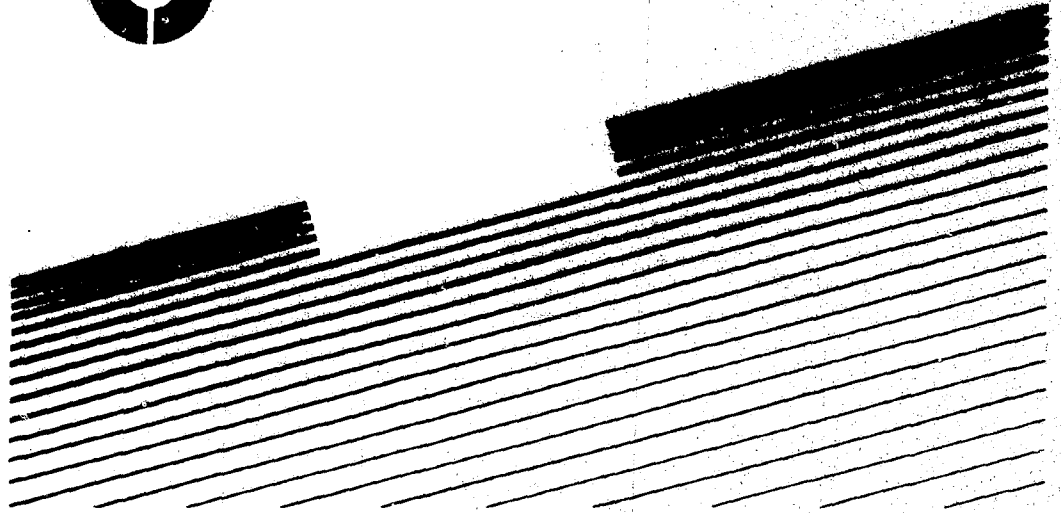


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ESTABLISHMENT OF ITER: RELEVANT DOCUMENTS



INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1988

**INTERNATIONAL
THERMONUCLEAR EXPERIMENTAL REACTOR
(ITER)**

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THERMONUCLEAR
EXPERIMENTAL REACTOR
(ITER)**

**ESTABLISHMENT OF ITER:
RELEVANT DOCUMENTS**

**INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 1988**

**INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR (ITER)
IAEA, VIENNA, 1988**

Printed by the IAEA in Austria
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FOREWORD

At the Geneva Summit Meeting in November 1985 a proposal was made by the Soviet Union to build a next generation tokamak experiment on a collaborative basis involving the world's four major fusion blocks.

In October 1986 the United States, in consultation with Japan and the European Community, responded with a proposal on how to implement such an activity. The ensuing discussions between diplomatic and technical representatives of the four prospective participants resulted in the establishment, under the auspices of the IAEA, of the International Thermonuclear Experimental Reactor (ITER) Conceptual Design Activity.

The documents assembled in this book represent a concise record of the decisions and actions taken in establishing ITER.

The Agency takes pleasure in making this book available to interested parties and hopes that it will serve as a useful reference to ITER.

Manfred Leiser

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**RECORD OF THE MEETING OF THE INTERNATIONAL
THERMONUCLEAR EXPERIMENTAL REACTOR (ITER)
QUADRIPARTITE INITIATIVE COMMITTEE (QIC)
IAEA, Vienna, 15-16 March 1987**

At the invitation of IAEA Director General Blix, delegations from the European Communities, Japan, the Union of Soviet Socialist Republics and the United States of America met in Vienna. The four Parties met to discuss the issues regarding enhanced international collaboration in fusion for peaceful purposes to the benefit of all mankind. (The List of Attendees is contained in Attachment 1; the specific US proposal for enhanced international collaboration in fusion, dated 30 October 1986, is contained in Attachment 2.)

DG Blix welcomed the four Delegations. The four Parties agreed to rotate the Chair in alphabetical order, i.e. EC, Japan, USSR and US.

Each of the four Delegations then made statements on policy goals, present status, and future plans of their fusion programs and the role of international collaboration in achieving their objectives. The statements of each of the Delegations is contained in Attachment 3.

The four Parties acknowledged that a common medium-term goal for each major fusion program is the design, construction, and operation of an engineering (experimental) test reactor (ETR) which should fully confirm the scientific feasibility of fusion and confront the problem of technological feasibility of fusion. (In the light of the international nature of the proposed design activity, the four Parties agreed to use the name ITER for international thermonuclear experimental reactor instead of ETR.) The Parties also acknowledged that international collaboration on ITER could be particularly fruitful in view of the wide database needed, the challenging requirements and the high costs involved, and that a collaborative effort on such a project should proceed step by step.

In this spirit, the Participants agreed to consider the proposal that the four Parties conducting the large fusion programs of the world coordinate their efforts aiming at a specific goal: producing by 1990, through a collaborative effort of four Parties having equal status and making equal contributions, a conceptual design of an ITER, and coordinating research and carrying out other activities supportive of this design effort. In parallel with the conceptual design activity, exploratory studies concerning implementation should also be considered.

The preliminary reactions of the four potential Parties, expressed during the present exploratory meeting, are generally positive. It has been realized that the detailed objectives of the ITER design as well as a plan for the organization of the conceptual design activity under the auspices of the IAEA will have to be developed at working level with a view to a subsequent in-depth examination and possible formal endorsement by the four Parties.

For this purpose, a working group of four representatives (one per Party) accompanied by appropriate experts should be appointed by the four Delegations in the coming weeks. It should submit its proposal to the four Parties in October 1987. The purpose of the next, mid-October meeting of the QIC is to determine whether the definition of the proposed three-year effort is sufficiently complete and technically feasible and, if so, to recommend approval of the proposed conceptual design effort to the respective authorities of the Parties. The Japanese representative agreed to initiate the Technical Working Group activities. The guidelines for the Working Group are contained in the Annex.

LIST OF ATTENDEES

**15-16 March 1987
IAEA Headquarters, Vienna
Meeting Room C-V**

**PARTICIPATING AND
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**PARTICIPATING AND
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A US PROPOSAL FOR ENHANCED INTERNATIONAL COLLABORATION IN FUSION

Background

President Reagan and General Secretary Gorbachev agreed in Geneva to advocate "the widest practicable development of international cooperation" in obtaining the beneficial use of magnetic fusion energy. Since the Geneva Summit, the United States has considered this matter and has consulted with its Western Allies and with the Soviet Union on the best means to implement this agreement. On the basis of these consultations, the US has formulated a proposal for intensification of international fusion collaboration.

Shortly after the Geneva Summit, the Economic Summit Members' Fusion Working Group met, and on the basis of current progress in fusion research, developed a consensus on the common mid-term goal for all their fusion programs. This goal is to complete the scientific base for fusion and to establish its technical feasibility. To this end an Experimental Test Reactor (ETR) is considered to be an important next step. Discussions at the IAEA's International Fusion Research Council and at a US/USSR bilateral meeting in Geneva affirmed that this consensus is shared by the Soviet Union.

In the past, the world's fusion programs have devoted considerable efforts to develop the technical base for this essential step. For the past seven years, an international effort to define an ETR like device, called INTOR, has been conducted under IAEA auspices. INTOR is an acronym for International Tokamak Reactor. This joint effort has defined both a candidate ETR and the necessary supporting research required to resolve critical design issues. This activity has produced an increased level of understanding and an excellent base for further development of fusion cooperation.

Motivation

However, even with substantial agreement on the nature of the ETR based on the detailed technical results of the INTOR activity, there still is not sufficient agreement on a common set of characteristics or on a single technical design. In fact, there are four candidates for major next stage experimental devices being developed by the EC, Japan, the US and USSR in parallel with the INTOR effort. Nonetheless, it is clear that the level of agreement on the nature of the goal, its exacting technical requirements, and the high cost of such an experimental facility are ample justifications for an increased effort toward developing a single design acceptable to all potential participants. In order to increase the chances of successful international collaboration on this device which is necessary for progress in all of the world's fusion programs, the US has formulated the following proposal.

The United States proposes that the European Communities, Japan, the USSR, and the US join together to produce one technically acceptable design for the essential next step in the world fusion program through the effective unification of our design efforts and supporting research. This design effort would be coordinated through mechanisms already established in the IAEA for the INTOR activity.

The United States is prepared to participate in an effort to define a set of technical characteristics and to prepare a single conceptual design report for an Experimental Test Reactor that are acceptable to all participants. Consistent with the joint statement on fusion at Geneva, the US is prepared to commit sufficient resources through its national program to support achievement of this goal within three years.

This proposed effort should provide a level of detail sufficient to prepare any nation, or group of nations, for subsequent decisions on whether or not to construct such a device. This work will also provide an essential ingredient for any subsequent decision on siting and the desirability of international collaboration in construction. This approach will result in a design for a device that is then available for all participants to use either in their own national program or as part of a larger international collaborative program.

Furthermore, the United States proposes that research supportive of this design effort be coordinated and carried out under existing bilateral and multilateral arrangements among the participants. The United States believes that all participants need to coordinate their research activities to the greatest practical degree. This will ensure the most effective technical support to this challenging design activity which is basic to achieving an inexhaustible source of energy for all mankind.

STATEMENT BY THE EC DELEGATION

1. The European Community Fusion Programme is a long-term cooperative project embracing all the work carried out in the field of magnetic thermonuclear fusion in the Member States and in Sweden and Switzerland. This fully integrated programme has placed Europe in the forefront of research in this field. Beside the JET Joint Undertaking, several medium-size specialized devices — mostly tokamaks, but also other alternative configurations — are in exploitation or in construction. From the early 1980s a comprehensive fusion technology programme has been started and implemented. The European Fusion Programme has thus built a true scientific and technical community directed towards the common goal defined by the Council of Ministers of the European Communities: the joint construction of prototype reactors. Within its strategy (JET and the other tokamaks — Next European Torus (NET) — DEMONstration Reactor), its main near-term objective is to establish the physics and technology basis for NET which is the European approach to an Engineering Test Reactor (ETR).

2. NET is conceived as a large Tokamak assembly which should fully confirm the scientific feasibility of fusion in a first phase, and confront the problem of technological feasibility in a second phase. Thus NET should aim at controlled ignition and extended burn of the deuterium-tritium fuel, demonstrate the reliability and maintainability of the system as well as its safe operation and low impact on the environment. Finally, NET should have the capability to qualify design concepts, to test materials, and to test tritium and energy extraction systems for DEMO. For this purpose, a staged and flexible operation scenario was developed.

Following the NET Design Agreement, the NET Team has been formally established in 1983; it is located at Garching and has the scope of defining the objectives, main design features options and planning of NET, and of identifying R and D, mainly in the area of technology, needed for the design of NET. This phase has been completed by the end of 1985 in sufficient detail to proceed to the predesign phase; the technology R and D programme has been launched in most areas of interest to NET. It is envisaged that before the end of the five-year European Fusion Programme 1987-91, a proposal will be made to embark on the detailed engineering design of NET provided that a sufficient data base has been established.

3. Since an ETR is a common medium-term goal for all major fusion programmes, the European Community considers more than ever that international collaboration on the Next Step could be particularly fruitful in view of the wide data base needed, the challenging technical requirements and the high costs involved. The EC hopes that its well developed NET activity, which will continue as planned until a possible international solution offering convincing guarantees is found for the Next Step, could form a focal point for such a collaboration.

4. The European Community enters therefore the present exploratory discussions with a positive attitude, understanding that the proposed collaborative action:

- would be performed by four partners (Euratom, Japan, United States and Soviet Union¹) having equal status and making comparable contributions;
- would relate to ETR design activities;
- would result in a final report in 1990.

The European Community is confident that substantial progress could already be made during the present meeting, yet it considers that further quadripartite discussions will be necessary in 1987 to establish the detailed objectives of a possible collaboration and the means for its implementation.

Attachment 3 (2)

STATEMENT BY THE JAPANESE DELEGATION

On behalf of the Japanese delegation, I would like to comment on the quadripartite meeting.

First of all, my delegation would like to pay tribute to the USA and the USSR for taking the initiative to strengthen cooperation in nuclear fusion programmes during the summit meeting held in Geneva two years ago. The leaders of these two countries underlined the potential contribution of nuclear fusion to solving future energy shortages.

I am aware that all the parties here have carried out their own nuclear fusion programmes but that many problems remain to be solved before nuclear fusion becomes a viable new energy source. In view of this fact, I believe meetings such as this where leading fusion research and development (R&D) parties are brought together are very valuable for future activities in fusion R&D.

Japan is ready to actively participate in and contribute to this meeting. I would therefore like to stress the importance of observing the basic principles of successful international cooperation, namely, respect for different approaches by other parties and equal treatment of all parties.

I would now like to touch briefly on our preliminary views toward the proposed International Fusion Cooperation Programme. We should bear in mind that the IAEA's INTOR Workshop is a good example of international cooperation in this field. Japan suggests that the IAEA's expertise and experience be fully utilized in order to implement this proposal when it is agreed upon. There are two possible

¹ Other interested countries with specific fusion capabilities would be invited to make arrangements with individual parties.

approaches: one is to define the long-term goals on the basis of this group's discussion and then to implement them; the other — a practical, realistic approach as implemented in the INTOR Workshop — is to begin cooperation activities in the individual sub-programmes which are agreed upon.

Questions regarding the framework of the programme and the modality of cooperation should be clearly defined through consultation among parties prior to the programme's initiation. It is also important that each party contribute to the programme according to its individual capacity to do so.

I would like to express my country's expectation that a frank discussion at this meeting will lead to the initial goal of a programme proposal.

I would also like to express my appreciation to the Agency for supporting this meeting.

Nuclear fusion research and development in our country has been carried out steadily for the past several years, in order to put it into practical use. Aiming at proving the scientific feasibility of nuclear fusion, JT-60 has been constructed and it is very likely that a breakeven plasma condition will be attained by it within a year or so. Along with this R&D, international collaboration, including that such as the INTOR Workshop within the framework of the IAEA, the host of this meeting, has been actively pursued.

Based upon this experience, we carried out an intensive discussion on the R&D program required for the next step, in other words, a post-JT-60 program. The Nuclear Fusion Council, after a one-and-a-half year discussion, submitted its report on the next-step program to the Atomic Energy Commission last October. In particular, the report recommended that in order to study long-burn ignited plasmas and test various fusion technologies, the next-step device should be domestically constructed, hopefully with additional international contributions, and its basic design started from around 1988.

We will thus proceed to our own program for an ETR in due time, though we have been watching with great interest the Geneva Summit initiative on ETR cooperation and its follow-up discussion.

Against this background, we have been discussing both domestically and internationally a proposal made by the US last October, and consider it timely and worthwhile to exchange views on the matter among the four potential participants.

Our position on ETR cooperation proposed by the US is as follows:

Within the framework of the IAEA, the joint work should be defined for the ETR conceptual design without committing parties to subsequent joint construction, and should be completed by around 1990.

A conceptual design for the ETR, which we consider should produce long-burn ignited plasma and test various fusion technology systems, should be jointly elaborated by the EC, Japan, the US and the USSR. The objectives of the ETR

should be high and capable of achievement only through international cooperation.

The above four groups should make equal contributions to the joint project. Each group should bear its own costs and there should be no cross-flow of cash among the groups or to the IAEA.

In order to start early next year, preliminary discussion on such items as design objectives, organization, required level and/or funds of cooperation, and relevant supporting R&D should be started soon so as to clarify an outline of the joint work.

After the preliminary discussion on the outline of cooperation, the Terms of Reference for this activity should be agreed to among the four groups, and then the joint design project should begin.

Administrative procedures for the commencement of ETR cooperation should be as simple as those for regular activities organized by the IAEA.

Attachment 3 (3)

STATEMENT BY THE DELEGATION OF THE USSR

Research on nuclear fusion began in the USSR in 1950 and is being pursued on a broad front, following many different lines of enquiry; tokamaks, stellarators, open magnetic systems and also various systems based on inertial plasma confinement are being studied.

In the opinion of most scientists and engineers, the most advanced system at present — the one which has taken us furthest towards the construction of a true fusion power reactor — is the tokamak, which was proposed and developed by Soviet specialists more than 30 years ago. It is accordingly natural that the principal human and financial resources available for the fusion programme in the Soviet Union should be directed towards the development, construction and investigation of tokamaks, with the full range of plasma parameters now close to the values required for a reactor.

The Soviet Union is completing construction on a large tokamak called the T-15, one specific characteristic of which is a superconducting magnetic solenoid to produce the toroidal field. The T-15, with its powerful plasma heating systems, will make it possible not only to study the physics of a plasma with reactor parameters but also to develop the technology required for manufacturing and operating a prototype superconducting system for a fusion reactor.

Apart from the "classical" tokamak system represented by the T-15, the Soviet Union is also giving a good deal of attention to the method of adiabatic

compression and plasma heating. The purpose of the TSP — a tokamak with a high magnetic field (approximately 13 Tesla) — is to produce for short intervals of time enough fusion energy to allow measurements of the vital plasma parameters to be made, with the device operating on a deuterium-tritium mixture. This machine is being built at the Kurchatov Institute of Atomic Energy and the first experimental results are supposed to be available in 1988. Given their success in studying the physics of high temperature plasma and their confidence that a physical demonstration of thermonuclear plasma ignition will be accomplished in the next few years, Soviet scientists now feel able to go ahead and lay the foundations of fusion power.

As a next step towards solving the problems of fusion, the Soviet Union has launched a Thermonuclear Test Reactor (OTR) project. The OTR has a number of objectives: to provide experience with a long-burning fusion plasma and to develop assemblies and systems for a fusion power reactor — in particular the tritium production, purification and extraction system; but we also intend to introduce system modules with a uranium blanket in order to study the production of plutonium which can then be used in fission power reactors. A broad range of scientific and engineering experiments are to be carried out on the OTR, experiments which are essential for the next stage: the development and construction of a fusion power reactor, which in the West has acquired the name of DEMO.

The aims and the stages of the Soviet fusion programme have much in common with the programmes of other participants at this meeting. The Soviet delegation was very happy to accept the proposal of the Agency's Director General, Hans Blix, that we should meet here in Vienna to discuss concrete measures for co-operation in an international fusion reactor project. The idea of developing a fusion reactor through the united efforts of many countries crystallized through an initiative of the General Secretary of our Party, M. S. Gorbachev, in the course of his meetings with the President of France, Mitterand, and the President of the USA, Reagan, at which the Soviet side stated its willingness to co-operate in every possible way to bring about practical international collaboration in the harnessing of fusion energy. Mr. Gorbachev's initiative posed the problem of developing specific paths for an important, large-scale international co-operation project in science, the successful completion of which would place at mankind's disposal a virtually inexhaustible source of energy, thereby solving one of the most severe contemporary problems of the world — the energy problem.

The Soviet Union is convinced that the policy of confrontation and of stock-piling nuclear weapons should be replaced, in the name of human survival, by a policy of broad, mutually advantageous co-operation in the peaceful utilization of nuclear energy, with equal rights for all.

The Soviet Government and Soviet scientists consistently favour broad international co-operation in this branch of science. The work done by our scientists on the INTOR project has demonstrated that it is realistic and useful to combine efforts. For a variety of reasons the INTOR project has been unable to move on to the stage of

engineering design and construction as planned at the outset. To take this step we would have required a political decision which not all participants were prepared to take. Herein lies precisely the point of the present Soviet initiative. In pursuit of that initiative, there took place last year, at the suggestion of the USSR, bilateral meetings of the Soviet delegation with the United States delegation and the French delegation to discuss specific steps towards the development of an international fusion reactor (IFR).

The vital questions which we proposed to discuss at these bilateral meetings, and on which we hoped to achieve an agreed approach, were:

- The aims of the project (collaboration);
- The organizational arrangements for carrying it out;
- The scope of participation in the project;
- Financing;
- The location of the reactor; and
- Further practical steps towards realization of the project.

Somewhat later we shall outline our position on these questions.

The bilateral meetings, as we know, led to wide-ranging discussions of our ideas among the possible participants in the project. Various proposals were put forward on the substance of the project, on ways of carrying it out, and on the stages of implementation.

We naturally proposed a discussion of further steps at the meeting of representatives of the USSR, France and the United States — the first countries with which we launched a discussion of the project. It was never our intention to suggest that only three countries, or that necessarily these three countries, should be project participants at the organizational stage. We regarded this trio of countries as an initiating group. The IFR project was also discussed when the Foreign Minister of the USSR visited Japan.

However, other ideas have been put forward as to how work on the project might begin. As we understand it, a majority of the potential participants in the project are in agreement that the most fruitful approach would be a quadripartite meeting of today's composition, where the countries of Western Europe would be represented by the delegation of the European Community.

The Soviet Union, as the initiator of the idea of this project, has expressed its willingness to discuss the aims, organizational arrangements and other aspects of the IFR project in such a group and to begin work on its practical realization.

Allow me now to outline our approach to a whole complex of problems associated with the implementation of the project as a whole, and then to discuss how we feel about the plan for the first stage of the project which has been proposed by the delegation of the United States of America.

Our feelings about the purposes, problems and practical aspects of the project as a whole - in the light of the bilateral consultations with the USA and France — can be summed up as follows:

1. **Purpose of project.** The Soviet Union suggests that the purpose of the project should be the development and construction of an IFR in the form of a tokamak, to test the main technical solutions, elements and systems of future fusion power stations. The IFR we regard as the next step — following large tokamak facilities such as TFTR, JET, JT-60 and T-15 designed for physical experiments — on the road to a demonstration power reactor (DEMO) without any intermediate stage. This defines the role of the IFR in the worldwide fusion programme as a facility where the main principles of the DEMO reactor are to be tested:

- The achievement of reactor plasma-physics parameters;
- Operational testing of reactor systems as a whole;
- Testing of remote maintenance systems;
- Trials on the main assemblies;
- Demonstration of electric power generation and tritium production; and
- Demonstration of a safe reactor operating regime.

2. **Organizational arrangements.**

Stage I — Creation of a Co-ordinating Committee and beginning of work on:

- Conceptual design;
- Development of a structure and of a statute for the international centre to construct and operate the reactor; and
- Work on administrative, financial and legal questions.

Stage II — Following the establishment of a technical project and a cost assessment for the construction of the reactor:

- Establishment of the international centre;
- Engineering design of the IFR (three to four years);
- Issue of purchase orders, manufacture of equipment and construction of the reactor; and
- Startup and engineering trials on the reactor.

Stage III — Operation of the reactor and carrying out of programmed experiments (approximately ten years).

At this stage the circle of project participants would probably be enlarged to include all who wish to contribute, or can contribute, to the performance of the experiments (through the provision of equipment or specialists).

3. **Financing.** The Soviet Union is prepared to consider the principle of equally shared unit financing. In doing so, we assume that the capital costs and part of the operational costs will be covered by the participation of the partners in developing, manufacturing and supplying equipment, systems, materials and electric power; and the administrative and operational costs by participants' contributions in the relevant currency.
4. **Participants.** During Stage I and Stage II the main criterion for participation will be adequate experience of fusion research, experience in the development and operation of large fusion devices, and the ability to contribute to the financing of the project. At the outset we feel it would be reasonable to include the USSR, the USA, France, the EEC and a number of other countries in the project.
5. **Project location.** We have proposals to make on this subject which we believe would allow for the interests of all participants; however, it would probably be premature to discuss these now.

Our present deliberations have great significance — a significance which probably goes beyond the purely scientific and technical sphere of co-operation. On the political plane, international collaboration in the peaceful development of fusion power can help to provide a sound basis not only for further scientific and technological progress, but also for sustaining and developing a climate of confidence and more stable relations among States.

The specific forms of co-operation and interaction evolved in the course of our project to deal with the various problems that arise could well serve as an important precedent for other kinds of scientific co-operation between our countries, and between East and West as a whole.

We look optimistically towards the future of our collaboration in creating an operational fusion reactor. The specialists believe, in the Soviet Union as elsewhere, that such a reactor could be built by our combined efforts in a comparatively short period of time — at all events before the year 2000. The scientific foundations for the project are really already in existence thanks to the work of scientists and engineers in the Soviet Union, the United States, Western Europe and Japan pursuant to the ideas proposed some time ago by Soviet science. The success of the scheme now depends on our mutual willingness to go ahead with effective collaboration inspired by a single purpose, and also on our ability to organize a joint project.

In proposing international co-operation for the speedy creation of an IFR, we are also following the dictates of reason. The complexity of the technology and the high costs involved make it irrational to pursue the project on a basis of rivalry; what we need, rather, is the united efforts of various countries and a rational sharing of risks and expenses with our partners.

We have carefully studied the American document which was prepared on the basis of considerations and suggestions put forward by all sides in the course of our preliminary exchange of views and bilateral consultations. In this sense the document represents a product of our collective thoughts and efforts.

The Soviet Union reaffirms its proposal that an international fusion reactor should be built by the combined efforts of interested countries; it considers the development of a conceptual IFR project as an essential stage in that process, but only as a first phase on the way towards implementing the project as a whole. In our opinion, while developing the conceptual project, we should also, at the same time, look for agreed solutions to other major problems: the scope of participation, questions of finance and of the organizational structure and management of the reactor project, the site question, a statute for the international organization (centre) which is to handle the project, legal questions and so on.

The Soviet delegation is prepared to take part in a constructive discussion of all these questions and to attempt to find solutions.

Attachment 3 (4)

STATEMENT BY THE US DELEGATION

As I see it, there are four "events" that bring us together today for what I believe is a historic occasion in the annals of international scientific and technical cooperation.

One is that magnetic fusion research and development has been successful in bringing about the conditions where a technical step such as an ETR is not only possible, but is reasonable to plan for. This has not come about as easily as many of us might have hoped and the cost of such a step is a bit more than we might have expected 15 or 20 years ago.

The second event: The IAEA sponsored a sequence of conferences beginning with the 1958 Geneva Conference on the Peaceful Uses of Atomic Energy. Then the Salzburg Plasma Physics and Controlled Nuclear Fusion Research Conference and so on up to the Kyoto Conference meeting last year. These meetings got the scientists of our respective countries in the habit of exchanging ideas and working together to solve the difficult experimental and theoretical problems associated with the creation, confinement and heating of high temperature plasmas. INTOR is in my view a sub-element in this event.

Three: President Mitterand suggested at the Versailles Economic Summit that Science and Technology were essential to the economic health of the developed countries. As a result the Working Group on Technology Growth and Employment (TGE-WG) was established and fusion became the subject of one of its sub-groups. Prof. Fasella and I had the privilege of co-chairing these meetings beginning in

Washington in 1983 with the most recent in Japan in November chaired by Mr. Tanaka of STA. These meetings were important in that they involved some of the governments at a political and administrative level and not just scientists concerned with technical matters. This step was crucial in laying the groundwork for the next event.

Four: President Reagan and General Secretary Gorbachev in a joint communique from the 1985 Geneva Summit said that we should try to accelerate the development of fusion by enhanced international cooperation.

This last event set in motion a number of discussions, activities, and meetings within countries and between them. Some of these went smoothly and without controversy and others that were not so easy.

But we are not here to dwell on the past. Rather we are here to determine whether this ground work together with the recognition that the expense of a next step such as an ETR makes it feasible and possible to plan for the possibility that we might jointly build such a device thus saving time and money, and perhaps most important conserve the essential and scarcest commodity — talent.

In order to even contemplate such a step it is necessary to first have a plan. A plan consists of three elements — deliverable, time, and money — in this case, what we call a conceptual design report. This conceptual design will identify what it takes to do the job technically, how much it costs and how long it takes.

By preparing such a conceptual design report we would make it possible for our respective governments to determine whether or not it would be in their interests in collaborating on design construction and operation of an ETR. Without such a conceptual design it is not possible for the US to commit even in principle to the eventual construction of an ETR — so this is an essential first step.

Because it is essential, does not mean that it will be easy. A great deal of work that will involve the need for effective compromises, and great discipline will need to be done in order to produce a conceptual design report that will accomplish the purpose of possibly persuading our governments that this might be a worthwhile joint effort.

I am quite pleased that we are even meeting to discuss this subject and I hope that we can come to agreement on the matter of terms of reference and a way to proceed that will produce a conceptual design report in a few years.

Our effort here today and tomorrow build on the many accomplishments of the scientists and engineers of our respective countries, and we must keep in mind their needs as well as those of our governments. I look forward to productive discussions on this fascinating subject of science collaboration.

Finally I want to thank Director General Blix for playing such a key role in bringing about this meeting and to his staff for arranging it in such short notice.

**RECORD OF THE MEETING OF THE INTERNATIONAL
THERMONUCLEAR EXPERIMENTAL REACTOR (ITER)
QUADRIPARTITE INITIATIVE COMMITTEE (QIC)**

**IAEA, Vienna
18-19 October 1987**

At the invitation of IAEA Director General Blix, the ITER QIC Delegations from the European Community, Japan, the Union of Soviet Socialist Republics and the United States of America met for a second time under IAEA auspices in Vienna. This second negotiating meeting followed the first exploratory meeting on March 15 and 16, 1987. The four Parties met to consider making recommendations for actions enhancing international collaboration in fusion for peaceful purposes to the benefit of all mankind. (The List of Attendees is contained in Attachment 1.) DDG Zifferero welcomed the four Delegations on behalf of DG Blix. The four Parties agreed to a single Chair and asked P. Fasella (EC) to chair the meeting.

At the first meeting, the QIC had established a Technical Working Group for the purpose of developing proposals on the central technical and organizational matters for an ITER activity. The Chairman of the TWG, K. Tomabechi (Japan) presented the TWG Report. The QIC reviewed and accepted the Report with appreciation for the considerable work done. The QIC especially acknowledged the importance of the technical consensus developed and represented in the Annexes to the Report. The TWG Report, including its Attachments and Annexes, is Attachment 2. The QIC then reviewed the draft Terms of Reference and agreed upon a final version which is Attachment 3.

As part of the discussion on the Terms of Reference, the Japanese Delegation asked for a clarification of the legal status of the proposed ITER activity under IAEA auspices. DDG Zifferero reported that as a part of the Agency's 1988 budget process, an ITER activity had been fully considered and approved as an Agency project as defined in Article XI of the Agency Statute.

After careful consideration of the TWG Report, the QIC Delegations decided unanimously to recommend to their authorities participation in the ITER activity under the Terms of Reference contained in Attachment 3.

The QIC then considered as a whole the matters of technical site for joint work and chairmen of the various ITER bodies. The QIC unanimously recommended to the Parties that, in order to initiate the ITER activity as fast as possible, the following actions be taken:

During the Definition Phase:

- (a) The Chairmen of the IC, the IMC and the ISTAC be appointed for the duration of this Phase — J.F. Clarke for the IC, K. Tomabechi for the IMC and B.B. Kadomtsev for the ISTAC.

- (b) The meetings of the IC and ISTAC be normally held at the IAEA in Vienna.
- (c) The technical site for joint ITER work be IPP-Garching.

The decision on the chairmanships, location of the IC and ISTAC meetings and the technical site for the joint work during the Design Phase will be taken by the IC before the end of the Definition Phase.

Pending formal acceptance of ITER activities by the four Parties, technical workshops will be held among representatives of the Parties in order to prepare for the initiation of ITER activity in April 1988. Dr. Tomabechi is charged with the organization of this workshop.

As to the procedure for reaching formal agreement, the QIC decided to ask the DG to send a letter (Attachment 4) to each of the four Parties inviting them to participate in the ITER activity under the proposed Terms of Reference, the acceptance of which would formally initiate the activity.

The Delegations each expressed their satisfaction at the high degree of cooperation evidenced in the meeting which has resulted in the foregoing consensus position.

Signed by the Leaders of the Delegations of the four Parties.

European Community — P. Fasella

Japan — T. Kazuhara

Union of Soviet Socialist Republics — E. Velikhov

United States of America — J. Decker

Attachment 1

LIST OF ATTENDEES

| PARTICIPATING AND DESIGNATING MEMBER STATES AND ORGANIZATIONS | ADDRESSES |
|--|---|
| EEC | |
| P. Fasella <i>Head of Delegation</i> | Director General for Science, Research and Development Commission of the European Communities 200, Rue de la Loi B-1049 Brussels Belgium |
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**PARTICIPATING AND
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**PARTICIPATING AND
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REPORT OF THE ITER TECHNICAL WORKING GROUP Vienna, 9-11 September 1987

1. INTRODUCTION

The guidelines for the Technical Working Group, TWG, organized at the decision of the International Thermonuclear Experimental Reactor (ITER) Quadripartite Initiative Committee (QIC) were defined as follows:

“The TWG will develop proposals on each of the following points:

1. Detailed scientific and technical objectives and main overall characteristics of an ITER which shall include controlled ignition and extended burn of the deuterium-tritium fuel, demonstration of the integrated performance and the maintainability of the system as well as its safe operation and low impact on the environment. In addition, ITER should have the capability to qualify component design concepts, to perform appropriate materials tests, and to test tritium and energy extraction systems for the DEMO.
2. Guidelines for cooperation including organizational arrangements and a work plan for producing by 1990 one integrated conceptual design from the coordinated efforts of the Parties' design teams.
3. Scope of the validating R&D tasks supporting the ongoing conceptual design activity.

The IAEA will appoint a liaison officer to assure coordination with the Activity. The TWG will organize its work to be completed in time for review by the four Parties at their next meeting, possibly in mid-October 1987.”

The TWG had its meetings on 21-23 May, 9-11 July, and 9-11 September 1987 at the IAEA Headquarters in Vienna.

The members of the TWG nominated by the QIC parties were Dr. R. Toschi (EC), Dr. K. Tomabechi (Japan), Dr. T.K. Fowler (USA), and Dr. B.B. Kadomtsev (USSR). Dr. K. Tomabechi was appointed to serve as Chairman of the TWG. The participants were accompanied at the meeting by experts. The full list of the attendees of the ITER meetings is given in Attachment A.

The TWG carried out their assigned tasks resulting in the preparation of the Draft Terms of Reference (Attachment B).

Proposals of the Lawrence Livermore National Laboratory, USA, and the Max Planck Institute of Plasma Physics, Garching, FRG, on a technical site for the ITER Conceptual Design Activities were discussed by the TWG and recognized as satisfying the site requirements as described in Attachment C. The IAEA Secretariat expressed its readiness to consider to establish in Vienna a site for the ITER joint design work, if so desired by the Parties.

The recommendation of the TWG to the QIC regarding the procedure by which the ITER Conceptual Design Activities would be established is that the Director General (DG) of the IAEA will invite the Parties by letter to participate in the Activities in accordance with the Terms of Reference. The cognizant authorities for the Parties will then respond by letter to the DG's invitation indicating their acceptance of his invitation. A draft of an invitation letter was submitted by the IAEA Liaison Officer and is presented in Attachment D.

A proposal for possible services from the IAEA to the ITER Conceptual Design Activities has been submitted by the IAEA Liaison Officer (Annex IV of the Draft Terms of Reference).

The question of "exploratory studies concerning implementation" was not considered by the TWG as relevant to its assigned tasks.

LIST OF PARTICIPANTS

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Attachment B

DRAFT TERMS OF REFERENCE
(Not included)

Attachment C

REQUIREMENT FOR THE JOINT WORK SITE

It was suggested by the TWG that about ten persons per Party would need to meet for periods lasting several montas at a common site in order to define a single set of technical characteristics, and to produce a coherent and integrated conceptual design of ITER. The joint effort is to have available at one technical site at least the following facilities and services:

- Office accommodation for up to 40 people,
- Access to large computer facilities, Computer Aided Design with adequate software and terminals,
- Excellent communications access including international telephone, electronic mail, telex, telefax, and computer linkage for rapid information transfer to home teams,
- Supporting staff including secretaries, programmers, computer assistants, and CAD operators,
- A scientific and technical library in the field of plasma physics and fusion engineering in English,
- Access to adequate housing for the participants and their families,
- Transportation and convenient access to an international airport for staff and visitors.

To be consistent with the proposed ITER schedule, the site facility with all equipment must be ready for use by March 1988.

Attachment D

A DRAFT OF AN INVITATION LETTER

(Not included)

**TERMS OF REFERENCE CONCERNING
CONCEPTUAL DESIGN ACTIVITIES FOR AN
INTERNATIONAL THERMONUCLEAR EXPERIMENTAL
REACTOR**

Article 1: Parties to the Cooperation

The Cooperation will be conducted under the auspices of the International Atomic Energy Agency (IAEA) by four Parties having equal status and making equal contributions. The Parties will be the European Atomic Energy Community (EURATOM), including countries associated with the Euratom Fusion Programme, Japan, the Union of Soviet Socialist Republics (USSR) and the United States of America (USA), hereinafter referred to as "the Parties".

Article 2: Subject-matter of the Cooperation

The subject-matter of the Cooperation (hereinafter referred to as "the Conceptual Design Activities") will be:

Design activities

- (a) To define a set of technical characteristics of an **International Thermonuclear Experimental Reactor (ITER)** and subsequently to carry out the design work necessary to establish its conceptual design;
- (b) to define future research and development needs and to draw up cost, manpower and schedule estimates for the realization of such a device;
- (c) to define the site requirements for ITER and to perform a safety and environmental analysis;

R&D activities

- (d) to carry out in a coordinated manner specific validating research and development work supportive of the design activities

with the objective of providing a design that is then available for all Parties to use either in their own national programme or as part of a larger international collaborative programme.

Article 3: Schedule and reporting

3.1. The Conceptual Design Activities will be conducted in two phases:

- a definition phase
- a design phase.

- 3.2. During the definition phase an ITER concept with a single set of technical characteristics will be defined in accordance with the Guidelines outlined in Article 4. This work will be documented by the Definition Phase Report which, after approval by the ITER Council, will be available to the Parties in November 1988.
- 3.3. As part of the definition phase, a preliminary programme of work for the design and R&D activities will be developed in accordance with the provisions of Articles 6 and 7. This programme, after approval by the ITER Council (Article 5), will be available to the Parties by mid-1988. Implementation of the R&D activities by the Parties will commence as soon as the programme has been approved by the ITER Council.
- 3.4. The design phase will commence as soon as the Definition Phase Report has been approved. The result of the design phase will be a Final Report containing the conceptual design of ITER and describing all the work carried out for the implementation of the Conceptual Design Activities. It will cover and document all areas defined in Article 2.
- 3.5. The Conceptual Design Activities will be completed by December 31, 1990.

Article 4: Guidelines for the conceptual design of ITER

The overall objective of ITER is to demonstrate the scientific and technological feasibility of fusion power. ITER would accomplish this objective by demonstrating controlled ignition and extended burn of deuterium-tritium plasmas, with steady state as an ultimate goal, by demonstrating technologies essential to a reactor in an integrated system, and by performing integrated testing of the high-heat-flux and nuclear components required to utilize fusion power for practical purposes.

More detailed objectives and main characteristics of ITER are given in Annex I.

Article 5: Organizational structure

The Conceptual Design Activities will be directed and managed by:

- the ITER Council (IC),
- the ITER Management Committee (IMC).

The IC will be advised by:

- the ITER Scientific and Technical Advisory Committee (ISTAC).

5.1. ITER Council

5.1.1. Composition and procedure

Each party will nominate two members to the ITER Council. The members may be accompanied by experts.

The IC will:

- act by unanimity;
- meet at least twice a year; extraordinary meetings will be convened either at the request of one Party or at the request of the ITER Management Committee; the meetings will normally take place in Vienna; the members of the IMC will normally attend the meetings;
- elect its Chairman from among its members;
- adopt its rules of procedure.

5.1.2. Functions

The IC will have the responsibility for the overall direction of the Conceptual Design Activities and will exercise overall supervision of their execution.

In particular, the IC will:

- (a) approve the programme of work to be executed for the implementation of the Conceptual Design Activities, and make suggestions on how the Parties may explore ways and means to comply with the objective of the cooperation set out in Article 2;
- (b) approve the Definition Phase Report, other intermediate reports and the Final Report;
- (c) ensure equal contributions of the Parties to the execution of the Conceptual Design Activities;
- (d) inform regularly the Parties and the Director General of the IAEA on the progress of the Conceptual Design Activities.

5.2. ITER Management Committee

5.2.1. Composition and procedure

Each party will nominate one member to the ITER Management Committee. Each member will be responsible for the contribution to the Conceptual Design Activities by the nominating Party.

The IMC will:

- act by unanimity;
- meet as frequently as is necessary to exercise its functions and at places to be agreed upon by its members;
- elect its Chairman from among its members;
- adopt its rules of procedure subject to the approval of the IC.

5.2.2. Functions

The IMC will be responsible for the execution of the Conceptual Design Activities within the overall directions established by the IC. It will manage and coordinate the work so as to achieve a coherent and workable conceptual design of the ITER device. The IMC will report to the IC.

In particular, the IMC will:

- (a) develop, regularly update and submit to the IC for approval a programme of work for the design and R&D activities, taking into account the schedule outlined in Article 3;
- (b) assign tasks within the programme of work to provide for equivalence of contribution by each Party;
- (c) draw up and submit to the IC for approval the Definition Phase Report and the Final Report as specified in Articles 3.2. and 3.4., and such other intermediate reports as may be requested by the IC;
- (d) evaluate the efforts of the Parties on the basis of performance on the assigned tasks and report thereon to the IC;
- (e) provide the IC and the ITER Scientific and Technical Advisory Committee with the information necessary to perform their functions.

5.3. *ITER Scientific and Technical Advisory Committee (ISTAC)*

5.3.1. Composition and procedure

The ISTAC will be composed of 12 members (3 members per Party) nominated ad personam by the ITER Council. They will be chosen so as to ensure that all areas of expertise required for the execution of the Conceptual Design Activities are represented at the ISTAC.

The ISTAC will:

- elect its Chairman from among its members;
- meet at the request of the ITER Council; members of the IMC will normally attend the meetings;
- adopt its own rules of procedure subject to the approval of the ITER Council.

5.3.2. Functions

The Scientific and Technical Advisory Committee will, upon request of the ITER Council, advise on scientific and technical matters.

Article 6: Design activities

The design activities, coordinated by the IMC, are expected to require:

- joint work (about 40 professionals) at one technical site for periods of several months;
- design work conducted at each Party's home site;
- workshops on specific technical issues held at places to be agreed upon.

Each Party will make equal contributions to both joint and domestic design work anticipated to be equivalent to 80–100 man years over the course of the design activities as defined in Article 2.

The detailed organization of the design activities will be set out in the programme of work to be developed by the IMC in accordance with Article 5.2.2 a).

An outline of the design activities is given in Annex II.

Article 7: R&D activities

The R&D activities will focus on the feasibility issues critical to a conceptual design that meets the ITER objectives. The R&D tasks will include the physics and the engineering technology required for the realization of ignition, and also the development of a physics data-base, the auxiliary current drive technology and the nuclear technology required for the realization of steady-state operating and testing.

The R&D activities will be performed in the laboratories of the Parties and by using existing bilateral and multilateral arrangements, should joint work be necessary.

Each Party will make equal contribution to the R&D activities anticipated to be equivalent to approximately \$10 M per year.

The R&D activities and the detailed organization of their coordination will be specified in the programme of work to be developed by the IMC in accordance with Article 5.2.2. a).

An outline of the R&D activities is given in Annex III.

Article 8: Funding

Each Party will bear the costs related to its contribution to the Conceptual Design Activities.

Article 9: Participation of other countries

After consultation with the other Parties, each Party may involve in its contribution to the Conceptual Design Activities other countries which possess specific fusion capabilities.

Article 10: IAEA support

The services to be provided by the IAEA for the Conceptual Design Activities are outlined in Annex IV.

Article 11: Annexes

The Annexes I, II, III, and IV are integral parts of the Terms of Reference. Technical details are provided in Annexes I, II and III as a firm starting point for the design process.

Annex I

ITER OBJECTIVES AND MAIN CHARACTERISTICS

I. PROGRAMMATIC OBJECTIVES

The overall objective of the ITER is to demonstrate the scientific and technological feasibility of fusion power. The ITER will accomplish this by demonstrating controlled ignition and extended burn of a deuterium and tritium plasma with steady state as an ultimate objective by demonstrating technologies essential to a reactor in an integrated system, and by performing integrated testing of the high-heat-flux and nuclear components required to utilize fusion power for practical purposes. The ITER, in accomplishing these objectives, will provide the data base in physics and technology necessary for the design and construction of a demonstration fusion power plant.

The basic ITER device should be based on the scientific and technological database that is expected to be available to support a decision, at the end of the present conceptual design phase (1990), to proceed to engineering design and construction (target date for start of construction, 1993). However, to the extent possible, the design should be sufficiently flexible to provide access for the introduction of

advanced features and new capabilities, and to allow for optimizing plasma performance during operation. The ITER concept will benefit from international cooperation by combining the technical expertise that exists in the participating countries, and by allowing the introduction into the design of advanced features and new technologies that are developed in the national programmes of any of the participants. The ITER should be designed to meet its objectives with reasonable cost.

1.1. Plasma Physics Objectives

The ITER shall demonstrate controlled ignition and extended burn of deuterium-tritium plasmas, with steady state as an ultimate objective.

1.2. Engineering Objectives

The ITER shall validate design concepts and qualify engineering components for a fusion power reactor. In addition, the ITER should demonstrate the reliability of its engineering systems and the maintainability of the reactor. The operation of ITER must demonstrate the potential for safe and environmentally acceptable operation of a power-producing fusion reactor.

1.3. Testing Programme

The ITER should serve as a test facility for neutronics, blanket modules, tritium production, and advanced plasma technologies. An important objective will be the extraction of high-grade heat from reactor-relevant blanket modules appropriate for the generation of electricity.

2. TECHNICAL OBJECTIVES AND CHARACTERISTICS

2.1. Operation Plan

After a period of commissioning and plasma optimization using hydrogen and deuterium plasmas, ITER operation will be carried out in two phases: a physics phase devoted mainly to achieving the plasma physics objectives, and a technology phase devoted to engineering objectives and the testing programme.

Machine modifications, for example in regard to shield/blanket components and plasma-facing materials, may be needed between various phases of machine operation.

2.2. Mode of Plasma Operation

In the physics phase, the ITER plasma will first be operated in pulsed mode under conditions of controlled burn, in which any external power input needed for control of the plasma profiles and power balance is insignificant compared with the alpha-particle power. In this phase, the burn pulse will then be extended towards steady state, aiming at as high a Q-value as possible (Q is the ratio between the fusion power and the power injected to drive the burn). In the technology phase, because of the desirability of transient-free nuclear testing, the ITER should be operated in a steady-state mode, even if the efficiency of non-inductive current drive and limitations on the plasma beta-value will only allow a Q-value of about 5.

2.3. Confinement Capability

The ITER should be designed to have a confinement capability sufficient for reaching ignition. The considerable uncertainty still present with respect to plasma confinement of reactor-grade tokamak plasmas imposes a careful choice of the ITER confinement characteristics. One way of quantifying these characteristics is via the plasma current possible in the device. Present large-tokamak experiments, not intended to ignite, are capable of plasma currents in the 3–5 MA range, with plans to increase this to 7 MA in JET.

The various scalings which have been proposed for plasma confinement in next-step devices imply that, at the magnetic fields accessible in ITER, the current needed for ignition ranges from just under 10 MA to as much as 20 MA or more. While it is difficult to cover fully this range of projections, it is considered that the current-carrying capability of ITER for ignition experiments will have to be such that it covers most of the above range, implying a current that is about twice the maximum current obtainable in the present generation of large tokamaks. This current-carrying capability will have to be achieved with a safety factor q consistent with the available data base for stable operation at a plasma elongation of up to about 2.

In addition, the ITER design has to be compatible with the requirements of steady-state operation. Since the confinement required for a Q-value of about 5 is reduced relative to that required for ignition, the plasma current may be correspondingly lower in the steady-state mode of operation.

2.4. Pulse Length

The pulse length must be sufficient for the plasma to reach equilibrium burn, in which the energetic and thermalized alpha particles and impurities have all reached steady-state conditions. The pulse length should also be as large a fraction of the

global plasma skin time as possible, so that equilibrium plasma profiles are approached, implying a pulse length of at least a few hundred seconds.

The ITER must have the capability in the physics phase for purely inductive ramp-up and maintenance of the plasma current for the minimum pulse length required. Radio-frequency techniques will be employed, e.g. for partially non-inductive current ramp-up, to extend further the inductively-driven burn pulse.

The goal of steady-state operation will be met by fully non-inductive current maintenance, using neutral-beam or rf techniques, or a combination of the two. Non-inductive current drive should be implemented and tested in the physics phase as soon as possible.

2.5. Neutron Wall Loading

To carry out nuclear and high-heat-flux component testing at conditions relevant to a fusion power reactor, it is necessary for the average neutron wall loading to be about 1 MW/m^2 .

2.6. Neutron Fluence

The ITER should provide a useful lifetime neutron fluence of about 1 MWa/m^2 . However, the design should allow the possibility of a higher neutron fluence, in the range of 3 MWa/m^2 .

2.7. Breeding Capability

The prescribed neutron fluence of 1 MWa/m^2 for ITER corresponds to a total tritium consumption in the range 20–30 kg. During the technology phase, the ITER should have provision for a tritium breeding blanket that aims to achieve a breeding ratio as close to unity as possible without jeopardizing the reliability and availability of the device. For maximum reliability, the breeding blanket may be of non-reactor-relevant design.

The purpose of the breeding blanket is to avoid limitations on device availability due to dependence on external sources of tritium. However, since the achievement of a breeding ratio of unity cannot be assured, it will be necessary to investigate the possibility of an external supply of tritium of typically 1 kg per year. For the physics phase, during which only limited quantities of tritium will be needed, it is expected that external sources will be adequate.

2.8. Availability

In order to attain the prescribed neutron fluence of 1 MWa/m^2 in a reasonable operating lifetime, the overall availability of the ITER in the technology stage must

be at least 10%. During years of peak reliability, the ITER should reach availability levels as high as 25%. An important requirement of the ITER will be to operate at very high availability (continuous operation) for periods lasting one to two weeks.

Annex II

OUTLINE OF THE DESIGN ACTIVITIES

1. SCHEDULE

The project shall consist of a definition phase and a design phase. The definition phase will begin in March 1988 and will be completed by the end of September 1988. This work will be documented by the Definition Phase Report which, after approval by the ITER Council, will be available to the Parties in November 1988. The design phase will commence as soon as the Definition Phase Report has been approved and shall be completed by December 31, 1990. Details of the scheduling are the responsibility of the ITER Management Committee.

2. MAJOR TASKS OF DESIGN ACTIVITIES

2.1. Definition Phase

The purpose of the definition phase shall be:

- to establish the plasma design concept and determine major design constraints
- to select major design features including impurity control methods, heating and current drive methods, magnetic field coil technology, breeding blanket types, materials, and reactor maintenance approach
- to determine plasma major parameters, TF coil shape, PF coil locations and currents, and plasma operation scenario
- to develop a preliminary reactor configuration
- to identify R&D items necessary for ITER conceptual design and to propose them to the ITER Council
- to document the conclusions in a report.

2.2. Design Phase

The objectives of the design phase shall be:

- to develop an ITER machine conceptual design, including auxiliary systems
- to perform a safety and environmental analysis

- to develop site requirements
- to define future research and development needs
- to estimate cost, manpower and schedule for construction and operation
- to document the results in a final report.

3. MODE OF ACTIVITY

The ITER design shall be carried out as a single integrated project. This will require a sharing of tasks among the participants and transfer of information between the Parties as well as continuous integration of the effort. In recognition of the intensive integration effort needed to conduct a single design, joint work (approximately 40 professionals or about 10 per Party) will be necessary for periods of up to several months. Many workshops of shorter duration will be required.

Annex III

OUTLINE OF R&D ACTIVITIES

The R&D effort specific to ITER should focus on the feasibility issues critical to a conceptual design that meets the ITER objectives.

Such R&D will need to be identified promptly and conducted expeditiously in order to provide the results in time for the design work.

Feasibility issues will include the physics performance and machine engineering features required for the achievement of ignition, and also the non-inductive current-drive and long-pulse nuclear technologies required for steady-state operation and testing.

1. R&D PLAN

The R&D plan should include:

- a definition of the ITER specific R&D tasks,
- a division/sharing of the tasks between the Parties,
- a specification of R&D milestones, required results and schedule.

The responsibility for executing its portion of the plan rests with each Party or, in appropriate circumstances, combinations of Parties working through existing bilateral or multilateral agreements. In assigning tasks the IMC should take into account such agreements and also any operative governmental restrictions; responsibility for assuring that the plan is consistent with such agreements and restrictions rests with the ITER Council.

2. REPORTING OF INFORMATION

Written reports will be delivered to the IMC as evidence of the R&D efforts performance. The reports should contain information that is considered published and does not contain proprietary or restricted information. Acceptance of the reports by the IMC would satisfy the responsibilities of the Parties.

Regular workshops should be held to report progress and adjust tasks and plans in accordance with the needs of the design effort. These meetings will be scheduled by the IMC as necessary for close coordination and convenience of travel. Access to other R&D efforts beyond the ITER tasks would be on a voluntary basis.

Annex IV

IAEA SUPPORT

The ITER Conceptual Design Activities will be conducted under the auspices of the International Atomic Energy Agency.

The individuals nominated by the Parties to the ITER Council and the ITER Management Committee will be accredited by the Director General of the IAEA.

The IAEA will provide administrative support for the ITER Activity. This support will include:

- Providing meeting and office space for ITER Activities located in Vienna together with the required secretarial and other support services.
- Providing, if needed, facilities for maintaining in Vienna an office established by the Parties to carry out those functions they deem necessary for properly conducting the Activity.
- Providing assistance to the ITER Activities in arranging the following functions: organization of ITER meetings, editing and publishing of ITER technical reports, and maintaining a library of ITER documents.
- Providing assistance in ensuring rapid communications between individual teams of the Parties.
- Providing a forum for presentation of ITER results at the IAEA Conference on Plasma Physics and Controlled Nuclear Fusion Research.

The expenses incurred by the IAEA in supporting the ITER Activity will not exceed the budget allocated for INTOR. Expenditures required to support the ITER Activity above this amount will be borne by the Parties.

IAEA DIRECTOR GENERAL'S LETTER OF INVITATION TO PARTICIPATE IN ITER



INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
ORGANISMO INTERNACIONAL DE ENERGIA ATOMICA

WAGRAMERSTRASSE 5, P.O. BOX 100, A-1400 VIENNA, AUSTRIA
TELEX 1-12645, CABLE: INATOM VIENNA, FACSIMILE 43 222 230184, TELEPHONE: (222) 2360

IN REPLY PLEASE REFER TO
PRIERE DI RAPPRETER LA RIFERENZA

DIAL DIRECTLY TO EXTENSION
COMPOSER DIRICTEMENTE LE NUMERO DI POSTE

1987-11-02

Sir,

I have the honour to refer to the recent discussions on fusion held in Vienna and to their positive outcome.

The attractions offered by a fusion power source are many. Fusion energy relies on an essentially inexhaustible, uniformly distributed and comparatively cheap fuel source. It is, in addition, more benign from an environmental point of view, presenting fewer problems in this area than many other technologies. The ultimate achievement of a commercially viable fusion based power plant is therefore universally recognized as a benefit to all of mankind.

Since 1958 fusion research has enjoyed a level of international cooperation unusual in other scientific areas, and since its inception the International Atomic Energy Agency has maintained a fusion programme which has been instrumental in facilitating this collaborative work. I believe that the Agency can continue to play the useful role in international fusion research it has played in the past.

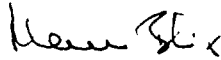
Because of these considerations the IAEA has taken a keen interest in the high level agreements reached in 1985 to expand international cooperation in fusion research, and has been glad to make available its services to the prospective partners in the organizational phase of the new and important international venture entitled the International Thermonuclear Experimental Reactor (ITER) Conceptual Design Study. We are further pleased to learn of the successful culmination of this work in that recommendations to embark on the ITER Activity, in conformity with the agreed Terms of Reference, will now be made to the appropriate authorities.

The Activity is to be conducted by four Parties: The European Atomic Energy Community (EURATOM), Japan, the Union of Soviet Socialist Republics, and the United States of America.

The IAEA will be ready to provide the services and discharge the functions outlined in the Terms of Reference, subject to the conditions defined in Annex IV of this document. In addition, the Agency will undertake necessary consultations with the European Community and the host country to define privileges and immunities that the Parties to the ITER project would enjoy at the site of the Conceptual Design Activities.

I now have the honour of inviting your Government to participate in the aforementioned Activity in conformance with the Terms of Reference (Enclosure 1) and the recommendations contained in the Record of the 2nd ITER Quadripartite Initiative Committee Meeting held in Vienna on 18 and 19 October 1987 (Enclosure 2).

Accept, Sir, the assurances of my highest consideration.



Hans Blix
Director General

Enclosures

LETTERS OF ACCEPTANCE TO PARTICIPATE IN ITER

DELEGATION OF THE COMMISSION OF THE EUROPEAN COMMUNITIES TO THE INTERNATIONAL ORGANIZATIONS IN VIENNA

The Head of the Delegation

Vienna, 26 February 1988
n° 3396 MG/cs

Dr. Hans Blix
Director General
International Atomic
Energy Agency
A 2822

Sir,

I have the honour to refer to your letter of November 2, 1987, addressed to the Head of the Delegation of the Commission of the European Communities to the International Organizations in Vienna, inviting the European Atomic Energy Community (Euratom) to participate, together with Japan, the Union of Soviet Socialist Republics, and the United States of America, in the International Thermonuclear Experimental Reactor (ITER) Conceptual Design Activities, in accordance with the Terms of Reference and the recommendations contained in the Record of the 2nd ITER Quadripartite Initiative Committee Meeting (Vienna, 18 and 19 October 1987), both of which are annexed to your letter.

I have the honour to inform you of the agreement by Euratom to participate in the aforementioned Activities on the terms and conditions specified in your letter together with its annexes.

Accept, Sir, the assurances of my highest consideration.


Michael Goppel

PERMANENT MISSION OF JAPAN
VIENNA

J.E. 3/88

8 February 1988

Dear Dr. Blix,

I am writing in response to your letter of November 2, 1987 inviting the Government of Japan to participate in the International Thermonuclear Experimental Reactor (ITER) Conceptual Design Study to be carried out under the auspices of the International Atomic Energy Agency.

The Government of Japan recognizes that the ITER Conceptual Design Study will promote fusion research activities in Japan and contribute to the research and development activities of the world in this field.

In this respect, the Government of Japan is pleased to accept your invitation to participate in the ITER Conceptual Design Study as described in the terms of reference and recommendations enclosed in your letter.

Japan's participation will be conducted in accordance with the laws and regulations in force in Japan and, particularly, will be subject to budgetary appropriations.

Sincerely yours,



Takatori Kazuhara

Resident Representative
of Japan to the IAEA

Dr. Hans Blix
Director General
International Atomic Energy Agency
Vienna VIC Rm.A-2822



UNITED STATES MISSION TO THE
UNITED NATIONS SYSTEM ORGANIZATIONS IN VIENNA

OBERSTEINERGASSE 11
A-1190 VIENNA, AUSTRIA
TELEPHONE 36 31 52

December 7, 1987

Dr. Hans Blix
Director General
IAEA
Room A2822
VIC

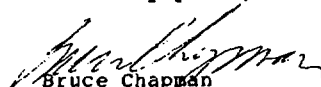
Dear Dr. Blix:

I am writing in response to your letter of November 2, 1987 inviting the United States to participate in the International Thermonuclear Experimental Reactor (ITER) activity. As you indicated in your letter, the achievements of potential fusion energy would clearly be of benefit to all of mankind. The pursuit of this goal has resulted in a remarkable degree of international cooperation over many years.

The United States would like to take this opportunity to acknowledge the unique and useful role played by the IAEA in facilitating this cooperative work. We are pleased that the IAEA has responded positively to facilitate the ITER design and validating R and D effort. The successful completion of the conceptual design report for ITER at the end of 1990 would be another significant step forward.

The United States Government is pleased to accept your invitation to participate in the quadripartite ITER activity as described in the terms of reference and recommendations enclosed with your letter. Our participation will, of course, be conducted in accordance with United States Law and will be subject to the availability of duly authorized and appropriated funds for this purpose. The United States intends to provide appropriate personnel and facilities to support successful conclusion of the common enterprise.

Sincerely yours,


Bruce Chapman
Ambassador



ПОСТОЯННОЕ
ПРЕДСТАВИТЕЛЬСТВО СССР
при
МЕЖДУНАРОДНЫХ ОРГАНИЗАЦИЯХ
В ВЕНЕ

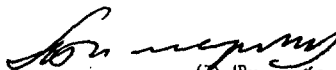
№ 129
"24" марта 1988 года

Уважаемый г-н Генеральный директор,

При этом направляю Вам письмо председателя Государственного комитета по использованию атомной энергии СССР А.И.Проценко, содержащее согласие Советского Союза на участие в проекте создания международного термоядерного экспериментального реактора (ИТЭР).

Примите, г-н Генеральный директор, уверения в моем высоком к Вам уважении.

Постоянный представитель СССР при
международных организациях в Вене


(Ф.Тимербаяев)

Г-НУ Х.БЛИКСУ
ГЕНЕРАЛЬНОМУ ДИРЕКТОРУ
МАГАТЭ
г. Вена

С С С Р
ГОСУДАРСТВЕННЫЙ КОМИТЕТ
ПО ИСПОЛЬЗОВАНИЮ АТОМНОЙ ЭНЕРГИИ

109180, Москва, Старомонетный пер., 26

Телекс: 411898 «Мелон»

88.03.14

№ ГО-В/152

Уважаемый господин генеральный директор,

идея создания термоядерного реактора объединенными усилиями многих стран выкристаллизовалась в результате инициативы Генерального секретаря ЦК КПСС М.С.Горбачева в ходе его встреч с президентами Франции и США, на которых, в частности, была высказана готовность всемерно содействовать практическому развитию международного сотрудничества в области мирного использования энергии термоядерного синтеза.

Эта инициатива поставила задачу выработать конкретные пути реализации важного, перспективного крупномасштабного проекта международного научно-технического сотрудничества, успешное осуществление которого позволит получить по существу неисчерпаемый источник энергии и тем самым решить одну из острейших глобальных проблем современности — энергетическую.

В Советском Союзе с вниманием и интересом было воспринято предложение Международного агентства по атомной энергии об участии в работах по проекту Международного термоядерного экспериментального реактора (ИТЭР), которое было изложено в Вашем письме от 2 ноября 1987 года.

Отмечая значительную роль МАГАТЭ в организации этой новой формы международного научно-технического сотрудничества в области практического овладения термоядерной энергией, считаем, что его результаты послужат всему человечеству. Успешное завершение в 1990 г. концептуального проекта термоядерного реактора явится еще одним важным шагом в этом направлении.

Господину ХАНСУ БЛИКСУ

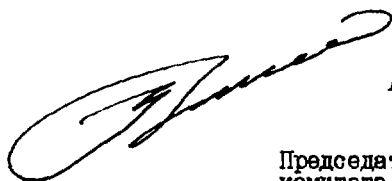
Генеральному директору Между-
народного агентства по атомной
энергии

г.Вена, Австрия

Информирую Вас, что Правительство Союза Советских Социалистических Республик приняло приглашение участвовать в четырехстороннем сотрудничестве по концептуальному проектированию ИТЭР, которое будет осуществляться в соответствии с одобренными "Основными положениями".

Участие Советского Союза в проекте ИТЭР будет обеспечено соответствующими материальными и людскими ресурсами с тем, чтобы успешно выполнить поставленную задачу.

Искренне Ваш,



А. Н. Проценко

Председатель Государственного
комитета по использованию
атомной энергии СССР

Translated from Russian

PERMANENT MISSION OF THE USSR TO THE
INTERNATIONAL ORGANIZATIONS IN VIENNA

No. 129

24 March 1988

Dear Sir,

Please find enclosed a letter from the Chairman of the USSR State Committee on the Utilization of Atomic Energy, Mr. A.N. Protsenko, indicating the Soviet Union's agreement to take part in the International Thermonuclear Experimental Reactor (ITER) project.

Yours, etc.,

(signed) R. Timerbaev
Resident Representative of the USSR to
the International Organizations in
Vienna

Mr. H. Blix
Director General
IAEA, Vienna

Translated from Russian

USSR STATE COMMITTEE ON THE
UTILIZATION OF ATOMIC ENERGY
Staromonetnyj per. 26
109180 Moscow, USSR

No. GO-V/152

14 March 1988

Dear Sir,

The idea of building a thermonuclear reactor through the combined efforts of a number of countries took shape following an initiative by the General Secretary of the Central Committee of the Communist Party of the USSR, Mr. Mikhail Gorbachev, during his meetings with the Presidents of France and the United States of America, at which a preparedness was expressed to make all possible joint efforts towards the practical development of international co-operation in the peaceful use of thermonuclear fusion energy.

This initiative gave rise to the problem of working out concrete ways of implementing a significant and promising large-scale project of international scientific and technical co-operation, the successful completion of which would make available an essentially inexhaustible source of energy and thereby solve one of the most pressing global problems of the present time - that of energy.

The Soviet Union received with attention and interest the proposal by the International Atomic Energy Agency that it take part in the work on the International Thermonuclear Experimental Reactor (ITER) project, which was put forward in your letter of 2 November 1987.

Noting the significant role of the IAEA in organizing this new form of international scientific and technical co-operation in the practical utilization of fusion energy, we consider that its results will serve all mankind. The successful completion in 1990 of the conceptual design of a thermonuclear reactor will be a further important step in this direction.

I am informing you herewith that the Government of the Union of Soviet Socialist Republics accepts the invitation to take part in the quadripartite co-operation on the conceptual design of ITER, which will take place in accordance with the agreed Terms of Reference.

The participation by the Soviet Union in the ITER project will take the form of appropriate material and human resources needed to carry the proposed task through successfully.

Accept, Sir, etc.,

(signed) A.M. Protsenko
Chairman, USSR State Committee on
the Utilization of Atomic Energy

Mr. H. Blix
Director General
IAEA, Vienna

**LETTER DESCRIBING PROCEDURES FOR THE TIMELY
ISSUANCE OF VISAS FOR TRAVEL TO THE
FEDERAL REPUBLIC OF GERMANY**



**INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
ORGANISMO INTERNACIONAL DE ENERGIA ATOMICA**

WAGRAMERSTRASSE 5, P.O. BOX 100, A-1400 VIENNA, AUSTRIA
TELEX: 1-12645. CABLE: INATOM VIENNA, FACSIMILE: 43 222 230184, TELEPHONE: (222) 2360

IN REPLY PLEASE REFER TO
PRIERE DE RAPPELER LA REFERENCE

F1.32

DIAL DIRECTLY TO EXTENSION:
COMPOSER DIRECTEMENT LE NUMERO DE POSTE:

28 March 1988

Sir,

I have the honour to refer to the International Thermonuclear Experimental Reactor (ITER) Conceptual Design Study in which your Government is participating.

In order to achieve the goals of ITER it will be necessary to convene meetings of experts from the ITER parties on an ad hoc basis at a single technical site. For the Definition Phase of ITER it has been determined that this site will be the Max-Planck-Institut für Plasmaphysik in Garching, the Federal Republic of Germany.

The International Atomic Energy Agency (IAEA) has accordingly requested the Government of the Federal Republic of Germany to make provisions enabling the timely attendance at these meetings by experts from each of the ITER parties.

I am pleased to inform you that the FRG will, within a period of 10 working days, issue multiple entry visas for up to 25 participants at a time from each of the parties to ITER. These visas will be valid for periods consistent with ITER's calendar. Similar provisions will apply to the participants' dependents.

In this context the Secretariat has been requested to inform the parties that participants requiring visas to enter the FRG apply for them to the appropriate consular or diplomatic channels, and that a provisional list of regular participants in the ITER activity be provided to the FRG as soon as possible.

Accept, Sir, the assurances of my highest consideration.

Maurizio Zifferero
Deputy Director General
Head of the Department of
Research and Isotopes

for DIRECTOR GENERAL

**RECORD OF THE MEETING OF THE PROVISIONAL
ITER COUNCIL
IAEA, Vienna
8-9 February 1988**

Delegations from the four Parties involved in the ITER activity met in Vienna on Monday and Tuesday, 8 and 9 February 1988, to prepare for the first formal meeting of the ITER Council. The List of Attendees is Attachment 1. The draft agenda for the meeting is Attachment 2.

The Provisional ITER Council was welcomed by IAEA DDG Zifferero. IC Chairman-Designate Clarke opened the meeting with a discussion of the agenda. The Provisional ITER Council then heard a report from Dr. Tomabechi on the work of the ITER Management Committee. This Report is Attachment 3. The Provisional ITER Council then heard the status of each Party's response to the IAEA DG's invitation letter. The USA had accepted the invitation letter earlier. The Japanese Delegation announced during the meeting that their Government had just formally accepted the DG's invitation. The EC Delegation said that the Council of Ministers had just approved the conclusion by the Commission of the ITER participation agreement and that a formal response would be forthcoming soon. The Soviet Delegation stated that their Government would soon accept formally the DG's invitation.

The Delegations were asked to indicate the likely nominees for the ITER Council and ISTAC. The list of likely names is contained in Attachment 4.

The Provisional ITER Council then discussed each of the items on the agenda. The various elements of consensus developed by the Delegations are contained in Attachment 5. These consensus statements were developed to provide a basis for the most effective conduct of the first ITER Council meeting.

The Delegations then dealt with the date of the first ITER Council meeting. The dates of Thursday and Friday, 21 and 22 April 1988, were accepted for the meeting to be held in Vienna. Furthermore, it was agreed to continue the meeting with a ceremony initiating the joint work in Garching on the next day, Saturday, 23 April, at which time it could be possible to have the presence of Director General Blix and other invited dignitaries.

The Chairman expressed his appreciation as did the other Delegations for the timely and strong support given to these ITER preparations by all concerned.

Attachment 1

LIST OF ATTENDEES

| PARTICIPATING AND DESIGNATING MEMBER STATES AND ORGANIZATIONS | ADDRESSES |
|---|--|
| <hr/> | |
| CEC | |
| Ch. Maisonnier | 200, Rue de la Loi B-1049 Brussels Belgium |
| E. Canobbio | 200, Rue de la Loi B-1049 Brussels Belgium |
| K. Pinkau | Max-Planck-Institut für Plasmaphysik D-8046 Garching FRG |
| R. Toschi | Max-Planck-Institut für Plasmaphysik D-8046 Garching FRG |
| JAPAN | |
| S. Mori | JAERI Fukoku-Seimei Bldg. 2-2-2 Uchisaiwai-cho Chiyoda-ku, Tokyo 100 |
| K. Tomabechi | Naka Fusion Research Establishment JAERI Naka-machi, Naka-gun Ibaraki-ken 311-02 |
| K. Ida | Atomic Energy Bureau Science and Technology Agency 2-2-1 Kasumigaseki, Chiyoda-ku Tokyo |
| S. Hino | JAERI Fukoku-Seimei Bldg. 2-2-2 Uchisaiwai-cho Chiyoda-ku, Tokyo 100 |

**PARTICIPATING AND
DESIGNATING MEMBER STATES
AND ORGANIZATIONS**

ADDRESSES

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Washington, D.C. 20520

M. Roberts
U.S. Department of Energy
Washington, D.C. 20545

USSR

N. Cheverev
State Committee for Utilization
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Staromonetnyj Pereulok 26
Moscow Zh-180

L.G. Golubchikov
State Committee for Utilization
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A. Mavrin
State Committee for Utilization
of Atomic Energy
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**PARTICIPATING AND
DESIGNATING MEMBER STATES
AND ORGANIZATIONS**

ADDRESSES

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**I. V. Kurchatov Institute of Atomic Energy
46 Ulitsa Kurchatova
D-182 Moscow**

A. Zhuravlev

**Ministry of Foreign Affairs
36/38 Smolenskaya Pl.
Moscow**

Attachment 2

AGENDA

(Not included)

Attachment 3

REPORT TO THE PROVISIONAL ITER COUNCIL February 1988 ITER Managing Committee Members Designate

The ITER Managing Committee members designate, R. Toschi (Euratom), K. Tomabechi (Japan), Y. Sokolov (USSR) and J. Gilleland (USA) met twice, first on December 9-11, 1987 and then on February 1-3, 1988, at Garching to prepare for the expected ITER Conceptual Design activities. They were accompanied by experts. The major subjects discussed at the meetings and the results from the discussion are given below.

1. TECHNICAL SITE IN GARCHING

A new two-story building for ITER design activities is under construction and is expected to be ready for use at the beginning of April 1988. The building has 40 offices as well as other rooms for meetings, secretaries and other support personnel. The Computer Center operates 24 hours a day, seven days a week, assisted by operators. Apartments of different sizes will be made for ITER Joint Work participants.

In general, the proposed facilities and personnel accommodations have been found quite adequate. IPP has agreed to provide additional offices as needed for short terms participants to ITER conceptual design activities.

2. ADMINISTRATIVE ARRANGEMENTS FOR PERSONNEL ASSIGNMENT AT THE IPP GARCHING

There are the administrative and legal requirements to be fulfilled for hosting long term visitors at the IPP Garching. Personnel exchange agreement or agreements are required. The matter is being discussed between IPP and the home institutes, and it is hoped that the problem will be resolved by the time of formal start of the ITER activities. There is also an unresolved issue of immunities and privileges of ITER participants which is presently under consideration at IAEA.

3. DATA COMMUNICATION AND COMPUTER SYSTEMS

It was agreed that an electronic mail system should be established between the relevant offices of the Partners as well as the IAEA and initial test of the system was successful. The system should be established between the relevant offices of the Partners and the IAEA. The system should be in operation as soon as possible, hopefully before the start of the ITER activities.

4. ORGANIZATIONAL STRUCTURE AND WORKING PLAN

Based on the principles specified in the Terms of Reference, the guidelines for ITER conceptual design activities have been developed (see Annex I).

Annex I

GUIDELINES FOR ITER CONCEPTUAL DESIGN ACTIVITIES

The basic principles for the ITER Conceptual Design activities are given in the Terms of Reference. Based on these principles, guidelines for these activities (i.e. organizational structure, mode of operation, and time schedule), are defined below. These guidelines may be subject to proper modifications, as the need arises during the process of the design.

1. ORGANIZATIONAL STRUCTURE AND MODE OF OPERATION

The organizational structure for design activities should have the following two basic functions:

- (a) A coordinating function which stems from the need to define overall objectives, performance and operating conditions of the apparatus and of each component and to integrate systems and components.

These functions are to be carried out by the Project Units.

- (b) Detailed design functions. The functions should be as comprehensive as possible; in addition to the design proper, material issues, R&D and testing should also be included.

These functions are to be carried out by the Design Units.

The Project Units and the Design Units report to the Management Committee, which has the overall executive responsibilities of the ITER conceptual design, as defined in the Terms of Reference. The Management Committee may create, on ad hoc bases, Working Groups which will meet for workshops of limited duration. The tasks to be assigned to those Units are described in the Attachment A

2. TIME SCHEDULE

An overall time schedule of the ITER Conceptual Design activities is given in the Attachment 2. Assuming formal commencement of the activities in the middle of March 1988, some milestones for design activities in 1988 are defined as follows:

- (1) The Joint Work at Garching starts on May 2, 1988.
- (2) A plan for R&D work to be carried out in a coordinated manner is to be submitted for approval by the ITER Council in the week of July 4, 1988.
- (3) A Report of the Definition Phase is to be completed by the end of September 1988 for submission to the ITER Council in the week of October 3, 1988.
- (4) The results of the work in the Definition Phase should be presented at the 12th IAEA Conference at Nice, France, October 12-19, 1988.

Attachment A

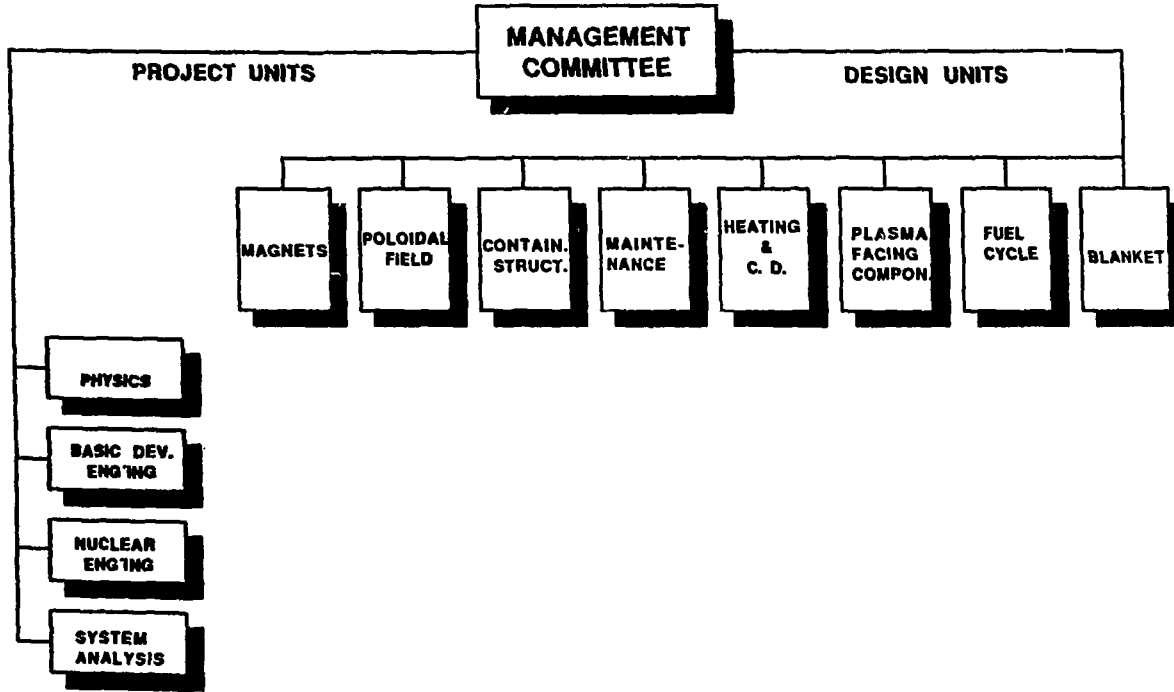
ITER MANAGEMENT STRUCTURE

| Project Group | Task |
|---------------------------------|--|
| Physics | Plasma Parameters Confinement and Operation Limits Integrated Plasma Operation Scenarios (Heating, Current Drive, Burn Control, Disruption) Plasma Edge Physics Fuelling System Requirements Diagnostics and Experimental Plan R and D Definition |
| Basic Device Engineering | System Integration and Basic Device Layout Machine Operation and Control Coordination of Design Units (Magnet, P.F. System, Containment Structures, Assembly/Maintenance, Heating and CD Systems, Divertor) R and D Definition |
| Nuclear Engineering | Nuclear Testing Programme Materials Tritium Production Scenarios Testing Programme Coordination of Design Units (Fuel/Exhaust Systems, First Wall, Blanket) R and D Definition |
| System Analysis | Parametric Studies Cost Analysis Availability and Reliability Analysis Safety and Environment Plant Layout, Site and Services Design Documentation |

| Design Units | Task |
|------------------------------------|---|
| 1 Magnet | Superconductor development Toroidal and poloidal coil design T.F. coil power supply Protection Testing programme |
| 2 Poloidal field system | Plasma configuration Transient electromagnetics Poloidal field system design P.F. coil power supply Testing programme |
| 3 Containment structures | Vacuum vessel and ports Shielding structure Cryostat and outer containment Testing programme |
| 4 Plasma facing component | First wall Divertor/limiters Protection materials Testing programme |
| 5 Blanket | Shielding blanket Breeding blanket Breeding/multiplier materials Testing programme |
| 6 Heating and current drive system | Neutral beam system Lower hybrid ECR ICR Testing programme |
| 7 Fuelling and exhaust system | Pumping system T extraction and purification Fuelling systems Testing programme |

| Design Units | Task |
|-----------------------------------|--|
| 8 Assembly and maintenance system | Maintenance scenarios Remote handling equipment Transporter and end effectors Procedures Testing programme |

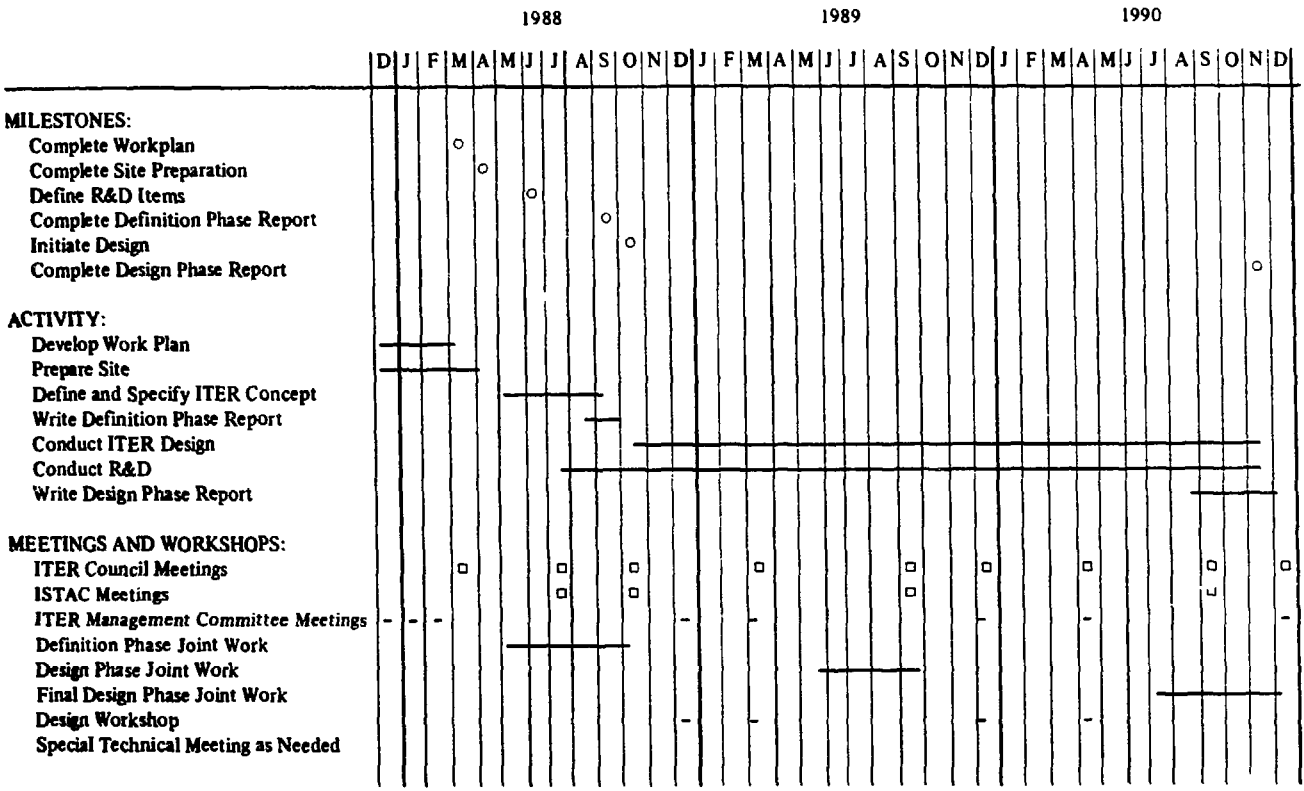
ITER STRUCTURE



ITER STRUCTURE

Attachment B

OVERALL SCHEDULE OF ITER CONCEPTUAL DESIGN



Attachment 4

LIKELY NOMINEES FOR THE ITER COUNCIL

| | |
|-------|---|
| USSR | Velikhov and Cheverev |
| USA | Clarke and Decker (or Decker's successor) |
| Japan | Mori and Ida |
| CEC | Fasella and Maisonnier (plus technical expert — Pinkau) |

LIKELY NOMINEES FOR ISTAC

| | |
|-------|---|
| USSR | Kadomtsev, Chuyanov, Krylov |
| USA | Fowler, Furth, Parker, Montgomery, Conn, Rosenbluth |
| Japan | Sekiguchi, Inoue, Tanaka |
| CEC | Troyon, Rebut, Sweetman |

Attachment 5.1.

ON THE ROLE OF THE ITER COUNCIL

According to the Terms of Reference the ITER Council will have the responsibilities for the overall direction of the Conceptual Design Activities and will exercise overall supervision of their execution.

In order to perform in a more effective way the ITER Council should be informed monthly by the ITER Management Committee during the Definition Phase and joint work at Garching.

ITER Council members may be assigned specific responsibilities for Council business on both a temporary and a permanent basis.

Between the sessions of the ITER Council, the Chairman may act for the Council in a manner consistent with IC policy. The Chairman will inform the Council members of actions so taken.

ISTAC, ITS ROLES, OPERATION, COMPOSITION AND PROCEDURES

1. ROLES OF ISTAC

(a) Independent Technical Advice

According to the Terms of Reference, "ISTAC will, upon request of the IC, advise on scientific and technical matters". It is anticipated that the ISTAC will provide advice to the IC on both design and R&D.

(b) Anticipated Future Needs and Trends

The ISTAC should also take the initiative in calling to the attention of the IC new scientific and technical developments that might have a bearing on ITER performance.

(c) Special Topics

The IC can call upon the ISTAC to study special topics including requests from the IMC.

2. MEANS FOR ISTAC TO FULFILL ASSIGNED ROLES

To fulfill the main role of independent technical review and advice for the IC, the ISTAC has to function on regular, ongoing basis. This means that ISTAC has to receive the progress reports and other scientific and technical documents that the IMC sends to the IC.

3. COMPOSITION OF ISTAC

The members of ISTAC should be leading scientists and engineers appointed by the IC to serve for the duration of the activity.

ON THE REPORT OF IMC

K. Tomabechi, the IMC Chairman-Designate, reported the results of the two IMC preparatory meetings held at Garching, first on 9-11 December 1987 and then on 1-3 February 1988. Major subjects of the report were on (1) technical site at Garching (2) administrative arrangements for personnel assignments (3) data

communication and computer systems and (4) organizational structure and working plan.

In his report, he proposed to hold three preparatory Specialists' Meetings which should be participated by three to six experts from each Party as follows:

- (1) Physics Specialists' Meeting at Garching on 21-25 March 1988
- (2) Engineering Specialists' Meeting at Garching on 21-25 March 1988
- (3) Nuclear Engineering Specialists' Meeting at Tokyo in the middle of April 1988.

He pointed out also the importance of the recognition of ITER work during the Joint Work by the IC, so that all the participants in the Joint Work will be able to be stationed almost full time at Garching, devoting full attention to their ITER work.

The view was strongly endorsed by the participants of the meeting by saying that ITER work would be given high priority and appropriate support would be given by IC members in this respect.

Opinions were expressed also during the meeting that IMC should keep in mind that proper interactions of the Joint Work participants with their home team experts at appropriate occasions would be needed during the Joint Work.

Attachment 5.4.

ON THE FIRST IC MEETING AND OPENING CEREMONIES

It has been agreed that the first IC meeting will take place on April 21, 22 and 23 and that it will include a visit to the technical site to initiate the joint design activities.

The Opening Ceremonies will take place during the IC meeting. The precise time of these ceremonies shall be determined through further consultations between the 4 Parties and the Agency (Dr. Roberts, Dr. Hino, Dr. Mavrin, Dr. Canobbio and Dr. Leiser). The personalities to be invited might be at the level of:

The Director General of the IAEA
Ministerial level for the Parties

Attachment 5.5.

ON THE NEED OF AN ITER SECRETARIAT

The participants have supported the view that the size and complexity of the ITER activity necessitate the establishment of an ITER Secretariat, the size of which shall be decided upon at the first IC meeting. The Secretariat will perform its functions under the direction of the ITER Council.

INTERNATIONAL
ATOMIC ENERGY AGENCY
VIENNA, 1988