostics – PPPL

Diagnostics – Only a few instruments (RGA & LFSR) needed for ITER 1st Plasma

The US is responsible for 14% of port-based diagnostic systems, including integration of 4 diagnostic port plugs, plus 7 instrumentation systems out of a total of approximately 40 individual diagnostic systems. The EU, RF, CN, KO, and IN are also contributing to ITER diagnostics.

ITER diagnostic systems provide measurements to aid understanding of plasma behavior and optimize fusion performance. Because of the harsh environment inside the tokamak vacuum vessel, these systems must cope with a range of conditions not previously encountered by diagnostic technology, all while performing with high reliability. US Diagnostics will include microwave, laser, x-ray, and optical systems. The US will provide design, fabrication, assembly, and testing of US port plugs, specifically the Upper Ports (U11, U17) and Equatorial Ports (E3, E9). In addition, the US will support the integration into these plugs of multiple diagnostics, including some from other DAs.

The US will also be responsible for the following instrumentation systems: Upper IR/Visible Cameras, Low Field Side Reflectometry (LFSR), Motional Stark Effect (MSE), Electron Cyclotron Emission (ECE), Toroidal Interferometer/Polarimeter (TIP), Core Imaging X-ray Spectrometer, and Residual Gas Analyzer (RGA).

R&D and Design Continue

Diagnostics staff spent two days with the ECE diagnostic team at University of Texas-Austin (UT) providing structural analysis and ITER design code training.

Staff also provided SDC-IC training for the Upper Wide Angle View Visible IR Cameras team from General Atomics and the Dutch firm TNO in June. The Upper Port Wide Angle View Visible-IR Camera (UPP WAVs) system is US ITER's largest diagnostic project. The UPP WAVs are distributed to five upper port plugs and provide Visible and Infrared views of the divertor and blanket shield modules for machine protection. General Atomics is the subcontractor through final design and has also contracted with Lawrence Livermore National Laboratory (LLNL) for system physics support and the Dutch company TNO for optical and mechanical engineering services. This month a meeting was organized at PPPL that brought together the full technical team from PPPL, GA and TNO. Optical and mechanical engineering details were discussed with the goal of locking in the designs for the early 2017 Preliminary Design Review (PDR).

A Diagnostics staff member was invited to represent the USDA at a series of technical meetings on the EUDA ITER diagnostics and port plugs. Attending this meeting was important for learning about innovative European design approaches, discussing common ITER requirements issues and checking on EUDA systems that are being integrated into USDA port plugs.

The annual ITER neutronics meeting was held at the ITER site over the week of June 30th to July 3rd and was attended by diagnostics staff. During this meeting, many topics were covered concerning the use of detailed neutronic models, updated neutronic analysis codes, and neutronic benchmarks. The C-lite analysis model has had significant updates and is being finalized for distribution among the community.

Diagnostics

Milestone Description	MS Level	Performance Plan Date	Forecast Date	Comments
PPPL - Motional Stark Effect - Award Phase 1 Design Contract	2	30-Sep-15	29-Sep-15	

= Completed = On-Schedule = Forecast to Miss PP Date = Missed PP Date

WBS 1.6 Project Support – ORNL

Procurement

Key procurement actions for June included:

- An Award for CS Structure Upper Components (1.1.1.2) was made to Hamill Manufacturing.
- An Award for Initial Cask & Piping Design Integration (1.3.1.3.4) was made to Teledyne Brown.

Human Resources

Three postings closed for the ITER Organization in June for which 10 candidates were nominated. One candidate was selected for the Project Analyst position. Also, 11 new positions were posted for 9 Engineers and 2 Technicians for which the Human Resources team continues to review applicants.

Category of staff	European Union	India	Japan	China	Korea	Russian Federation	United States	Total
DES	231	13	20	26	25	20	16	351
SEC	11							11
Total	**242**	**13**	**20**	**26**	**25**	**20**	**16**	**362**
Post Doc	3			1	1			5
VRs		1		1				2
	66.9%	3.6%	5.5%	7.2%	6.9%	5.5%	4.4%	

DES: directly employed staff by the IO;
SEC: Secondees to the IO;
VRs: Visiting Researchers at the IO

Quality Assurance (QA)

US ITER Quality Assurance conducted an annual quality program assessment at General Atomics (GA) on June 10. The GA quality program was noted to be fully implemented; there were no findings.

WBS 1.7 International Organization Support (Secondees and Cash Contributions) – ORNL

Per the JIA, the US is obligated to contribute 9.09% of the value estimate of the construction of ITER. The contributions are measured in ITER kilo Units of Account (kIUA), which has been used by ITER for many years; 1 kIUA equals $1M US dollars (January 1989). The US commitment, 424.618 kIUA, includes hardware fabricated/procured by the US, cash for installation and commissioning, staff (secondees or cash for direct employees), and cash for R&D directed by the IO.

The US can also receive credit (kIUAs) for performing additional work through approved Task Agreements (TAs). The US will cover its share of the cash contributions through cash payments in current year Euros upon request by the IO. Euros are purchased with current year dollars using the current exchange rate when the payment is due. To establish the kIUA value of annual cash contributions, the Euros are de-escalated to Euros (January 1989) using proven inflation rates, and then converted to millions of dollars (January 1989) to yield kIUA.

Note: the tables below reflect a new decision not to grant credit for contributions to the IO prior to CY 2007. The Cash Payments Table contains the 2006 cash contribution but the credit does not contain this 2006 value.

Cash Payments

Calendar Year	Budgeted €	Paid €	Paid $	Remaining Obligation €
2006	409,000 €	409,000 €	$528,918.80	0
2007	3,985,000 €	3,985,026.06 €	$5,463,231.76	0
2009	15,689,630.70 €	15,689,604.64 €	$21,102,518.24	0
2010	9,567,409 €	9,567,409 €	$13,552,234.85	0
2010 Supplemental	1,577,433 €	1,577,433 €	$2,018,010.04	0
2011 Advance Payment	9,132,173 €	9,132,173 €	$11,650,826.31	0
2012	9,450,359 €	9,450,359 €	$12,133,315.92	0
2013	17,672,925 €	17,672,925 €	$23,975,973.67	0
2014	14,885,339 €	14,885,339 €	$20,280,343.91	0
2015	13,741,328 €	13,741,328 €	$14,827,218.12	0
Cumulative	*96,110,596.70€*	*96,110,596.70€*	*$125,532,591.62*	*0*
Estimated Credit Earned to date: 59.284 kIUA				
Average Exchange Rate realized for cash paid = 1.306				

Secondees/Employees

U.S. Secondees	Credit Earned: 1.531 kIUAs
	Current Number of Secondees: 0
U.S. Direct Hires	Current Number of U.S. Direct Hires: 32
	1 New Hire starting in August 2015

Total Credit Earned (~20% of total planned)

Allocation	Total Planned Credit (kIUA)	Actual Credit Received (kIUA)	Change in Actual	Remaining Credit (kIUA)
Secondees	1.531	1.531		-
HW	207.520	11.730		195.790
TA	15.193	12.685		2.508
Cash	202.986	59.284		143.702
Total	427.230	85.230		342.000

	2007	2008	2009	2010	2011	2012	2013
Cash	2.711	0	10.138	13.063	0	5.835	10.645
Secondees	.629	.274	.277	.246	.105	0	0
TAs	0	.300	.048	2.284	4.611	2.497	1.939
PAs	0	0	0	2.500	0	5.850	0
Total	*3.340*	*.574*	*10.463*	*18.093*	*4.716*	*14.182*	*12.486*

	2014	2015	Total
Cash	8.842	8.050	59.284
Secondees	0	0	1.531
TAs	1.006	0	12.685
PAs	3.380	0	11.730
Total	*13.228*	*8.050*	*85.230*

WBS 1.8 Supplemental Task Agreements (TA) with the IO

Task Agreements currently in-progress

TA #	Description	Agency	US Contact	Credit Amount (kIUA)	Credit Received to Date (kIUA)	TA Start	Expected Finish	Comments
TA-FC-IPT-US-RP-01	Validation of Mechanical Roughing Concepts	US-IPO	M. Hechler, Larry Baylor	0.456		01/02/2011	08/14/2015	Approved amendment added 0.021 kIUA
C 74 TD 21 FU	Neutronics Analysis Support for ITER	ORNL / U. of Wisc.	B. Nelson / Mohamed Sawan	0.391		09/01/2014	09/30/2015	Approved amendment added 0.073 kIUA
TA-FC-IPT-US-RP-02	ITER Roughing System Cryogenic Viscous Flow Compressor Development	US-IPO	M. Hechler, Larry Baylor	0.267		01/02/2011	11/24/2015	
C 55 TD 36 FU	Generic Diagnostic First Wall Preliminary and Final Design	PPPL	Wayne Steffey, Doug Loesser	1.237	0.322	09/01/2012	03/31/2016	
C 18 TD 35 FU	Development of ITER class Pellet Injector	US-IPO	D. Rasmussen	0		10/01/2008	07/28/2016	
TA-FC-IPT-US-13-01	Preliminary Design Tasks associated with PBS 32.EP Plant System	SRNL	Bernice Rogers	0.571		10/17/2013	06/30/2017	
TA-FC-IPT-US-RP-03	Validation of Piston Pump for ITER Roughing System	US-IPO	Dave Rasmussen, Larry Baylor	0.002		10/17/2012	11/30/2017	
			Total kIUA	2.924	0.322			
			Approx. $	6.1 M	0.7 M			

WBS 1.9 Instrumentation and Controls (I&C)

Centralized Instrumentation and Controls Support. Required for ITER 1st Plasma

The US is responsible to provide I&C for all Procurement Arrangements (except Magnets and SSEN). Work scope includes: conceptual, preliminary, and final I&C design; I&C software design; I&C hardware and software procurement; I&C equipment fabrication; and I&C qualification and testing. The WBS 1.9 work scope definition includes the majority of US DA I&C work scope, but the details will be defined on a WBS-by-WBS basis. (e.g. Some major equipment procurements will include I&C content; some engineering services contracts such as for Diagnostics will include I&C content; etc. so this work scope will remain in the other WBS areas). Benefits of a centralized I&C support include: sharing of specialized engineering resources; the promotion of standard designs, standard software components, and standard equipment; and the provision of commonly-required services including technical and qualification support.

Assembling I&C team and starting Conceptual and Preliminary Designs

WBS 1.9 Instrumentation and Control – ORNL

At the Symposium of Fusion Engineering (SOFE) conference in Austin TX, meetings were conducted with US and IO Diagnostic team leads, as well as, strategic planning with the IO vacuum lead.

Good progress was achieved on the development of I&C design tools.

- Updated Magnetic field map tool to automate extraction of magnetic field for given geometric coordinate (e.g. I&C sensor or electronics of interest). Incorporated latest magnetic field analysis data based on 17MA, original analysis based on 15MA.
- Generated first prototype radiation analysis tool based on generation of Python script to automate radiation field information from Paraview viewer for given geometric coordinate.

WBS 1.9.2.1 TCWS I&C

US I&C representative attended Radiation Hardness Assurance meeting to ensure close alignment with progression of PCR-662 TCWS activated water mitigation. Presented and explained in detail the USDA-compiled list of TCWS baseline instruments and electronics for the IO to base their initial design.

WBS 1.9.3.2 Vacuum Auxiliary Systems I&C

Met with representatives from Glenair to better understand all the connectors required for Service Vacuum System (SVS) & Cryo-Guard Vacuum Systems (CGVS).

WBS 1.9.3.3 Pellet Injector I&C

Investigated options for hydrogen detection.

WBS 1.9.5.1 ICH I&C

Current work is focused on Radio Frequency (RF) Building PDR in November 2015.

WBS 1.9.6.1 ECH I&C

Updated Radiation hardness table for TL I&C to correct categorization of sensors.

Participated in teleconference for 2nd ECH I&C workshop. Gave presentation and participated in discussion of interfaces and other related topics.

WBS 1.9.7 Diagnostics

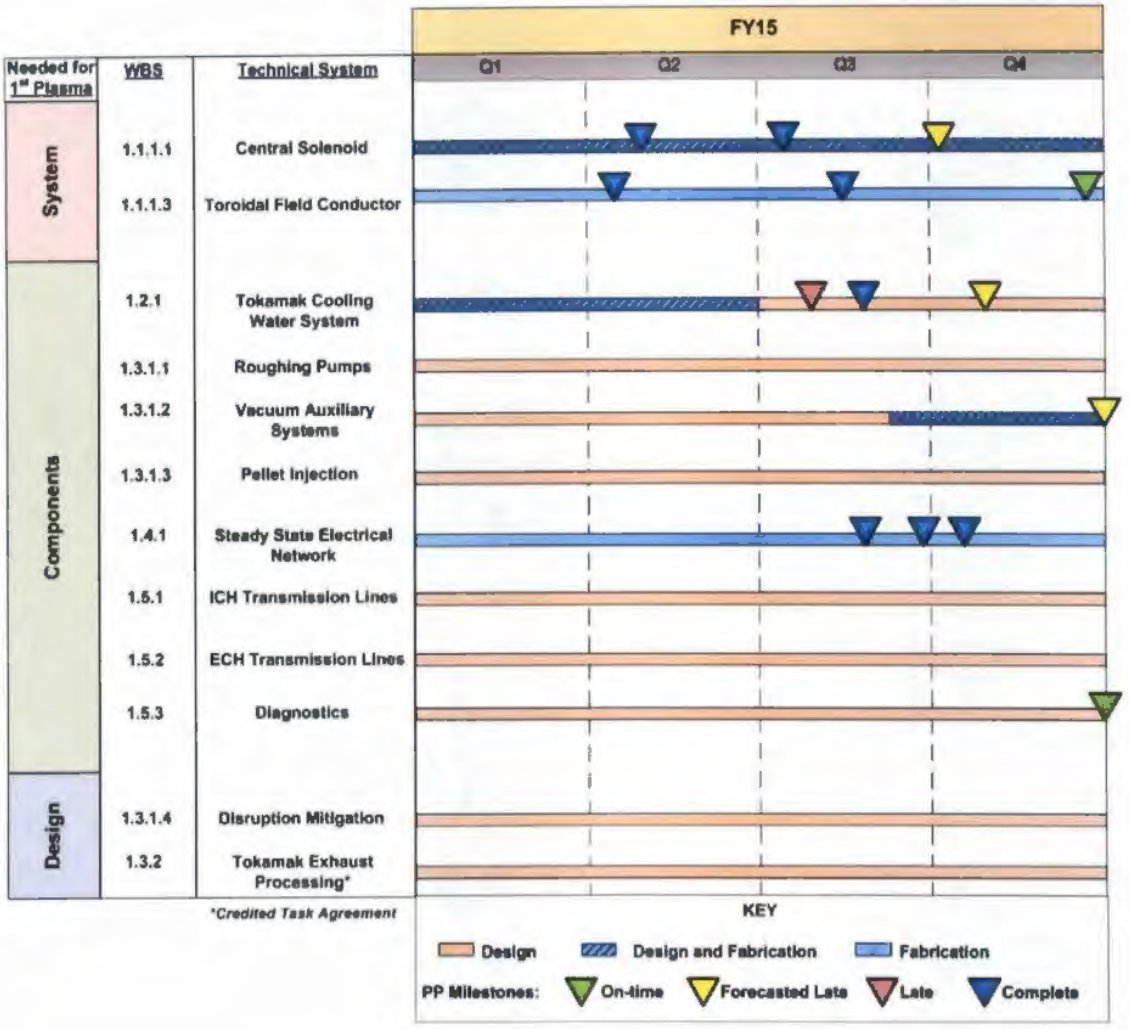
Jointly conducted US Diagnostic/I&C meeting at ORNL on June 16-17. Key members from IO Diagnostics I&C attended meeting, as well as, representation from all US institutions involved in US Diagnostics development.

Appendix A

US ITER Project Schedule

(L1/L2 Milestones)

Shown below is the summary schedule for the Project's planned activities in FY15. The schedule is aligned with the revised funding provided by the DOE Office of Fusion Energy Science which assumes funding of $150M in FY15 and $150M in FY16.



Appendix B

Project Change Requests processed this month

There were ten Project Change Requests (PCRs) processed in June. All PCRs were reviewed against the contingency guidance to determine the applicable usage of Management Reserve and DOE-held contingency.

All PCRs were Level 3 (Project Manager).

				Impact ($M)	
Month	PCR #	Description	WBS	Management Reserve	DOE Contingency
June	TA-2015-3	Incorporate Neutronics TA Amendment	1.8.14.1	0.030	
June	EC-2015-6	ECH High Power Testing Venue Change	1.5.2.1	(0.723)	
June	DM-2015-2	Design and Fab of DM Valves	1.3.1.4	(0.009)	
June	ST-2015-8	CS Structures - Revise Upper Components start date	1.1.1.2	-	
June	AT-2015-3	Assembly Tooling - Additional task for the frictional test study	1.1.1.4	(0.075)	
June	PI-2015-4	PI Cask Design Estimate Increase	1.3.1.3	-	
June	EP-2015-3	SSEN - Reactive Power Compensator Re-Plan	1.4.1.1	0.248	
June	DA-2015-13	RGA - I&C Transfer from 1.5.3.6 to 1.9	1.5.3.6	1.461	
June	CT-2015-15	Receive DRGA Transfer from 1.5.3.6	1.9.7	(1.479)	
June	VF-2015-7	Modify Piping Centralization Payments Schedule	1.3.1.2	-	

Appendix C

Level 3 (Project Manager) FY15 Milestones

WBS	System	Activity ID	Milestone Description	MS Level	Performance Plan Date	Forecast Date
1.1.1.1	CS Modules	USMSITER1734	Conduct Heat Treatment MRR	3	02-Jun-15	11-Jun-15 A
1.1.1.1	CS Modules	USMSITER5195	Conduct Ground Insulation MRR	3	24-Sep-15	23-Sep-15
1.1.1.2	CS Structures	USST0207015100	Award contract for Upper keyblock, load distribution plate, pre-compression components.	3	30-Sep-15	08-Jun-15 A
1.1.1.3	TF Conductor	USTF0305250	Cable 3 fabrication complete	3	11-Mar-15	09-Jan-15 A
1.1.1.3	TF Conductor	USTF0305730	Cable 4 fabrication complete	3	08-Jul-15	31-Jul-15
1.1.1.4	CS Assembly Tooling	USAT0407009300	Award contract for Assembly Platform	3	30-Sep-15	02-Jul-15
1.1.1.4	CS Assembly Tooling	USAT0407010400	Award contract for Lifting Fixture	3	30-Sep-15	25-Sep-15
1.2.1	Tokamak Cooling Water	USCW08042442	IO contract in-place for Analysis and Calculation (Mechanical Eng) for Captive Piping Design	3	04-Mar-15	17-Sep-15
1.2.1	Tokamak Cooling Water	USCW08042344	IO completes implementation of the staffing plan to manage and oversee work done under the TCWS Arrangements	3	30-Sep-15	31-May-15 A
1.3.1.3	Pellet Injection	USPI309031790	Begin Procurement of Initial Cask and Piping Design Integration	3	27-Feb-15	13-Feb-15 A
1.3.1.3	Pellet Injection	USPI030429150	Complete Pellet Injection Systems Level Preliminary Design Review Meeting	3	13-Jun-15	13-May-15 A
1.3.1.4	Disruption Mitigation	USDM04040425	Complete Disruption Mitigation System Preliminary Design Review Meeting (with IO)	3	07-Jan-15	07-Nov-14 A
1.5.1	ICH	USIC01020340	Award contract for DC Breaks Test Article	3	02-Sep-15	28-Jul-15
1.5.1	ICH	USIC2034805	Award contract for Tuning Stub and Drive Mechanism Test Article Design and Fabrication	3	30-Sep-15	27-Mar-15 A
1.5.2	ECH	USEC0104B21205	Complete Development of Waveguide Interior Visual Inspection Tool	3	25-Feb-15	15-Dec-14 A
1.5.2	ECH	USEC0104A10380	Award Contract - 4.2 M Waveguide Manufacturing Process	3	30-Sep-15	06-Jul-15
1.5.2	ECH	USEC0104A13190	Technical Pkg to Procurement - Polarizer Pair Test Article Design	3	30-Sep-15	24-Aug-15
1.5.3	Diagnostics	USDA080400A180	PPPL - Diagnostic Shield Module - Contract Award Manufacturing Design Studies	3	01-May-15	20-Feb-15 A
1.5.3	Diagnostics	USDA11010001019	PPPL - Visible/Infrared Cameras (Sensors & DAQ) UPP - Award Phase 2 Contract	3	30-Sep-15	02-Sep-15
	2014 Carryover					
1.1.1.1	CS Modules	USMS202464080	Complete Stack and Join, He Penetrations MRR Meeting	3	30-Jul-14	09-Jun-15 A
1.1.1.1	CS Modules	USMS202464070	Complete Joint and Terminal Prep MRR Meeting	3	30-Jul-14	08-Apr-15 A
1.3.1.1	Roughing Pumps	USRP0103010200	Complete Testing of Roots & Screw Prototype Pumps	3	23-Sep-14	09-Mar-15 A

= Completed