



U.S. DEPARTMENT OF
ENERGY

Office of
Science

First Plasma Subproject Baseline for the U.S. Contributions to ITER Project

February 1, 2017

Joseph J. May, Director
Facilities, Operations, and Projects Division
Office of Fusion Energy Sciences
Office of Science

Outline

- Background
- Purpose
- U.S. Hardware Scope
- U.S. Commitments to ITER
- U.S. ITER Subproject Structure
- Updated CD-1 Total Project Cost Range
- Subproject-1 Scope and Status
- Subproject-1 Cost and Funding Profile
- Summary Schedule
- Recommendations to Dep Sec
- Approvals

Background – May 2016 Report to Congress



United States Department of Energy
Washington, DC 20585

Report excerpts:

“For the U.S. in-kind effort going forward, DOE will:
... 3) establish a CD-2 performance baseline in FY
2017; ...”

“By the time the FY 2019 budget is developed,
there is expected to be an approved ITER baseline
to FP, ... “

“... and the U.S. ITER Project to FP will be baselined
in FY 2017.”

“DOE will baseline the U.S. ITER Project (the in-
kind contribution to the IO) to FP in FY 2017.”

“Prior to the FY 2019 budget submittal, we will be
in a better position to assess the project as we will
have ... a baseline for the U.S. ITER Project through
FP, ...”

Background - Baseline Assumptions



Department of Energy
Washington, DC 20585

August 22, 2016

MEMORANDUM FOR THE SECRETARY AND DEPUTY SECRETARY

FROM: Cherry Murray, Director - Office of Science
THROUGH: Franklin Orr, Undersecretary for Science and Energy
SUBJECT: U.S. ITER Project - Key Assumptions for Baseline First Plasma
MEMO TYPE: FEEDBACK REQUESTED

I'm writing to update you on the efforts to implement the management improvements for the U.S. Contributions to ITER (U.S. ITER) Project described in the May 16, 2016 ITER report to Congress. The May report stated the Department's intent is to remain a partner in the ITER project through Fiscal Year (FY) 2018; and to focus on efforts related solely on First Plasma (FP) through FY 2018. In addition, the report stated that DOE will establish a Performance Baseline for U.S. ITER FP.

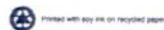
The U.S. ITER project team is well on their way to restructuring the FP subproject, formulating required project documentation, preparing for independent reviews, and other actions necessary to baseline the FP subproject. In parallel, the Office of Science (SC) is coordinating with the Office of Project Management Oversight and Assessments (PM) and other staff organizations to meet your expectations to baseline the FP subproject before the end of the Administration. Part of this coordination included clarification of approach and roles and responsibilities that were implicit in the descriptions of management improvements.

Foremost, the U.S. ITER project has been, and will continue to be implemented in a manner that adheres to both DOE's project management principles articulated in DOE O 413.3B, and the successful standard practices established by SC for project management execution.

In support of the baselining effort described above, your approval is requested for the following key assumptions:

1. The Deputy Secretary is the Project Management Executive (PME) for the U.S. ITER Project. Critical Decision approvals will follow established Project Management Risk Committee and ESAAB processes.
2. The U.S. ITER project is classified as a *Major System Project*, but not as a *Capital Asset* (Memorandum attached).
3. With the intent to focus solely on FP, only the FP portion of the U.S. ITER project will be baselined at this point in time, and will be classified as a subproject.
4. The FP subproject consists of the following elements:
 - a. completion of the design for all U.S. hardware contributions to ITER, both FP and Post-FP;

Page 1 of 2



- b. completion of U.S. hardware components needed for FP or needed for the ITER construction sequence prior to Post-FP (e.g., embedded or captive piping or tankage); and
 - c. U.S. payments to the IO required to fulfill the 9.09% FP hardware commitment not met by the delivery of in-kind components in b).
5. Based on the maturity of ongoing FP subproject design and fabrication activities, PME approval will be requested for both Critical Decision (CD) CD-2, "Approve the Performance Baseline and CD-3, Approve Start of Construction/Execution".
 6. Consistent with the May 2016 Report to Congress, cash contributions to ITER Organization to support the IO's design, assembly, installation and management of the international project are not included in the FP subproject scope.
 7. Consistent with SC's implementation of DOE O 413.3B, SC's Office of Project Assessment (OPA) will conduct Independent Project Reviews with participation by PM; project performance will be reported in Project Assessment and Reporting System (PARS) II, and all documentation supporting CD approval will be submitted to PM.
 8. Assessment of the CD-1 Cost Range "refresh" for the entire project (e.g., FP plus Post-FP and IO cash contributions) will be performed concurrent with the CD-2/3 IPR.
 9. Prior to attaining CD-2/3 approval, current and/or planned subcontract activities for FP subproject hardware fabrication and design activities will not be suspended.
 10. The *2028 First Plasma Construction Cost Profile* from the May Congressional Report will be used as the notional profile for baseline planning purposes. Adjustments to this profile may be necessary as the detailed cost and schedule estimates are finalized to support baselining the FP subproject.

Approved:

Ernest J. Moniz, Secretary

SEP 29 2016

Date

ATTACHMENTS:

- Dec 4, 2012 Memorandum from Deputy Secretary on U.S. ITER project management.

REVIEWED BY:

- Paul Bosco
- John MacWilliams
- Stephen Meador
- Joseph Hezri
- Edmund Synakowski

Background - Independent Project Review

Stephen W. Meador, DOE Office of Science (SC), Chairperson

SC1
Magnets
(WBS 1.1.1)

* Ruben Fair, TJNAF
Mike Lamm, FNAL
Bruce Strauss, DOE/HEP

SC2
Tokamak Cooling Water
(WBS 1.2.1)

* John Bernardin, LANL
Dave Rowsell, INL

SC3
Other Technical Areas
(WBS 1.3.1; 1.3.2; 1.5.1; 1.5.2; 1.5.3; 1.9)

* Don Rej, LANL
Charlie Gentile, PPPL
Ray Leeper, LANL
Konstantin Likin, Wisconsin

SC4
Cost and Schedule

* Dianne Hatton, BNL
Kin Chao, DOE/SC
John Post, LLNL
Lucas Taylor, FNAL
Barbara Thibadeau, ORNL

SC5
Project Management

* Mark Reichanadter, SLAC
Jim Diekmann, U. of Colorado
Elaine McCluskey, FNAL

Observers

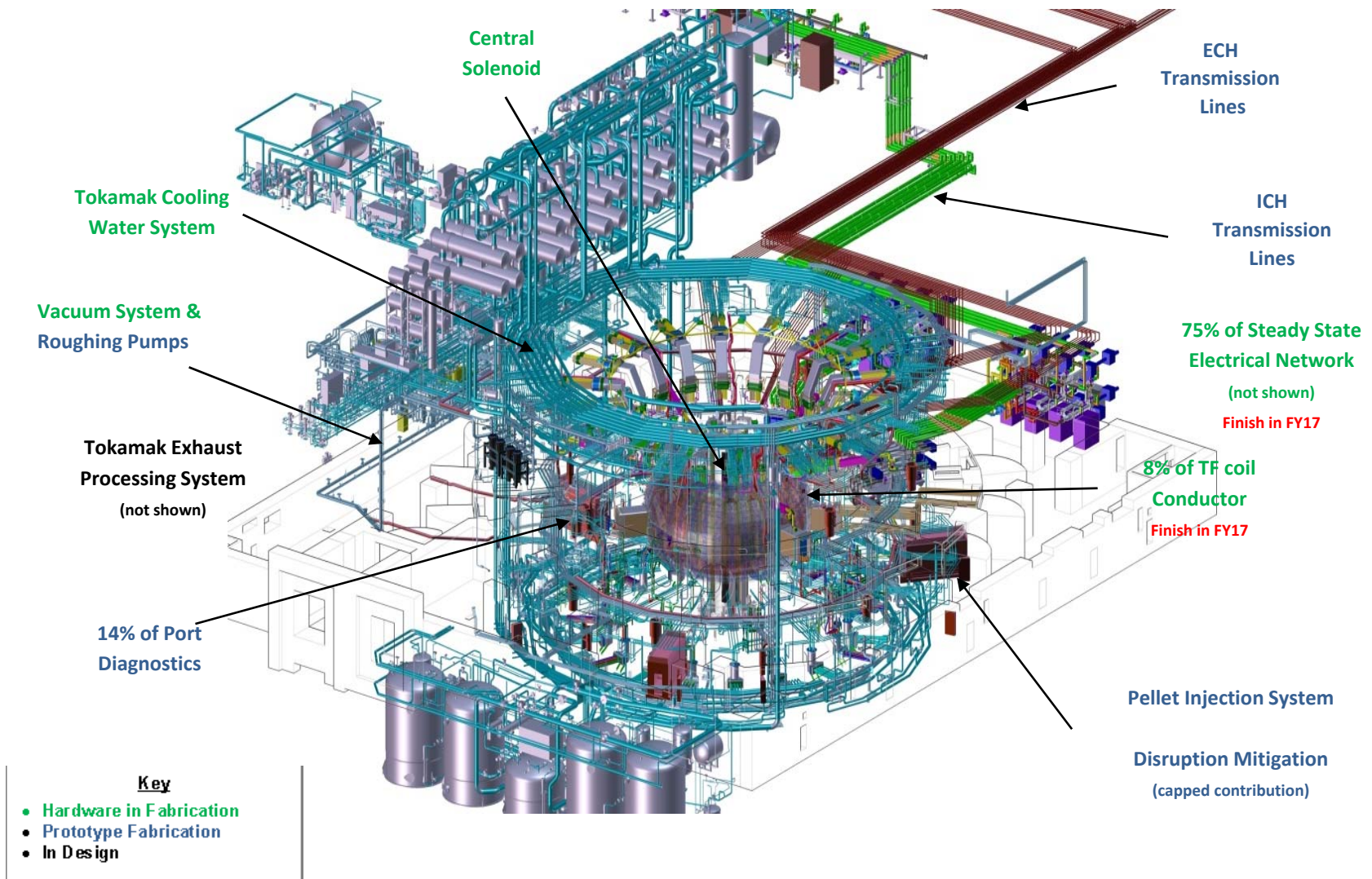
Ed Synakowski, DOE/SC
Joe May, DOE/SC
Barry Sullivan, DOE/SC
Bill Cahill, DOE/ORSO
Brian Huizenga, DOE/PM

Purpose

Request Deputy Secretary Approval for:

- **Critical Decision-1 (CD-1), Revised Cost Range and Schedule for the US ITER Project**
 - Cost Range: \$4.7B - \$6.5B
 - CD-4: March 2034 – 2038
- **CD-2 and CD-3 for Subproject-1 (First Plasma) of U.S. ITER**
 - Subproject-1 Total Project Cost (TPC): \$2.5B
 - CD-4: December 2027

U.S. Hardware Scope



U.S. Commitments to ITER

Construction Phase (U.S. share: 9.09%)

Hardware

CD-2/3 Baseline Action

- Hardware needed for First Plasma* including design of all Hardware contributions
- Hardware needed post-First Plasma

*or cash in lieu of hardware

Cash

- Funds to support ITER Organization (IO) staff, site expenses, IO hardware, and assembly/installation during Construction Phase

CD-1 Cost Range Update

Operations Phase (U.S. share: 13%)

IO Operations Cash

- Supports IO-performed Commissioning, Operations

IO Deactivation/ Decommissioning Cash

- Contributions to a Decommissioning Fund
- Deactivation payments

U.S. ITER Subproject Structure

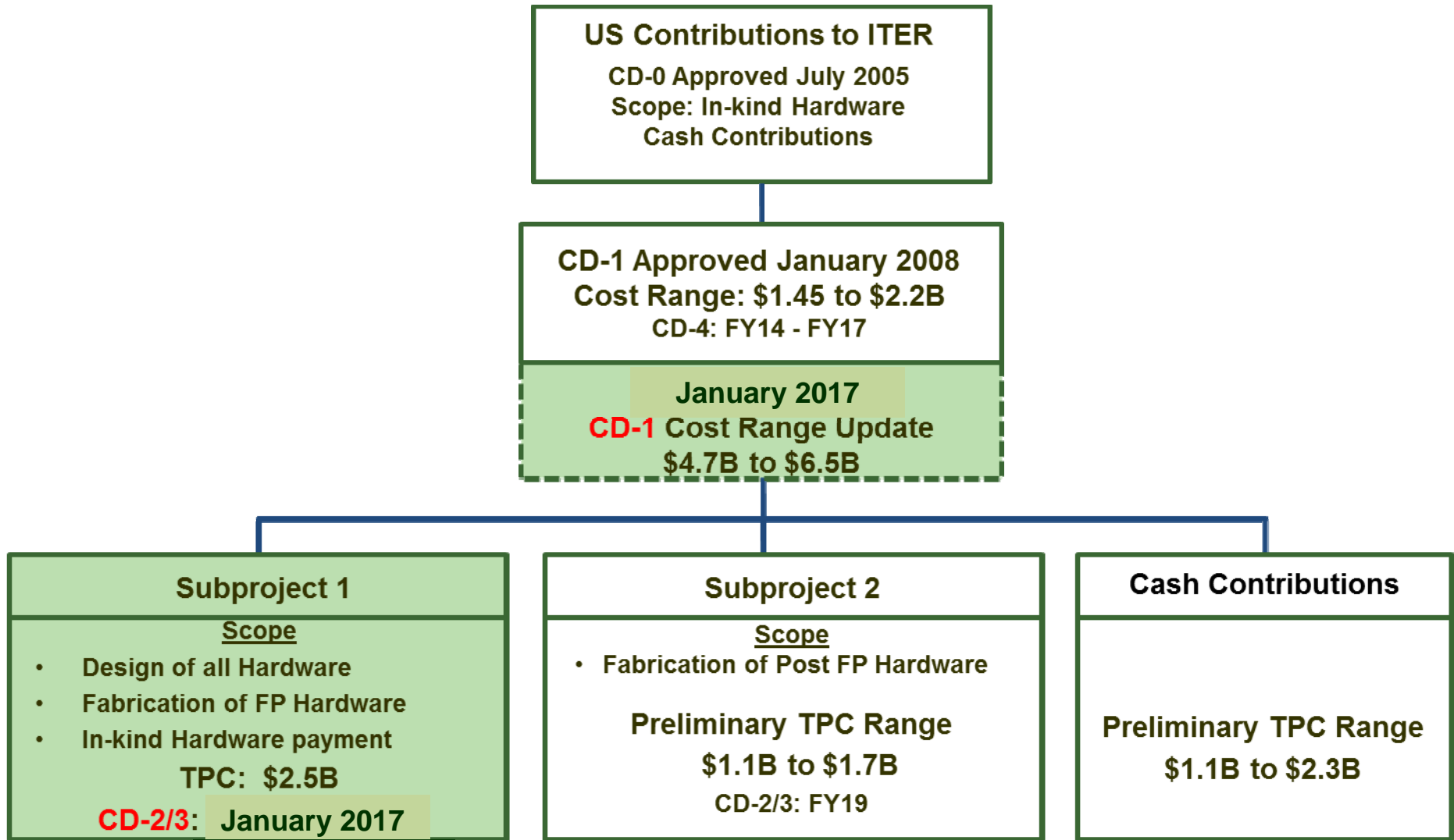
First Plasma (Subproject-1 (SP-1))

- An ITER operational phase that includes: 1) integrated systems testing at low power, and 2) achievement of First Plasma and integrated systems testing of magnets at full field.

Post-First Plasma (Subproject-2 (SP-2))

- A series of stages including fabrication, installation, and operations/research following the First Plasma phase, leading to achievement of full performance of engineering systems and operation with deuterium and tritium aimed at demonstrating a high-gain fusion “Burning Plasma.”

Project Breakdown



Updated Total Project Cost Range

Updated CD-1 Total Project Cost Range – January 2017		
Subproject-1 Total Subproject Cost	\$2.5B	
	Low Estimate	High Estimate
Subproject-2 Cost Range	\$1.1B	\$1.7B
Cash Contribution Cost Range	\$1.1B	\$2.3B
Total Project Cost Range	\$4.7B	\$6.5B

Subproject-1 – Scope & Status

100% R&D - All U.S. Hardware Scope

100% Design - All U.S. Hardware Scope

Full Hardware Production

- Central solenoid (in fabrication)
- Toroidal field conductor
(to be completed in FY17)
- Steady-state electrical network
(to be completed in FY17)

Partial Hardware Production

- Tokamak cooling water system (some components completed)
- Roughing pumps
- Vacuum auxiliary system (in fabrication)
- Pellet injection
- Ion cyclotron heating
- Electron cyclotron heating
- Diagnostics
- Instrumentation & controls

- In-Kind IO Cash Contribution to achieve 9.09% of In-Kind Hardware Commitment

Subproject-1 (First Plasma) Status

- Approximately 45% complete
- Actual cost to date \$885M (Sept. 2016)
- 19% of Hardware components delivered

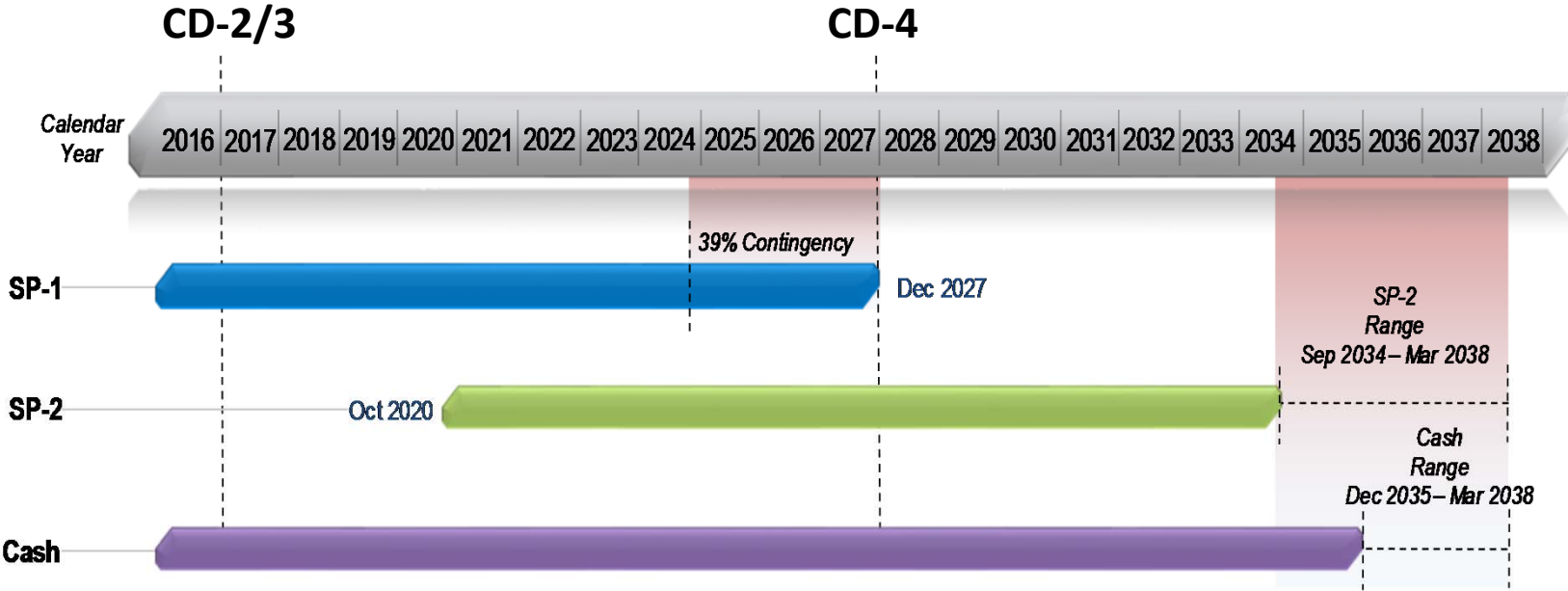
Subproject-1 Cost and Funding Profile

	(\$M)
1.1.1 Superconducting Magnet Systems	519.8
1.1.2 First Wall and Shield Systems	29.2
1.1.3 Port Plug Limiters	0.6
1.1.4 Equatorial Port-Mounted Blanket Shield Modules	0.7
1.2.1 Tokamak Cooling Water System	350.3
1.3.1 Vacuum Pumping and Fueling System	174.8
1.3.2 Tokamak Exhaust Processing System	46.5
1.4.1 Steady State Electrical Network	38.4
1.5.1 Ion Cyclotron Heating System	92.7
1.5.2 Electron Cyclotron Heating System	91.9
1.5.3 Diagnostics Systems	151.9
1.6 Project Support	200.7
1.7 Support to International Organization	171.5
1.8 Supplemental Task Agreements	22.8
1.9 Instrumentation and Controls	114.6
Budget at Completion	2,006.5
Contingency	493.5
Total Project Cost---Subproject 1	2,500.0

**46% Cost Contingency
on Work to Go**

Fiscal Year	Prior Years	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	Total
(\$M)	1,012	100	122	163	168	157	148	139	149	140	122	80	2,500

Summary Schedule



Late Finish Schedule

Recommendations to the Dep Sec

- **Approve the Updated CD-1 Cost Range and Schedule for the US ITER Project**
 - Total Project Cost Range: \$4.7B - \$6.5B
 - CD-4 Completion Range: 2034 – 2038

- **Approve CD-2 & 3 for Subproject-1**
 - Total Project Cost: \$2.5B
 - CD-4 Completion Date: December 2027

Approval 1 of 2


3




Department of Energy
Washington, DC 20585

January 13, 2017

MEMORANDUM FOR THE DEPUTY SECRETARY

THROUGH: DAVID M. KLAUS 
DEPUTY UNDER SECRETARY
FOR MANAGEMENT AND PERFORMANCE

FROM: PAUL BOSCO 
DIRECTOR, OFFICE OF PROJECT MANAGEMENT
OVERSIGHT AND ASSESSMENTS

SUBJECT: **ACTION:** Approve the Revised Critical Decision-1 (CD-1R),
Alternative Selection and Cost Range, and Approve CD-2,
Performance Baseline, and CD-3, Start of Construction for the U.S.
Contributions to ITER First Plasma Subproject

ISSUE: Whether to approve the revised Critical Decision (CD)-1R, Alternative Selection and Cost Range, and approve CD-2, Performance Baseline, and CD-3, Start of Construction, for the U.S. Contributions to ITER First Plasma subproject.

BACKGROUND: The genesis of the international collaboration to develop fusion energy began in November 1985, at the Geneva Superpower Summit, when Soviet Premier Gorbachev proposed to then President Reagan that an international project be established to develop fusion energy for peaceful purposes. While significant progress had been made with large fusion experiments around the world since this proposal was made, it was clear from an early stage that a larger and more powerful magnetic confinement device would be needed to create the conditions expected in a fusion reactor to demonstrate its scientific and technical feasibility. ITER became the solution. It was selected by the Department as the most viable option to demonstrate the capability of producing more energy than it takes to operate a fusion reactor.

The initial concept was to cooperatively design and build such a device as a four-party collaboration between the former Soviet Union, the United States, the European Union (EU) and Japan. Following the collapse of the Soviet Union, the Russian Federation took its place as an ITER member. The People's Republic of China and the Republic of Korea both joined the project in 2003. India joined in December 2005, bringing the total number in the consortium to seven.

The ITER Project, sited in southern France, is an international collaboration involving

This action memo requests the approval of the revised CD-1R cost range for the U.S. ITER Project and the approval of CD-2/3 for Subproject-1 (First Plasma) of U.S. ITER project as follows:

ITER Project CD-1R:

- Cost Range: \$4.7B – \$6.5B
- CD-4: 2034 - 2038

ITER Subproject-1 (First Plasma) CD-2/3:

- Total Project Cost (TPC): \$2.5B
- CD-4: December 2027

Scope: Subproject-1 (First Plasma) scope consists of the following:

- Provide the design and fabrication of the U.S. hardware needed for First Plasma
- Provide all remaining preliminary/final design effort for the U.S. post-First Plasma hardware
- Provide a defined amount of "in-kind" cash contribution to fulfill the remainder of the U.S. hardware credit obligation

Key Performance Parameters: Subproject-1 (First Plasma) criteria and key performance parameters to achieve CD-4 are:

- The delivery to and acceptance by the IO of the Subproject-1 (First Plasma) hardware
- Obtain IO acceptance/approval of the final designs for all U.S. hardware
- Payment of the "in-kind" cash contribution due to the IO

RECOMMENDATION: Approve the revised CD-1R for the ITER project. Approve CD-2/3, Performance Baseline/Start of Construction, for the U.S. ITER Subproject-1 (First Plasma).

APPROVE: LS DISAPPROVE: _____ NEEDS DISCUSSION: _____ DATE: 1/13/2017

Attachment:

ITER Project CD-1R and Subproject-1 (First Plasma) CD-2/3 Approval Memo



Approval 2 of 2



The Deputy Secretary of Energy
Washington, DC 20585

January 13, 2017

MEMORANDUM FOR FRANKLIN ORR
UNDER SECRETARY
FOR SCIENCE AND ENERGY

FROM: ELIZABETH SHERWOOD-RANDALL 

SUBJECT: Approval of Revised Critical Decision-1R, Alternative Selection and Cost Range, for ITER Project and Approval of Critical Decision-2/3, Performance Baseline/Start of Construction, for Subproject-1 (First Plasma) for the U.S. Contributions to the ITER Project

The revised Critical Decision (CD)-1R, Alternative Selection and Cost Range, for the ITER project, and the CD-2/3, Performance Baseline/Start of Construction, for Subproject-1 (First Plasma) for the U.S. Contributions to the ITER Project are approved.

ITER is a global partnership that was established to demonstrate the scientific and technological feasibility of generating virtually unlimited energy through the fusion of hydrogen isotopes. Now under construction in southern France, the ITER experimental fusion research device is designed to achieve and sustain self-heated – or “burning” – plasma that can produce approximately ten times more power than required for plasma heating.

The U.S. ITER Project was established to provide the U.S. share of ITER hardware and cash contributions to support ITER construction. Due to multiple cost and technical issues the original CD-1 cost range is being updated to reflect current project status and cost projections. Furthermore, two subprojects are being established to synchronize the work execution and mission need to provide ITER components and cash contributions. The two subprojects are First Plasma and Deuterium-Tritium Operations (or Post-First Plasma).

As supported by the Energy Systems Acquisition Advisory Board (ESAAB) on January 12, 2017, the revised CD-1R for the ITER project and new Subproject-1 (First Plasma) cost, schedule, scope and key performance parameters are approved as follows:

ITER Project CD-1R:

- Cost Range: \$4.7B – \$6.5B
- CD-4: 2034 – 2038

ITER Subproject-1 (First Plasma) CD-2/3:

- Total Project Cost (TPC): \$2.5B

