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INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR



INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1990

**INITIAL REPORT
OF THE ITER COUNCIL'S
WAYS AND MEANS WORKING PARTY**

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FOREWORD

Development of nuclear fusion as a practical energy source could provide great benefits for all mankind. This fact has been widely recognized and fusion research has enjoyed a level of international co-operation unusual in other scientific areas. From its inception, the International Atomic Energy Agency has actively promoted the international exchange of fusion information.

In this context, the IAEA responded in 1986 to calls for expansion of international co-operation in fusion energy development expressed at summit meetings of governmental leaders. At the invitation of the Director General there was a series of meetings in Vienna during 1987, at which representatives of the world's four major fusion programmes developed a detailed proposal for a joint venture called International Thermonuclear Experimental Reactor Conceptual Design Activities. The Director General then invited each interested party to co-operate in ITER activities in accordance with the Terms of Reference that had been worked out. All four Parties accepted this invitation.

ITER Conceptual Design Activities, under the auspices of the IAEA, began in April 1988 and are scheduled to be completed in December 1990. The plan includes two phases, the Definition Phase and the Design Phase. In 1988 the first phase produced a concept with a consistent set of technical characteristics and preliminary plans for co-ordinated R&D in support of ITER. The Design Phase is producing a conceptual design, a cost estimate and a description of site requirements. All information produced within the Conceptual Design Activities is being made available for all ITER Parties to use either in their own national programme or as part of a larger international collaboration.

As part of its support of ITER Activities, the IAEA is pleased to publish the documents that summarize the results of the Conceptual Design Activities.

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1. INTRODUCTION

The Terms of Reference of the ITER Conceptual Design Activities (CDA) state that the ITER Council (IC) will "...make suggestions on how the Parties may explore ways and means to comply with the objective of the co-operation..." To develop these suggestions, the Council has chartered a Working Party (see Annex I) to "explore these ways and means" and to propose "those support elements needed for the possible conduct of the Engineering Design of ITER." The members of the Working Party, listed in Annex II, have been asked to explore the various views on these elements. Thus the expressions of common views represented in this Report do not commit the members' organizations or the Parties in any way. This Initial Report contains the outcome of the Working Party's effort to date and is meant to be read in parallel with the Interim Conceptual Design Report containing the technical work of the CDA.¹

2. DEFINITION OF THE EDA

2.1 General Definition of Engineering Design Activities

An Engineering Design Activity (EDA) is an intermediate task between the conceptual design activities and construction in a full-term facility project. It is a direct preparation for decisions to proceed with construction. An EDA is conducted, therefore, with subsequent construction in mind. An EDA would typically begin with agreement on a single, specific conceptual design, encompass design, R&D, and development and testing of scalable models, and at its end, the preparations necessary to initiate the contracts for construction would have been completed.

2.2 Initiating Conditions for the EDA

The approach to a successful ITER EDA should encompass the following elements:

- a. Existence of a single conceptual design for ITER, agreed and supported by all Parties as the basis for the EDA. This ITER conceptual design report would include projections of financial and

¹INTERNATIONAL ATOMIC ENERGY AGENCY, ITER Conceptual Design: Interim Report, ITER Documentation Series, No. 7, IAEA, Vienna (1990).

personnel requirements both for the EDA itself, using the usual definitions noted above, and, as an essential part of the EDA planning, for the construction and operation activities of ITER, activities whose fulfillment would require future decisions.

b. Agreement among the four Parties on arrangements for the conduct of the EDA. This should include (although it would not be limited to):

- Tasks comprising the EDA and necessary parallel activities (suggestions are given in Table I),
- Approach to task sharing,
- Duration of the EDA,
- Project organization and management,
- Selection of the EDA work site,
- Responsibilities of the Party hosting the EDA Central Team,
- Financial and personnel resource commitments,
- Treatment of intellectual property, i.e., information and knowhow,
- Conditions for the involvement of other countries in the EDA,
- Role of the IAEA.

TABLE I. TASKS COMPRISING THE EDA AND NECESSARY PARALLEL ACTIVITIES

1. Production of the engineering drawings of the components of the device and their interfaces
 2. Completion of the supporting R&D and the development and testing of scalable models
 3. Completion of the detailed design of the basic system and the plant system under the conditions of the selected site and licensing by the Construction Site Party (CSP)
 4. Drawing up of the network plan for the construction of the basic device, the plant system, and their assembly
 5. Development of the operation plan
 6. Development of the maintenance and decommissioning plan
 7. Production of the construction cost estimate
 8. Parties' selection of the construction site and the CSP
 9. Licensing by the CSP's regulatory bodies
 10. Agreement on a final procurement policy and task sharing among the Parties
 11. Completion of the specifications for the construction contracts of the basic device and plant system
 12. High-level commitment by the Parties to the financial plan for construction
 13. Drafting the agreement document for construction
-

- c. **Common intent to negotiate within a reasonable time matters related to construction. This common understanding is needed because, in practice, the later design work involves substantial tailoring of the design to the actual construction site, to the licensing conditions (including environmental and safety aspects) and to other features envisaged for the construction (e.g., procurement approach).**

Apart from this design-related need, there should also be a consensus at an early stage on some other matters related to construction, notably the responsibilities which should be taken on by the Party which would provide the construction site. (Suggestions for the Construction Site Party's responsibilities are given in Table II.)

TABLE II. SUGGESTIONS FOR THE RESPONSIBILITIES OF THE CONSTRUCTION SITE PARTY

- 1. The Construction Site Party (CSP) should be responsible for:
 - a. site construction, traffic access to the site, access to the electric power lines, and the supply of cooling water,
 - b. preparation of all the necessary accomodation for assigned personnel from the other Parties.**
 - 2. The CSP would carry out the licensing for the construction of ITER on its own responsibility.**
 - 3. The CSP would take ultimate responsibility for compensation for any damages arising from the ITER-related activity in its territory.**
 - 4. The CSP would be responsible for the decommissioning of the whole system.**
-

2.3 Logic of the EDA and Related Activities

Figure I sets out the logic implied by the technical needs of the EDA.

In order to produce a completed engineering design, with specifications for contracts, etc., the designers would need information on the construction site, on the conditions which would be applied by the licensing authorities, and on the way in which the construction work would be shared. In effect, they would need a good picture of the construction project that could follow. This means that the Parties should be prepared to make such decisions during the course of the EDA. As long as these decisions are not made, the engineering design cannot be completed and costs would rise.

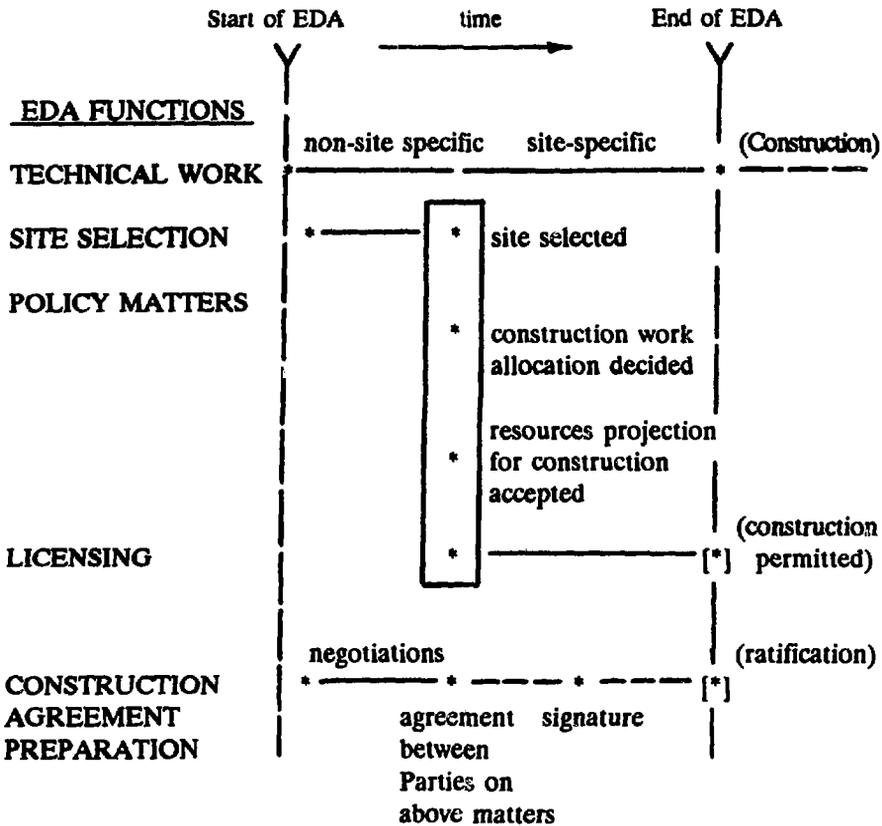


Fig. 1. Logic of the EDA and Related Activities

An alternate EDA definition, which consists of design, R&D, and scalable model development and testing work without a site selection, was also explored. This alternate definition was abandoned because the output of such an EDA was not a complete design and, therefore, not responsive to the Council's direction to consider an EDA as defined above in 2.1.

The decisions to be made during the EDA, shown in Figure I, would constitute in the aggregate an important, though not final, step on the road to a formal commitment by the Parties to construction.

3. PRACTICAL TOPICS FOR AN EDA

3.1 Project Organization and Management

The following thoughts represent an initial consideration of the requirements for an EDA. They might have to be reconsidered because the organization and management of the EDA would depend very much on its objectives and content. In any case, further exploration is required to consider important details, such as administrative support, crucial to the actual functioning of the organization.

The principal elements of the organizational and managerial structure of the EDA should be the following:

- Council
- Technical Advisory Committee
- Advisory Committee for Administration and Finance
- Director
- Co-ordinating Committee
- Central Team
- Home Teams

These elements, defined below, should be arranged as shown in Figure II.

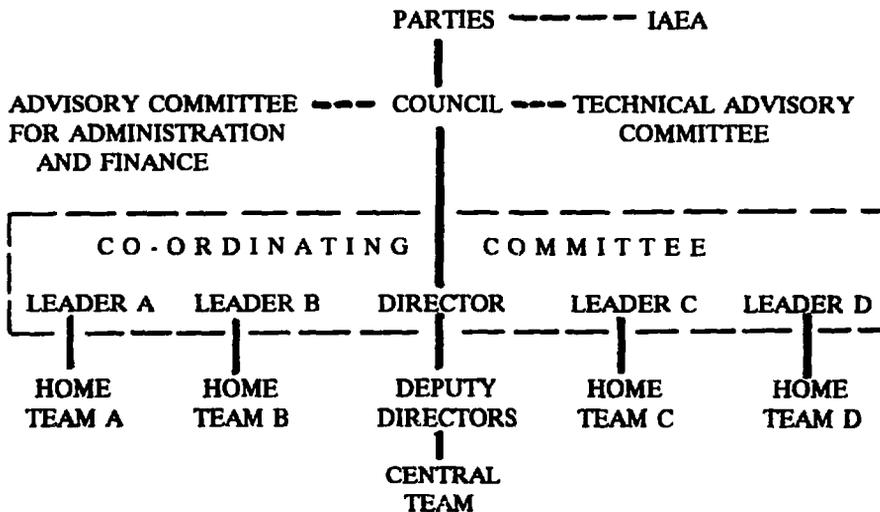


Fig. 2. A Tentative Organization for the ITER EDA

3.1.1 Council

The Council should report to the Parties. Overall responsibility for the conduct of the EDA within the agreed-upon EDA Terms of Reference should rest with the Council. Each Party should appoint its own members. There should be an equal number from each Party.

3.1.2 Technical Advisory Committee (TAC)

The TAC should report directly to the Council. The TAC should be responsible for assisting the Council to assure the technical quality and appropriateness of the work. The Council, with the Parties' recommendations, should appoint an equal number of members from each Party *ad personam* to the TAC.

3.1.3 Advisory Committee for Administration and Finance (ACAF)

The ACAF should report directly to the Council. It should be responsible for assisting the Council in administrative and financial matters. The Council, with the Parties' recommendations, should appoint members from each Party to the ACAF. There should be an equal number from each Party.

3.1.4 The Director

The Director should report to the Council and, under the Council's policy guidance, should be responsible for directing and co-ordinating the ITER EDA project including the design, supporting R&D, and the development and testing of scalable models. Within the guidelines of the Council, the Director should organize and direct the Central Team. Within the framework established by the assignment of tasks (see 3.4 below) and by means of a mechanism approved by the Council, the Director should have the responsibility of monitoring and controlling the various task efforts to ensure acceptable results and compatible timing. In this responsibility, the Director should be assisted by the Co-ordinating Committee and the Central Team. Programme changes which affect the above framework should be approved by the Council.

The Director should have a Deputy Director from each Party. The Director and Deputy Directors should be paid from a joint fund.

3.1.5 The Co-ordinating Committee

The Co-ordinating Committee should assist the Director in assuring the coherence of the work performed in the Central Team and in the Home Teams. It should be composed of the Director and the Leaders of the four Home Teams. The Director should be the Chairman of the Co-ordinating Committee. The Co-ordinating Committee should meet periodically.

3.1.6 Central Team

The Central Team should assist the Director in the performance of his/her task described above. In particular, the Central Team should be capable of overseeing all and performing some of the design work, of co-

ordinating, supervising and carrying out quality control of work performed in industry and in the Home Teams, and of integrating all contributions into a coherent design. The scientific and technical professionals of the Central Team should be seconded in equal numbers by the Parties. The possibility could be examined of paying certain expenses of the members of the Central Team from the joint fund.

3.1.7 Home Teams

The Parties should each organize their Home Teams to accomplish the R&D and scalable model development and testing tasks allocated to them.

3.2 Environment, Safety and Licensing

As indicated in Figure 1, steps toward the license for ITER should be taken during the course of the EDA in order to complete the engineering work. The site-specific conditions, which would be applied by the licensing authorities, would need to be known before the design is brought to completion.

The Construction Site Party (CSP) would be responsible for obtaining the license. The importance of the environment and safety objectives is already reflected in the ITER CDA Terms of Reference statement that "The operation of ITER must demonstrate the potential for safe and environmentally acceptable operation of a power-producing fusion reactor."

3.3 Construction Site Requirements

As shown in Fig. 1, the completion of the design requires that a construction site be chosen during the course of the EDA. To facilitate the making of this choice, there should be a consensus among the Parties before the start of the EDA on the procedure for site selection and the responsibilities which the CSP would take on. Conscious that the costs and benefits broadly associated with siting are difficult to measure, the Working Party suggests consideration of the general principle that the Party which would provide the site should neither gain nor lose by doing so.

3.4 On the Approach to Task Sharing

The process of acquiring information, services, and equipment should be addressed at the outset of the EDA. It would involve many competing and complicating factors, such as the determination of equity among differing economic systems, the assessment of worth of differing subsystems, and the technical preference for central co-ordination.

In this circumstance, the Working Party has attempted to develop a number of principles which could be translated at a later time into a specific task-sharing approach.

- a. **The Working Party examined two distinctly different approaches, one centralized and the other decentralized. In discussing the various pros and cons of each, it appeared that some form of hybrid approach as follows would be more appropriate than either of the two models discussed. The general approach to the sharing of tasks in the EDA should be agreed at the outset by the Parties. Within these guidelines, the Director should develop and propose to the Council, for approval, an allocation of a comprehensive set of packages of work among the Central Team and the four Parties. One of the Director's considerations in making this proposal would be equity. (See paragraph e. below.) Once allocated by decision of the Council, it would be up to the individual Parties to organize the fulfillment of their work packages, either by their personnel specifically assigned to the ITER EDA in their Home Teams or by procurement from industry or other sources. The technical needs of the project would imply a certain degree of central monitoring and control as discussed in 3.1.4 above.**
- b. **Traditionally most of a project's design work is done by a core group. The EDA arrangement is a complex one involving both a Central Team and Home Teams. Therefore, packages of design work for certain components of the device could be assigned to Home Teams or presented in procurement packages to industries or Home Team resources beyond committed ITER personnel. But, however, the design work is eventually shared, design integration work should be done by the Central Team.**
- c. **In any case, technical success would be best ensured by staffing a Central Team sufficiently that it would be able to define or approve the technical specifications of all elements of the facility design.**
- d. **For the procurement of R&D and the development and testing of scalable models, the Working Party suggests that a procurement system be adopted that does not require transfer of funds across the Parties' boundaries and is independent of exchange rates, labour rates, overhead rates and other similar complications.**
- e. **Central to assurance of equity is some acceptable method of establishing standards for equity and evaluation methods. While the Working Party has not assured itself that it has found such method(s), at least one concept has been discussed. In this method, cost estimation by each Party of each of the EDA procurement packages would lead to an averaged relative cost of these packages independent of currency exchange rates. Further study is necessary on this point.**

3.5 Intellectual Property Rights

The process of producing a good, workable engineering design and the process of obtaining a license would both imply a need for disclosure of technical information, i.e. intellectual property, which might include proprietary information or information protected in some other way. In Table III, a set of elements is suggested as a balanced approach for arranging and controlling access for project personnel while respecting ownership rights and the need for protection. While these elements seem to be common to most of the current international co-operation agreements, the list would require further review.

3.6 Formal Arrangements

There appear to be four options for structuring the legal framework of the EDA arrangement:

- a. Four separate replies to an invitation from the IAEA Director General, just as for the CDA.
- b. One reply, jointly signed by the four Parties, to an invitation from the IAEA Director General.
- c. A quadripartite agreement under IAEA auspices.
- d. A stand-alone, quadripartite agreement.

At this stage, all four options should be kept open. While the first two options would provide the simplest approach from a technical point of view, some preference has been expressed for a quadripartite agreement under IAEA auspices. Whatever form is eventually chosen, the level of signature should also be considered in due time. Any arrangement involving the Agency should, just as in the CDA, take into account the Agency's three basic requirements, i.e., i) possibility of access by other IAEA members, ii) dissemination of information resulting from the EDA to the Agency membership, and iii) no additional financial burden on the IAEA beyond the presently budgeted amount. There would not seem to be any major difficulty in meeting these requirements by development of mechanisms which would be agreed among the four Parties, similar to those in the CDA.

3.7 Financial Matters

A joint fund should be set up to maintain some of the activities of the Director, Deputy Directors and the Central Team. This fund would provide payment for the services of the Director and Deputy Directors. Certain

TABLE III. HANDLING OF INTELLECTUAL PROPERTY

1. Ownership of Intellectual Property
 - a. Intellectual property created in the Central Team would be owned jointly by the four Parties.
 - b. The copyright on the formal reports produced by the Central Team would be owned jointly by the four Parties.
 - c. Upon making an invention at the Central Team, the inventor would report to the Director who would then report to the Council and inform the Co-ordinating Committee.
 - d. Intellectual property created in the Home Team of one of the Parties would be owned by the Party (according to its domestic laws).
 - e. Upon making an invention in the Home Teams, the inventor would report to the Leader of the Home Team who would then report to the Director while informing the Co-ordinating Committee. The Director would report to the Council.
 - f. If any question on the ownership arises, the Director, after consultation with the Co-ordinating Committee, should propose to the Council which Party should have the right to apply for a patent. This should be settled before any application would be made.
2. Transfer of Intellectual Property
 - a. In regard to the intellectual property created in the execution of the EDA by one of the Parties in its facilities, the owning Party should license its use at no charge to the other Parties for ITER purposes.
 - b. The owners of the pre-existing intellectual property of interest to the ITER design should license its use for ITER purposes to the Parties over a finite time, possibly on a paying basis. If the government of a Party is a co-owner, the Party could arrange for the free use of the property for ITER purposes over a finite time.
 - c. Protected, pre-existing information that a Party wishes to contribute to the ITER work could be used confidentially with ITER-related access permitted under agreed upon rules.
 - d. Intellectual property created in the Central Team and thus jointly owned by the Parties could be transferred to "third persons" only after approval by all the owning Parties.
3. Protection of Proprietary Information
 - a. Proprietary information is that information meeting the following requirements:
 - It is not generally known or available from other sources.
 - It has not been made available by its owner to other Parties without a stipulation on its use.
 - It is not at the disposal of the receiving Party without stipulation on its use.
 - It is, or is similar to, the kind of information usually related to commercial purposes.
 - b. In general, proprietary information and know-how would not appear in the reports produced in the EDA.
 - c. Proprietary information that is used in the ITER process would be clearly marked and handled by the Parties in accordance with the applicable laws, rules and administrative practices throughout the time period mutually agreed upon.

expenses of the members of the Central Team could also be paid from this fund. The Council may further decide that the joint fund would be appropriate for further uses, e.g. critical equipment needs of the Central Team. Equal contributions should be made by the four Parties and the fund should be under the control of the Council. Legal authority to manage the joint fund and to employ personnel and the authority of audit should be arranged. One possibility is that the IAEA could provide a suitable mechanism, provided that the fund's financial level remains modest; the Agency has indicated that it could provide such a mechanism.

3.8 Working Arrangements and Housing for the EDA Team

The Central Team should be located at a single site to be chosen by the Parties. In order to assure the fulfillment of the task and, in particular, to assure that people with the necessarily considerable skills and abilities would be willing to relocate to this site, there would be many administrative issues that should be addressed (see Table IV). The selection of the EDA Central Team work site should not prejudice the future selection of a construction site.

TABLE IV. PERSONNEL ISSUES RELATED TO THE EDA WORK SITE

1. The following issues, among others, should be considered by the EDA Host in preparing the social infrastructure for the EDA Work Site:
 - office space,
 - administrative service aides fluent in both local and ITER languages,
 - computing and communication systems,
 - housing,
 - schooling for children,
 - spousal employment,
 - medical care,
 - application of tax and customs duties,
 - legal services.

 2. The following issues, among others, should be considered by all the Parties in preparation for seconding personnel to the EDA Work Site:
 - travel and relocation allowances,
 - cost of school for children,
 - re-employment policy.
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**ANNEX I CHARTER FOR ITER COUNCIL'S
WORKING PARTY ON WAYS AND MEANS**

13 July 1989

The Terms of Reference document for the International Thermonuclear Experimental Reactor (ITER) Conceptual Design Activities states that the ITER Council "...will make suggestions on how the Parties may explore ways and means to comply with the objective of the co-operation..." (5.1.2.a)

With the successful conclusion of the Definition Phase and the preparation of the technical basis for the Interim Conceptual Design Report, the Council is ready to address item 5.1.2.a. Therefore, the Council hereby charters a Working Party to explore those ways and means.

More precisely, the Working Party is charged with the task of proposing those supporting elements needed for the possible conduct of the Engineering Design of ITER. The Working Party should report on its first findings at the November 1989 meeting of the ITER Council for use with the Interim Conceptual Design Report and present its final report to the Council in April 1990.

ANNEX II. WORKING PARTY MEMBERSHIP

<u>EC</u>	<u>Japan</u>	<u>USSR</u>	<u>USA</u>
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H. Donoghue *	A. Kitsunezaki	A. Mavrin	C. Newstead
G. Grieger	Y. Tajima	A. Zhuravlev	A. Opdenaker
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* Secretary

** Chairman