



STATUS OF THE ITER EDA

by Dr. R. Aymar, ITER Director

This article summarizes the progress made in the ITER Engineering Design Activities in the period between IC-12 and December 1997, as reported to the ITER Council at its 13th Meeting (IC-13).

Overview

The Project has focussed on completing the Final Design Report, Cost Review and Safety Analysis (FDR), and the related documentation in time for the ITER review process and submission of FDR to IC-13 in February 1998. The preparations have involved continued intensive detailed design work, analyses and assessments by the Home Teams and JCT who have co-operated closely and efficiently, following the plans presented to MAC-12 and IC-12.

The main technical documents were completed in time for circulation as planned to TAC members for their review at TAC-13 (12-16 January 1998). Supporting documents, including Design Description Documents (DDDs) for all the ITER systems, are also available for reference.

One important element of the work was the completion by the Parties' industries of costing studies of some 80 "procurement packages", each representing a potential real procurement contract for an ITER component. The results, after analysis and evaluation by the JCT, provide the basis for a confidential Detailed Cost Report which was circulated to the Parties' costing experts and discussed with them at a review meeting in San Diego on 10-12 December 1997.

A draft of the ITER Physics Basis document has been prepared through the framework of the Expert Groups and ITER Physics Committee. The ITER Physics Assessment for the FDR is based on the information in this document which is also planned for publication in the journal *Nuclear Fusion*, published by the IAEA.

Project Documentation

Project documentation related to the Final Design Report, Cost Review and Safety Analysis has been made available following the plan supported by IC-12, namely:

- a) a synoptic paper for ITER Council review;
- b) a larger "technical basis" document which synthesizes and assesses supporting technical information as the main source for TAC review;
- c) an "ITER Physics Basis Document" being reviewed through the Physics community;
- d) a number of stand-alone technical documents on specific topics, e.g. ITER Plant System Integration Report (PSIR), Materials Assessment Document, NSSR, Handbooks, manuals & standards documents, indexes of Task Reports, etc.;
- e) a set of Design Description Documents (DDDs) covering all the ITER subsystems and components, which contain the detailed information on the design, interfaces, related R&D results (with references to related task reports), analysis results, etc.

The "Technical Basis" document, the DDDs and key stand-alone documents, have been circulated to Home Team Leaders in CD-ROM format.

The DDDs and the main stand-alone documents, as "living" documents, will be continually updated and revised in the light of ongoing design and analysis and of new R&D results flowing from the continuing programmes. The DDDs will, in due course, provide the data source from which actual procurement packages are developed, as was done for the FDR cost estimate exercise. DDDs will continue in existence through procurement, installation commissioning and operation. Other documents such as the PSIR look beyond procurement and construction to ITER operations. The manuals, handbooks and standards documents such as Materials Properties Handbook, Structural Design Criteria, and Remote Handling & Standard Components Manual will also be maintained as living documents. The comprehensive report, required in Article 16 of the ITER EDA Agreement upon completion of the EDA, will reference all these project documents in their latest form.

Together, the overall set of documents embodies the fruits of combined investments of the ITER Parties in the EDA and merits careful protection and stewardship in line with the provisions in the EDA Agreement concerning information and intellectual property.

Joint Central Team and Support

The status of the JCT at the end of 1997 is summarized by Joint Work Site and by Party in the Table below. 8 members (4 EU, 2 JA, and 2 US) left the team, and no new members joined.

Status of JCT Staff on Site at 31 December 1997

Garching	Naka	San Diego	EC	JA	RF	US	Total
52	57	53	52 ¹	46	28 ²	36	162 ^{1,2}

¹ includes four Canadians provided through the Canadian association with the EC Party.

² in addition, 20 RF professionals have spent time at the Joint Work Sites under special VHTP arrangements.

The estimated cumulative Professional Person Year (PPY) effort on site to 21 December 1997 is shown in the Table below by JWS and by Party.

Cumulative PPYs on-site to 21 December 1997

	EC	JA	RF	US	Total
Garching	66.9	55.6	25.2	43.7	191.4
Naka	66.8	57.6	33.9	54.1	212.4
San Diego	53.7	61.4	44.8	63.1	223.0
Total	187.4	174.6	103.9	160.8	626.7

The JCT staffing is now below the level of 167 assumed in the Work Programme approved by IC-11. If staff numbers remain unchanged after the known departures, total PPY for the six-year period to July 1998 will not exceed 715 including the special RF VHTP effort. This can be compared with the figures of 840 PPY of JCT effort derived from the ITER CDA final report and adopted by IC-5, and of 798 PPY accepted in the IC-8 Work Programme.

Visiting Home Team Personnel (VHTP) Scheme

The Visiting Home Team Personnel scheme continues to function well as a means of enhancing JCT/Home Team interaction and to offer some flexibility. Following the offer made by the RF Party, thirteen new RF VHTPs now have been or are on assignments at the Joint Work Sites of about two to four months each; further assignments in 1998 are under consideration. As noted at IC-10, these VHTPs are being assigned by the RF in lieu of further JCT secondments. They are therefore accorded zero PPY credit and are noted in the RF contribution to JCT resources and omitted from the figures for VHTP effort.

RF Design Support Contracts

The planned RF Design Centre support work agreed during 1997 valued, in total, about \$494,000 (cf the budget figure of \$500,000). The contracts were staged, following the established management procedures, and work has progressed satisfactorily. The electronic transfer of drawings between the JCT and Design Centre institutes and exchange between AutoCAD and CATIA formats is well established and working routinely. Staged releases in 1997 were authorized subject to the acceptance of the earlier stage reports and the availability of funds.

Work orders for 1998 are being developed by the JCT in consultation with the Design Centre staff, within the relevant Joint Fund budget provisions. Draft contracts are being staged so as to limit commitments to the period to July, pending decisions about the Project's future.

Task Assignments

The status of existing Task Assignments was presented in detail to MAC-13 who supported the small number of proposals for new tasks or task modifications. The updated task status is summarized in the tables below. The total R&D resources and design task PPYs now expected in the period to July 1998 at present stand at 578 kIUA and 735 PPY, respectively (cf 583 kIUA and 715 PPY reported to MAC and IC-12).

The main variations since the report to IC-12 include reductions in credit totalling about 9 kIUA (US) and 2 kIUA (RF) reflecting cancellation or reductions in scope of R&D tasks. These reductions in general arise from Home Team budget limits. There is an increase of 7 kIUA (JA), reflecting extension of the specifications for the model coil test facility.

About 70% of tasks, including both design and technology R&D, have been completed and the final reports have been submitted by the Home Teams. Total values of task allocations to date, including the VHTP tasks, are as shown in the Table below. As was previously noted, the bulk of the technology R&D resources are in the 7 large tasks, several of which are now expected to be completed only after July 1998. The current expectation is that, by July 1998, the L7 tasks will be about 80% complete overall.

Type	IUA	PPY
TA Work Completed ¹	200,935	415,60
L7 Tasks	324,500	
Other Tasks	49,097	301.65
Committed/ongoing		
Tasks newly reported	3,650	19.85
Totals	578,182	736,60

¹ Tasks for which the HTL concerned has submitted an acceptable final report

The pattern of the task assignments to the Parties as of January 1998 is summarized below:

Party	IUA	PPY
EC	192,141	207.73
JA	181,625	179.28
RF	89,004	162.75
US	115,412	187.34
Totals	578,182	736.60

ITER Physics

A definitive statement of the current status of ITER physics is embodied in the ITER Physics Basis document written, under the aegis of the ITER Physics Committee, by the ITER Physics Expert Groups. The purpose of the document is:

1. to address the present state of theoretical and experimental knowledge of the physics of reactor-scale devices as exemplified by ITER;
2. to recommend a methodology (or methodologies) to project present knowledge to an ITER-scale device and estimate the associated uncertainties;
3. to recommend physics research to be carried out after July 1998 which will reduce the uncertainties in projections, expand ITER operating scenarios and support detailed design work planned for the ITER construction period.

The ITER Physics Committee reviewed, at its meeting in November 1997, reports from the Expert Groups on the progress on the Urgent and High Priority topics for 1997 and considered recommendations for continued work in 1998, taking account of the possibility of an extension of the ITER EDA Agreement, which might include a joint assessment of readiness for construction after about two years. Against such a background, the Committee adopted the following definitions (overleaf) for priority levels in 1998:

- Urgent:** Information needed (and potentially available) for January 2000 to contribute to the joint assessment;
- High:** Information valuable for the joint assessment and/or information supporting ITER flexibility.
- Long Term:** Information of fundamental long-range importance to fusion reactor science or technology.

On the above basis, 16 topics within the existing framework which have been proposed by the Expert Groups were included in the "Urgent" category for 1998.

The following databases are also included in the "Urgent" category:

H-mode Power Threshold	H-mode Thermal Confinement
ELM and Pedestal Properties Database	Divertor Scalar Database

The following Code Development projects are deemed "Urgent".

3-D Halo Current	Integrated Disruption
Runaway Currents	High-n TAE Linear Stability

2-D Monte Carlo Divertor codes have moved off the Urgent development list and are in regular use for research and ITER predictions.

A substantial revision/update of the Priorities for ITER Physics Research will be carried out by April 1998, with an objective of simplifying and shortening the task descriptions. Topics which span two or more Expert Groups will receive special attention.

The Physics Committee considered that the Expert Groups should continue during the possible extension of the EDA and that it was important to maintain the excellent momentum that the Groups have developed in stimulating high quality, focused Physics work in the Parties.



ITER Director, Dr. R. Aymar (center) in consultations (1997) with ITER Parties' Contact Persons (CPs) before the ITER Council Meeting. Since then, the JA CP, Dr. A. Kitsunezaki (second from the left), was replaced by Dr. H. Takatsu (see note following the article). The other CPs (from left to right) are: Drs. E. Canobbio (EU), M. Roberts (US), and L. Golubchikov (RF).

ITER Public Information

There has been steady demand for the ITER Brochure in both English and Japanese language versions. At the request of the RF Party, a Russian language version has now been published.

A new WWW Home Page for ITER (<http://www.iter.org>) has been released and has received favourable comment. A guiding policy has been to ensure that all parts of the ITER Home Page provide unrestricted public access to up to date information and that all initial links from the Home Page (e.g. to Home Teams or other fusion institutions) are to public sites.

The ITER Home Page is intended to represent the Project as a whole; the Parties and Home Teams are invited to assist in keeping it up to date, for instance by providing illustrated updates on the progress of the large projects.

CHANGE OF JA CP

by Dr. M. Roberts, Chair, CPs

As of April 1, Akio Kitsunozaki, JA CP, will become Director, Department of ITER Project in JAERI at Naka. In taking up his new position, Akio will bring to an end his long-standing role as the JA CP. Hideyuki Takatsu, also of JAERI, will now become the new JA CP.

I know I can speak for all the CPs and the Point of Contact with the Director in saying that we have all appreciated working with Akio during the five plus years of the ITER EDA to date. As Chair, I especially appreciated the many times when Akio would provide a thoughtful straw plan or position or statement of issues for us all to consider as a starting point. Each of us has enjoyed Akio's positive approach, his increasingly skilled representation of the JA Party positions and his consensus-building efforts, characterized by honesty and clarity, supporting ITER progress, all of which have made a significant contribution to our collective work. These attributes as well as his 'outside' skills in languages, arts and crafts have helped us to turn many long intense days into well-remembered and satisfying as well as productive experiences.

While we will obviously miss working with Akio at first hand, we are delighted that he will still be working with ITER in his new position.

At the same time, it is my pleasure to welcome Hideyuki Takatsu as the new JA CP. Hideyuki joined us on an informal basis at our last working session and we look forward to continued good works with him in our group.

FIFTH TECHNICAL MEETING ON QUALITY

by Dr. A. Girard, ITER Joint Central Team

The 5th Technical Meeting on Quality was held on 20-22 October 1997 at the ITER San Diego Joint Work Site (JWS) and was attended by representatives of the Home Teams (HTs), of the Joint Central Team (JCT) and of manufacturers currently involved in the Large R&D projects.

The meeting made progress towards:

- the finalization of the ITER Quality Manual document for inclusion in the Final Design Report (FDR);
- the definition of the quality necessary for ITER procurement and construction.

The current Action Plan (see page 7) was updated to reflect the progress made by the HTs and the JCT in the implementation of the Action Items.

ITER Quality Manual

Prior to the meeting, each HT circulated its review report on the draft Quality Manual prepared by the JCT for inclusion in the FDR.

The Quality Manual currently focuses on the specification of the assurance for quality to be provided by suppliers as part of procurement contracts. It includes the following ITER EDA documents:

- "QID 003 - Quality Classification" establishes four quality classes;
- "QID 004 - Quality Requirements in Procurement Specification" describes, for each of the Quality Classes, the minimum quality requirements to be specified in procurement contracts. It refers to the following documents where detailed requirements can be found:
 - ◊ "QCD 001 - Procurement Quality Specification"
 - ◊ "QCD 002 - Implementation Plan"
 - ◊ "QCD 003 - Documentation Schedule"
 - ◊ "QCD 004 - Procurement Schedule"
 - ◊ "QCD 005 - Work Schedule"
 - ◊ "QCD 006 - Deviations and Non-Conformities"
 - ◊ "QCD 007 - Release Note"

The participants considered the Quality Manual to be suitable for the purpose of the FDR, subject to:

- the addition of a Quality Program to be developed by combining the two proposals presented during the meeting, and
- inclusion of improvements agreed upon during the meeting,

It was recognized that the Quality Manual is a living document that will need to be further enhanced when more detailed information will be available, in particular, regarding the ITER organization for construction, in order to cover all aspects of the ITER Project.

Discussions showed that contrasting views still remain regarding the selection of the key factors (such as safety, machine availability, complexity and maturity) to be considered to establish quality classes. It was, therefore, agreed not to exclude the relevant Action Item of the Action Plan to allow further work on this issue.

Quality Requirements of Regulatory Bodies

The HTs reviewed the quality requirements which may be imposed on the ITER Project by regulatory bodies which will be responsible for granting licenses to construct and operate ITER. The approach taken on this subject has been limited to the examination of publications from national regulators and informal contacts with individuals having experience in license applications for nuclear construction projects.

All four HTs have found that regulatory bodies require the applicant to produce a comprehensive management and procedural system for all matters concerning safety of the plant, and this system must either explicitly or implicitly be represented as a Quality System. The Quality System, in most cases, must be approved by the regulator, who will monitor its implementation for the entire life cycle of the plant.

In view of these requirements, the participants recommended that:

- a quality program be prepared in order to submit a case for the construction and operation of ITER to regulatory bodies;
- consideration should be given to providing information in order to enable the preparation of the quality program responding to the standards required by the regulators.

ISO 9000 and ITER Procurement

Presentations by HTs and JCT focused in two main areas:

- Status of ISO 9000 series certification world wide;
- Advantages and disadvantages of introducing ISO 9000 as a requirement.

Participants agreed that:

- the ITER quality program should be based on conventional quality principles as described in the ISO 9000 series of standards or IAEA Code 50-C-QA;
- ITER contractor should implement a quality system based on a recognized quality standard (e.g. ISO 9001).

Procurement Technical Specification

HTs and JCT proposed formats and contents to be used as guidelines for the preparation of procurement specifications. Agreement was reached that a standard approach was required, and that of the four proposals the one of the JA HT was the most suitable. The JA HT agreed to develop their proposal to include explanations for each of the topic headings, with the aim of expanding the document into the required guide.

Action Plan

At the 4th Technical Meeting on Quality, a discussion of the most urgent needs led to the definition of seven objectives requiring short-term action (see box).

It was then agreed that the subsequent Action Plan would ensure that the schedule of activities to be undertaken by the JCT and by the HTs can achieve these objectives (Action Items).

Objectives of the Action Plan

- Establishment of a quality classification scheme to provide a basis upon which a stepwise hierarchy of quality requirements can be developed;
- specification of the quality requirements applicable to ITER procurement;
- identification of the extent to which the ISO-9000 series of quality standards should be used in ITER procurement specifications;
- production of guidelines for the preparation of procurement technical specifications;
- exploratory investigation of the quality requirements which regulatory bodies may specify for ITER;
- preparing proposals for the quality organization that might be required within the project during the construction phase;
- compilation of available experience regarding the control of procurement that could be beneficial to ITER.

The Action Plan, as it stands now, specifies actions, responsibilities and deadlines regarding the following issues:

- graded approach to quality;
- use of ISO 9000;
- production of guidelines for the preparation of procurement technical specifications;
- exploratory investigation on the quality requirements regulatory bodies may specify for ITER;
- quality organization which will be required within the project during construction.

At this meeting, Action Item sheets were updated to reflect the progress made in the implementation of the Action Plan.

The two following Action Items, having achieved their objectives were closed out:

- Specification of the quality requirements applicable to ITER procurements;
- Compilation of available experience regarding the control of procurement that could be beneficial to ITER.

Three new Action Items were adopted:

- Preparation of the ITER Quality Program for the purpose of the FDR;
- Control of documents and records;
- Compilation of experience gained and lessons learned on quality matters during EDA.

Visit to Lockheed Martin

During the 4th Technical Meeting on Quality (16-18 April 1997, St. Petersburg, Russia) its participants visited Izhorskiye Zavody steelworks, which provided an opportunity to observe the quality controls which are in place for the manufacture of components - the structural steel of the CS Model Coil Inserts - for one of the L7 R&D projects.

This time, the US HT hosted a half-day visit to the nearby Lockheed Martin facility (plant 19) which provided an opportunity to observe the quality assurance program which is in place for the manufacture and assembly of components of the Central Solenoid Model Coil (CSMC), L1 project.

Visitors were presented the documentation system used to control manufacture, inspection and test. Operators are supplied with documents listing the sequence of operations to be performed with indication of the applicable acceptance criteria. On this same document:

- operation completion is dated and signed-off by the performer or his direct supervisor;
- acceptance status and changes are recorded as necessary.

During the tour of the facility, used for the manufacture of the CSMC components and of Titan/Aries rocket fuel tanks, visitors were impressed by:

- the high standard at which calibration of equipment such as jigs and fixtures is maintained;
- the quality of welding.

Overall, the visit demonstrated:

- the benefits of use of a documentation system;
- the kind of quality approach needed for the manufacture of critical ITER components;
- the value of training, workshop practices (e.g. clean conditions, maintenance of equipment), use of approved procedures and record keeping;
- that quality documentation in the workshop can be effective while reasonably simple.

Meeting Participants

EU HT:	L. Baker, N. Pawsey (NNC)
JA HT:	Y. Ozawa
RF HT:	P. Chaika
US HT:	G. Miyata, F. Southworth (both Lockheed Martin), K. Sowder
ITER JCT:	J. Dietz, A. Girard, Y. Shimomura

Items to be considered for inclusion in the ITER Newsletter should be submitted to B. Kuvshinnikov, ITER Office, IAEA, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria, or Facsimile: +43 1 237762, or e-mail: c.basaldella@iaea.org (phone +43 1 206026392).

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