INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR

# ITER EDA NEWSLETTER

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INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, AUSTRIA

## THE ITER DESIGN INTEGRATION DIVISION

**by F. Puhn, Division Head, Design Integration**

The Design Integration activity is part of the responsibility of the San Diego Joint Work Site (JWS). The Design Integration Division reports to the Deputy Director who has responsibility for Design Integration, Dr. Yasuo Shimomura. The Division Head is Fred Puhn.

The two main functions of the Design Integration Division are:

(1) maintaining overall consistency and quality of design while incorporating project requirements; and
(2) providing technical services to management and design organizations. These services include configuration control, systems integration, technical standards, drawing office services, tokamak assembly planning and tooling design, and assisting in the technical approval process.

When fully staffed, the Design Integration Division will consist of four groups: Analysis Integration, Construction Preparation, Design Standards, and Tokamak Integration. The San Diego JWS drawing office is also under the responsibility of the Design Integration Division. Good progress has been made in staffing up this office.

The responsibilities of the Analysis Integration Group includes setting standards for analysis, establishing structural design criteria for the project, performing engineering analysis at the overall systems level, and documenting the material properties for use by the project. Peter Smith and Pietro Barabschi are at present performing this work in San Diego.

The major activity of the Construction Preparation Group is planning the tokamak assembly. This work includes design of assembly toolings and interfacing with other JCT organizations which are developing plans for on-site manufacturing and remote handling. The Construction Preparation Group will provide a Remote Maintenance Manual for use by the project, based on input from the JCT technical staff. Akira Oikawa is working on these activities at the San Diego JWS.

Design Standards is a major area of R&D activity for the Design Integration Division. This Group will organize and direct the R&D work on standard materials, processes, and components used on ITER. They will document the results in a Design Standards Manual for use by the project. This manual will also include results of R&D performed for other JCT Divisions wherever appropriate.

The Tokamak Integration Group will be responsible for the overall design integration of the tokamak, including space allocation, systems integration, and documenting uniform design rules. This Group will be responsible for the top level assembly drawings of the tokamak. Sergey Sadakov has recently joined the Design Integration Division to work in Tokamak Integration.

The Tokamak Integration Group will work very closely with the drawing office. The drawing office is responsible for establishing drawing standards as well as providing design services at the San Diego JWS. Space allocation and configuration control data will be controlled by the San Diego JWS drawing office. This information is communicated for use at the Garching and Naka JWS.

A major challenge in implementing the Design Integration activities is technical communication between the three Joint Work Sites. Several methods are being used to accomplish this communication. Formal technical meetings are held several times a year at each JWS, and Design Integration is represented at these meetings.

Informal communications are at present accomplished using a weekly Design Integration Meeting at the San Diego JWS. The purpose of the meeting is to discuss all recent designs and associated issues. All interested JCT people are invited to attend these meetings. Immediately before each meeting the latest design drawings are electronically exchanged between the Joint Work Sites. The Design Integration Meeting agenda incudes a discussion of these drawings, as well as other technical subjects. Immediately after the meeting the minutes are written and electronically transmitted to the co-ordinators at the Garching and Naka JWSs. F. Puhn calls the Garching and Naka JWSs and discusses the technical progress with the co-ordinator at each JWS. In this way technical information is transmitted on a regular weekly schedule. The communication is nearly "real time". It is anticipated that this informal communication system will evolve as the project grows and the needs change.

The Design Integration division anticipates a significant amount of design and R&D work with the Home Teams. An important part of this work will be in establishing design standards for ITER. These include structural design criteria, design rules, material properties, standard processes, and standard components. These subjects were addressed at the Technical Meeting on Design Standards and Remote Handling held in San diego on May 24-28. Valuable input was obtained from Home Team experts in these and other important areas for use by the project. After the meeting the Design Integration Division has turned its attention to defining specific tasks for the Home Teams to address the most critical issues identified at the meeting.

## 5TH IAEA TECHNICAL COMMITTEE MEETING ON DEVELOPMENTS IN FUSION SAFETY

**by Dr. F.N. Flakus, Division of Nuclear Safety, IAEA**

An IAEA Technical Committee Meeting (TCM) on Developments in Fusion Safety was held on 7 - 11 June 1993 in Toronto, Canada. The purpose of the TCM was to provide an international forum for the exchange of information on current studies in Member States related to safety aspects of fusion reactors. Previous IAEA TCMs on fusion safety had been held in Vienna, Austria (1981), Ispra, Italy (1983), Culham, UK (1986) and Jackson Hole, USA (1989).

The meeting was hosted by the Canadian Fusion Fuels Technology Project (CFFTP) of the National Fusion Programme (NFP) of Canada. Mr. W. Holtslander, Manager of International Programmes of the National Fusion Office of Canada, welcomed the participants on behalf of the Government of Canada. 54 experts from nine Member states (Canada, France, Germany, Italy, Japan, Netherlands, Russian Federation, Sweden, USA), from the Commission of the European Communities (CEC) and from the International Thermonuclear Experimental Reactor (ITER) Joint Central Team attended. Participation by the CEC included experts from the Joint Research Centre (JRC) at Ispra, Italy, the Joint European Torus (JET) at Culham, UK, and the Next European Torus (NET) at Garching, Germany. The ITER team was represented by three experts from the Joint Work Site San Diego. Mr. Gary A. Vivian, Project Manager, ITER Integration, CFFTP, Canada, acted as liaison officer for the preparation of the meeting and chaired it.

The programme of the meeting included the presentation of 38 scientific papers in 8 plenary sessions. In addition, two major discussion sessions were held in plenary session, one highlighting important international activities relevant to fusion safety and one summarizing the findings of the meeting with respect to long-term needs in the area of fusion safety. The contributed papers covered a broad spectrum of topics including reports on the status of certain national/international developments, safe handling of tritium, operational safety including occupational protection, accident analysis (mainly loss-of-coolant and loss-of-flow accidents), selected safety assessment studies, environmental protection issues, particularly tritium releases, licensing of fusion related facilities, and radioactive waste from fusion reactors. Lithium safety issues were not addressed. It was stressed that ITER is an experimental facility and that ITER should not be termed "prototype fusion reactor" in order to make its purpose clear to the public. Generally, the need for close interaction between design and safety considerations was apparent in order to achieve a high degree of safety in fusion reactors and the importance of international co-operation in fusion safety was underlined.

*Text continued on page 6*

## TO THE READERS

A year has passed since the Agreement on Co-operation in the Engineering Design Activities for ITER was signed on July 21, 1992.

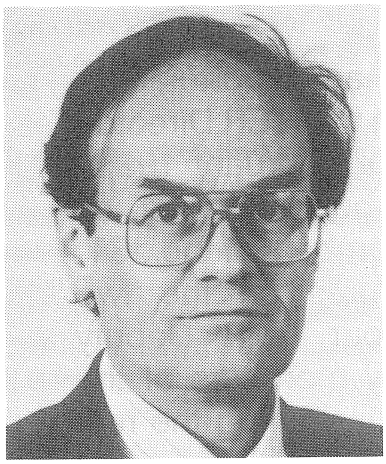
One of the significant features of this year has been the buildup of the Joint Central Team. Assembling the Team of the required size and quality is, in essence, the permanent activity which will continue through all the ITER. However, the major part of this task should be completed by the end of Protocol 1 by which time the ITER Council has agreed that there should be about 150 team members on site. While the ITER EDA has progressed through roughly 60% of the duration of Protocol 1, 60% of the total staffing agreed for the end of it had been selected and 34% were on site. All but one of the staff of the Joint Central Team at the level of the Division Head and above are on site already.

The Newsletter has already used an opportunity to publish a brief biographical sketch on the ITER Director, Dr. P.-H. Rebut (see Vol. 2, No.2 of February 1993). The process of introduction will be continued by publication of brief profiles on key members of the JCT. This issue of the Newsletter features on the two following pages profiles of the four ITER Deputy Directors. Brief profiles of other key members of the JCT will be published in the Newsletter during the rest of this year.

**Dr. Valeriy Chuyanov, ITER Deputy Director, Head, San Diego Joint Work Site**

Dr. V. Chuyanov defended his Doctorate in Physics at Moscow State University in 1968. He then successfully defended his Doctor of Science in 1976. Both degrees are in the field of "Application of Control Theory to Plasma Physics (Theory and Experiments)". During his career Dr. Chuyanov has worked on a wide variety of magneti fusion energy concepts including mirror machines and tokamaks, as well as fusion reactor development.

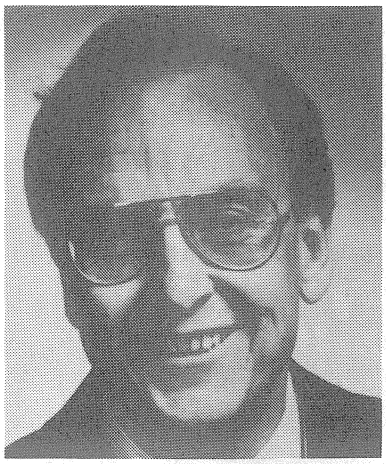
From 1964 to 1968 he worked as a Science Officer at the Kurchatov Institute of Atomic Energy in Moscow. He worked as a Science Officer at the Culham Plasma Physics Laboratory in the United Kingdom from 1968 to 1970. From 1970 to 1984 he became a Senior Scientific Officer and Group Leader at Kurchatov Institute for Plasma Physics. He then moved to the Troitsk Site as Head of Laboratory in 1984. In 1988 he was elected Head of the Fusion Engineering Division at Kurchatov and participated in the ITER Conceptual Design Activities (CDA) as the Leader of the USSR Home Team. At present, he is the Head of the San Diego Joint Work Site and Deputy Director responsible for Nuglear Integration, Safety, Siting and Licensing.



**Dr. Michel Huguet, ITER Deputy Director, Head, ITER Joint Work Site Naka**

Dr. M. Huguet obtained his engineering degree at Ecole Supérieure d'Electricité (Paris France) in 1964. He then took a lecturerposition at Faculté des Sciences (Nice, France), where he obtained in 1967 his doctorate degree (docteur ingénieur) in the field of gamma-ray spectroscopy.

He then moved on to CEA (Commissariat à l"Energie Atomique) at Fontenay aux Roses (France), where he started his work in the fusion field. He was responsible for the construction and assembly of the magnet system of the JET Tokamak. In September 1973 he joined the JET Design Team at Culham (UK) as group leader for the toroidal field magnet and mechanical structures. In June 1978, at the start of the JET Construction Phase, he was appointed Head of Magnet Division and was responsible for the design, manufacture, installation and commissioning of the JET magnets and structures. In 1983 when the JET machine started operation, he became Head of Torus Division with responsibilities for the whole machine in the areas of magnets, vacuum, first wall and technical aspects of machine operation. In 1986 he became Head of Machine and Development Department with responsibilities extending to Magnets and Power Supplies, First Wall and Nuclear Technologies (tritium handling and remote maintenance). In 1988 he was appointed JET Associate Director. During the period he was involved in all machine upgrades and aspects of operation including the tritium experiment in November 1991. In October 1992 he took up his new ITER position at the Naka Joint Work Site.



**Dr. Ronald R. Parker, ITER Deputy Director, Head, ITER Joint Work Site Garching**

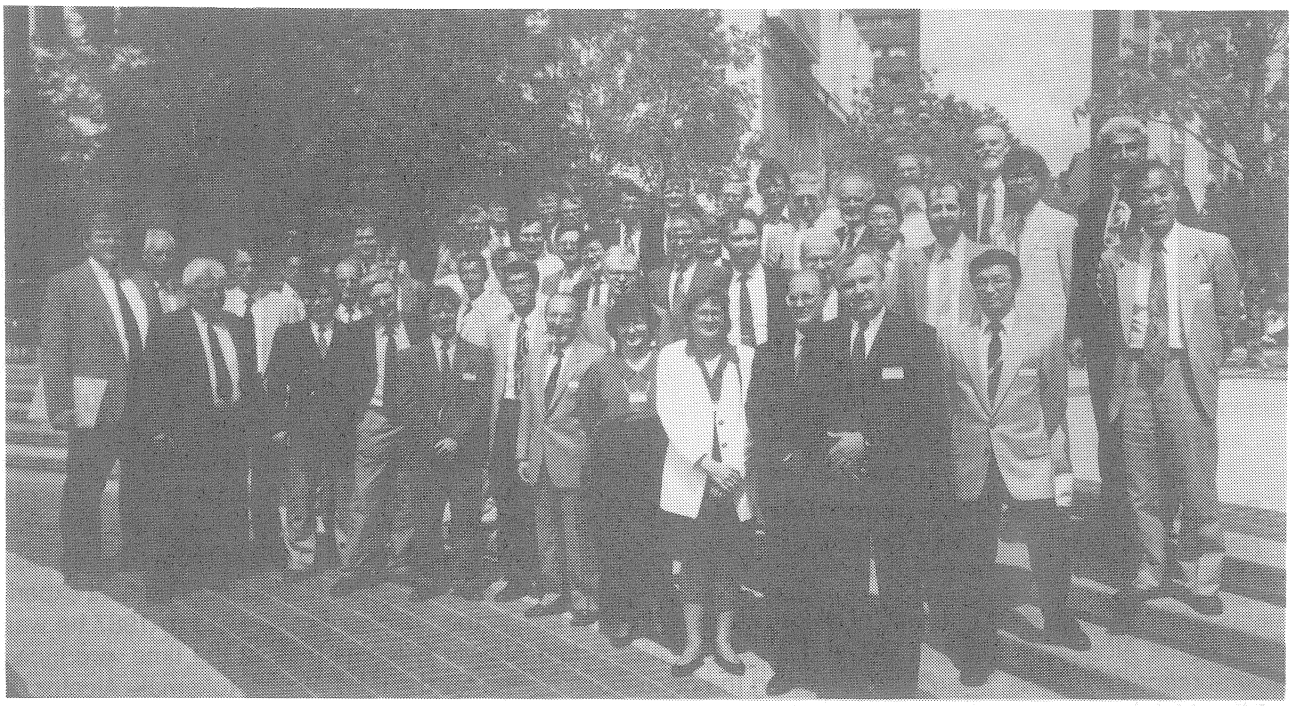
Dr. R. Parker assumed his duties last October when he arrived at Garching. Dr. Parker came to the Joint Central Team from the Massachussetts Institute of Technology where he was a professor and, since 1988, Director of MIT's Plasma Fusion Centre.

Dr. Parker joined the faculty of the Department of Electrical Engineering at MIT after receiving his Ph.D. there in 1967. Throughout his career, his research interests have been mainly in experimental plasma physics, evolving from fundamental "table-top" experiments around the time of his PH.D., to fusion-related confinement experiments with the advent and growth of the Alcator program at MIT in the 1970s. From 1973 to 1987 he was Head of the Alcator program at MIT and led the Alcator A and Alcator C teams that, at the time, produced several record values of "n-tau". After leading the conceptual design for the third Alcator tokamak, Alcator C-MOD, which began operation last spring, Dr. Parker went to Princeton during 1987-1988 to work on the design of the Compact Ignition Tokamak. He has thus had a long-standing interest in the development of high-field tokamaks and their application to producing burning plasmas, and is especially pleased to be given the opportunity to again pursue this line with ITER.

**Dr. Yasuo Shimomura, ITER Deputy Director, Deputy to the Director**

Dr. Y. Shimomura entered the Japan Atomic Energy Research Institute (JAERI) in 1971 after studying High Temperature Plasma Physics at Osaka University.

From April 1973 to March 1980 he was Leader of JFT-2a/DIVA Group at JAERI. He constructed and studied experimentally the first divertor tokamak (JFT-2a/DIVA) in the world and developed the open divertor concept for INTOR. He was Guest Scientist at th Princeton Plasma Physics Laboratory and worked on the Poloidal Divertor Experiment (PDX) Project from June 1976 to June 1977. He proposed impurity radiation cooling for edge plasma control. From April 1981 to March 1985 he was Leader of JT-60 Experimental Planning and Plasma Analysis Group, as well as prepared the JT-60 Experiment. From December 1981 to December 1982 Dr. Shimomura was a Guest Scientist at the Max-Planck-Institute für Plasmaphysik. While working on the ASDEX Project he demonstrated the gas cooled divertor plasma. In April 1986 he was selected to be the Division Head of the Large Tokamak Experiment Division at JAERI. In April 1988 he was selected as the Head of the Poloidal Field Design Group during the ITER Conceptual Design Activities. At this time he was also responsible for directing and co-ordinating the JT-60 experiment, as well as the modification of JT-60 to JT-60U. In July 1992 Dr. Shimomura was appointed the ITER Deputy Director with responsibility for the design integration of the ITER Project, which is being co-ordinated at the San Diego Joint Work Site.



Participants in the Meeting

The panel discussion of international activities included informal oral contributions addressing safety aspects of international fusion undertakings, particularly ITER, but also JET and NET, the elaboration of international basic safety standards for protection against ionizing radiation and for the safety of radiation sources (jointly sponsored by FAO, IAEA, ILO, NEA-OECD, PAHO and WHO), the IEA co-operative programme on Environmental, Safety and Economic (ESE) aspects of fusion power, and comments by the CEC on their contributions to fusion safety, including the issue of activation advantages of vanadium alloys versus steels.

The panel discussion of long-term research and development needs identified a number of key areas for future work, including - inter alia - development of improved techniques for tritium inventory accounting in various plant systems, validation of computer codes for predicting tritium transport, further research on ingestion pathways of tritium, particularly organically bound tritium, establishment of databases of fusion specific activation materials and of reliability of fusion reactor components and systems having safety functions, further analysis of the transient response of plant components and systems to accident conditions, structural response of fusion reactor components to seismic events, interaction of tritium with materials and performance of low activation materials in a fusion reactor environment (e.g. hydride formation, irradiation effects).

During the closing session of the meeting it was pointed out that, besides intensive exchange of technical information and discussion of specific fusion safety issues, the TCM had been very useful for obtaining a good overview of current work being performed in many laboratories, which was considered most valuable for orientation of participants' individual scientific efforts. The opportunity of gaining an improved understanding and overview of international fusion reactor projects was also particularly welcomed by the participants.

The proceedings of the meeting will be published in the "Journal of Fusion Energy". A summary of the technical papers will be published in "Fusion Technology".

The Agency's initiative for convening this TCM was highly appreciated. The meeting facilities provided by Canada for the meeting were excellent. Support staff of the host organization is complimented for the efficient manner in which they planned and conducted this meeting. It was recommended that the next IAEA TCM on fusion reactor safety be held in the fall of 1996 and JAERI, Japan, offered to host it. At its 31st meeting held on 8 July 1993 in Vienna, the International Fusion Research Council (IFRC) endorsed this recommendation.

## IAEA ATOMIC AND PLASMA-MATERIAL INTERACTION DATA ACTIVITIES IN SUPPORT TO ITER EDA

**by Dr. R. Janev, Head, IAEA Atomic and Molecular Data Unit**

For more than fifteen years the IAEA Atomic and Molecular Data Unit has been co-ordinating the worldwide efforts on compilation, evaluation and generation of atomic and molecular data for the fusion energy research. Five years ago this Unit established a similar activity in the area of plasma-material interaction processes, and quite recently this activity has also been extended to the field of thermomechanical properties of fusion reactor plasma facing materials. The IAEA atomic and plasma-material interaction data activity is supervised and directed by the Subcommittee on Atomic and Molecular Data for Fusion of the International Fusion Research Council, and its long- and short-term programmes are established by the work of broad international panels (such as the Technical Committee on Atomic and Plasma-Material Interaction Data for Fusion) and through continuous direct interaction of the IAEA with the fusion, atomic and plasma-material interaction physics communities.

The primary objectives of this Agency's activity are the establishment of internationally recommended atomic, plasma-material interaction and material properties databases for fusion, integration, co-ordination and promotion of the world efforts in fusion related atomic and plasma-surface interaction research fields, maintenance and continuous updating of an international data bank for fusion and dissemination of the appropriately formatted data files to fusion laboratories and other users. The Agency currently co-ordinates the work of 15 national atomic and plasma-material interaction data centres (organized in a network), conducts three major international co-ordinated research programmes for fusion-related data generation (with active involvement of more than 30 world leading laboratories), sponsors about ten additional research projects in support of these programmes, and organizes yearly four to five experts meetings to facilitate the interaction of fusion and atomic material physics communities on fusion research issues which require a significant atomic or plasma-material interaction data input. The current content of the Agency's atomic and plasma-material interaction data bank (ALADDIN) includes, with variable completeness, recommended collision data for all plasma generic and impurity constituents, for the major plasma-wall interaction processes involving a wide range of materials, and limited sets of evaluated data on thermomechanical properties data for selected plasma facing materials. These data have already been incorporated in many fusion application (both modelling and diagnostic) codes, and the entire database will soon become accessible on-line (via INTERNET) to fusion users.

During the ITER CDA, the Agency's activity in the area of atomic and plasma-material interaction data for fusion has strongly been focussed on meeting the needs for such data in certain critical design areas such as power and particle exhaust, impurity control, plasma heating and current drive and plasma facing materials. This general programmatic orientation will also be followed during the ITER EDA, with emphasis on the completeness of the databases required in specific applications and their compatibility and coupling with the fusion codes. The potential of existing evaluated Agency databases and Agency co-ordinated data generation programmes is particularly significant in the areas of divertor performance modelling (in all divertor plasma cooling options), characterization of plasma facing materials (erosion, reposition, tritium retention and thermomechanical properties), neutral beam based plasma diagnostics (in both active beam emission and charge-exchange recombination versions) and helium exhaust. In all these areas the Agency intends to enhance its activities through initiation of new, co-ordinated research programmes. The efficient implementation of the results of this activity during the ITER EDA will require an appropriate co-ordination with the ITER design process.

## FORTHCOMING EVENTS *)

- TAC-3 Meeting, Naka, Japan, 9-11 September
- MAC-3 Meeting, Naka, Japan, 16-17 September
- IC-4 Meeting, San Diego, USA, 29 September - 1 October

*) Attendance at all ITER Meetings by invitation only.

ERRATUM:

Please refer to the "ITER EDA Status Report, June 1993", published in the June issue (Vol. 2, no. 6) of the ITER EDA Newsletter. The nominal major radius as presented by the ITER Director at IC-3 was 7.75 m. We regret any confusion or inconvenience that the error may have caused.

Items to be considered for inclusion in the ITER Newsletter should be submitted to B. Kouvchinnikov, ITER Office, IAEA, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria, or Facsimile: 43 222 237762 (phone 23606392).

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