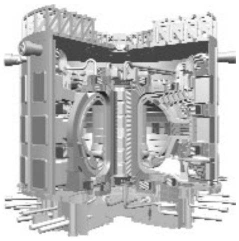

ITER ITA NEWSLETTER

No. 29, MARCH 2006

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, AUSTRIA

ISSN 1727–9852

ITER DIRECTOR-GENERAL NOMINEE IKEDA STARTS FULL-TIME WORK IN CADARACHE

The ITER Director-General Nominee, Dr. Kaname Ikeda, took up his position as ITER Project Leader in Cadarache on 13 March.

In a letter to all staff, the Parties, and the Participant Team Leaders, he expressed how eagerly he had awaited this moment, and how he looked forward to the challenges ahead, and to making the project a great success at the technical, international, intellectual and cultural level. “It is a huge opportunity, and one we should not miss.” he wrote.

In the same letter Dr. Ikeda thanked Dr. Shimomura for his achievements as Interim Project Leader, and asked him to stay on as his Senior Advisor until the end of September 2006.

Dr. Ikeda settles in to his new surroundings

CONSOLIDATION OF INFORMATION TECHNOLOGY INFRASTRUCTURE FOR ITER

by Dr. H.-W. Bartels, Head, ITER Information Technology Office

The ITER project has recently performed a quantum leap in its information technology architecture: a heterogeneous landscape which has grown up over more than 14 years has been transformed into a high availability site using “blade” and consequent virtualization technology. This integrated solution has emerged with the assistance of external consultants. The advantages are more power, flexibility, reliability and less effort in maintenance and less trouble-shooting.

As often seen in fast changing complex organizations, after more than a decade the ITER information technology infrastructure had developed in many directions. Whenever the need arose, a new server was deployed, often with a new operating system. For long term planning there was no time, other tasks were always more urgent. This way ITER ended up with about 50 servers on 7 operating systems (old and new) which became harder and harder to maintain.

In theory the compatibility of the various systems should have been no problem. However, in daily practice the heterogeneous systems caused all sorts of ‘little’ problems which required an enormous effort to resolve case by case. On top of that the hardware failed regularly – causing inconveniences for many ITER members plus loss of trust in services offered to hundreds of external collaborators. We reached a state in which more than 50% of the available resources were spent on trouble-shooting and maintenance. There was almost no time to improve the services to the users.

With the transformation from a design to a construction-oriented project the task for the information technology staff becomes more demanding. More documents, and more complex and detailed design and analysis are required, as well as close interactions with the laboratories and industry in 7 Parties. What is needed for this is a central, modern, highly available and powerful information technology infrastructure. At the same time any solution must be scalable for larger amounts of data and services. It must also serve as a reliable basis for the ITER community to access and cooperate with the project in a seamless manner.

This consolidation was done as a model case at the ITER Garching JWS by seeking technical advice from an external company specialized in system integration and administration, and with financial support from the European Commission and the host institute of the Garching JWS, the Max-Planck Institute for Plasma Physics. The goal was an implementation with a maximum of flexibility while minimizing the costs. The chosen solution uses the virtualization of a Unix AIX operating system environment together with an IBM BladeCenter for the Windows- and Linux servers using the software for virtualization of VMWare. The storage of all data and (virtual) operating systems is consolidated in an independent Storage Area Network (SAN). Up to 14 servers can be housed in the BladeCenter. Using the software for virtualization allows to host many virtual servers on one blade, which leads to an efficient use of the resources.

Once the consolidation is finished and all servers are virtualized, we expect that 9 blades can easily host servers which needed 50 machines before. Nevertheless, ITER will support a changing variety of server operating systems (Unix, Linux, and Windows) but the server and storage hardware remains the same. The effect is amazing. The hardware resources can be used much more efficiently. With the new architecture the management of all servers has also become much easier as the management and monitoring is an integral part of the system. And if a new server is needed, it is available within 30 minutes. Earlier it took up to 3 month: specifications had to be written, many committees had to approve the budget, a call for tender had to be launched, contracts signed, and the new hardware had to be installed etc.

The strict separation of the hardware for data storage and computing facilities is significant: if the ITER Document Management system would need 100 Gbyte of additional storage space, this is no problem any more. The information technology office can now assign the additional storage online without interruption of the service. Should the total storage capacity of currently 5 Tbyte be insufficient, ITER can add additional capacity without problems.

And, most importantly, the whole system is fully redundant. There will always be a system which takes over in case of failure of storage media, cables, or servers. An e-mail (or SMS) is sent to system administrators and the problem can be fixed before is has serious consequences. In practice we experienced already the failure of one CPU and one storage disk but in both cases this was completely invisible to our users and was repaired within 24 hours. In addition we had one case of a complete failure in our server room – all systems were knocked out by an electrical failure – only our new blade system remained up and running on its dedicated emergency power.

The combination of blade and virtualization technology has been quite exciting. More power and flexibility, no ‘geographical chaos’, fast access and very good reliability, much less trouble-shooting: the list of advantages is long. This all-in-one solution has more advantages: it frees the information technology staff from excessive maintenance and trouble-shooting tasks and more resources can be used for strategic developments in information technology such as groupware, calendar functions, screen sharing and video conferencing. There is a nice side-effect for the transition of ITER sites from Garching to Cadarache: the transfer of the virtual services is much easier compared to a transfer of conventional servers. All that is need is a file transfer of the virtual machines and some minor work to assign new network addresses. This transfer can be done as soon as the Cadarache JWS has build up an information technology infrastructure based on the same technology. And what about the old computers: they can be released for less critical uses, or retired where they produce mostly heat and trouble.

In a parallel effort the network structure of all ITER sites was restructured. Now all ITER sites are connected by a so called ‘virtual private network’. What this means is that although the ITER sites at Naka, Garching and Cadarache are geographically separated by continents, they are closely connected in one ‘virtual’ network using the internet. To deal with security issues, all network traffic on the internet is encrypted. As a result the users find identical services and data on all sites. To make this work efficiently several issues had to be solved. The structure of network addresses had to be changed. Now only private computer addresses are used for the internal networks which is also more secure since a direct connection from external networks is not possible. The private address space was carefully designed in a way that many sites can be connected without the chance of address collisions. A symmetric security policy is another pre-requisite. This is achieved by a central administration of the firewall rules at one location which are then pushed to all sites. Good network connectivity is the backbone of this approach. Due to some basic limitations of the standard internet protocol (TCP/IP) we experienced a very limited effective data transfer rate between Europe and Japan of only 0.4 Mbps. By using a technology called SkyX the deficiency of the standard protocol could be removed and the effective data transfer speed increased by a factor of 100 to 40 Mbps. This allows the efficient collaboration of the Design Offices at the various Joint Work Sites. This approach will also provide experience on the optimum network configuration for the future work between the ITER International Team and the future Domestic Agencies.

THIRTY-FIFTH MEETING OF THE FUSION POWER CO-ORDINATING COMMITTEE *)

by Dr. M. Seki, Chair

*) **Note to the readers**: *This report covers mainly the ITER-relevant issues of the FPCC Meeting Both the FPCC report and the presentation to the CERT addressed all current fusion development issues including the role of fusion in future energy scenarios, attractiveness, feasibility and cost of fusion power, the roadmap to the generation of fusion electricity, the ITER project and the nomination of Mr. Ikeda (Japan) as ITER Direct-General, the IFMIF projects, the European/Japanese Broader Approach to fusion energy, and finally the role of the IEA FPCC and Implementing Agreements.*

The Thirty-Fifth Meeting of the Fusion Power Co-ordinating Committee (FPCC) was held on 28 February – 1 March 2006 at the headquarters of the International Energy Agency (IEA) in Paris. The meeting was attended by 32 participants, chaired by Dr. M. Seki.

In his introductory remarks, the Chair briefly recalled the recent developments in the fusion programme, including the positive decision on ITER construction at the European site of Cadarache (France), the European-Japanese agreement on the Broader Approach, and India’s participation in the ITER project.

THE ROADMAP TO FUSION ENERGY FOLLOWING THE DECISION TO SITE ITER

Summary

1. The purpose of this paper is to update the CERT on recent developments in the international R&D programme on fusion technology with regard to the construction of the ITER facility and its implications for the activity of the IEA Fusion Power Co-ordinating Committee (FPCC) and the IEA fusion Implementing Agreements. The paper aims to address the request for information expressed at the CERT meeting on 18-19 October 2005 and is intended as a draft to stimulate comments by the CERT Delegates.

2. ITER is the first fusion experiment that produces up to 500 MW net thermal power output for long-standing pulses of hundreds of seconds, up to steady-state operation.

3. In June 2005, the participants in the ITER project, namely, China, the European Union, Japan, Korea, the Russian Federation and the United States, agreed to embark upon the construction of the 4.5 billion ITER facility and decided that the experimental reactor will be located at the European site of Cadarache, France. India joined ITER in December 2005 as a seventh party. Ambassador Kaname Ikeda (Japan) was designated as the ITER Director General Nominee and will begin his services on 1 March 2006. The preparation of the *ITER Agreement* was essentially completed at the latest negotiation meeting on December 1-7, 2005.

4. The FPCC and the IEA Implementing Agreements are active contributors to the ITER Accompanying programme, a cluster of multinational R&D activities and experiments in existing facilities that have been, and will be, supporting and complementing the ITER programme and paving the way to the step beyond ITER i.e., the

construction of the DEMO fusion power plant. In this context, Japan and the European Union are currently finalising the bi-lateral so-called *Broader Approach* programme. The IEA offers an important framework for these international collaborations in support of ITER and fusion in general.

5. According to the *Broader Approach,* the roadmap to the production of fusion electricity builds on four main pillars, the implementation of which could considerably accelerate the achievement of fusion power on a 30-year timescale:

— **The ITER programme will** demonstrate the feasibility of the fusion process by producing up to 500 MW fusion thermal power and by testing the basic physics and technology necessary to build a fusion power plant.
— **The current experimental work in existing facilities** such as JET, JT-60 and DIIID will continue to provide the knowledge base for ITER design optimisation and operation.
— **The technology programme** enables fusion technologies and systems to be developed and tested, including concepts and materials for a future DEMO power plant.
— **The DEMO power plant,** the step beyond ITER, is intended to finally integrate all the technical elements for electricity generation from fusion and demonstrate that it is economically attractive.

6. The fusion roadmap as well as the fusion R&D investment and the contribution of the FPCC and Implementing Agreements to the fusion programme, are highlighted in Annex 1.

Conclusions
The Committee on Energy Research and Technology accordingly is invited to adopt the following entry in its Conclusions:

"THE COMMITTEE ON ENERGY RESEARCH AND TECHNOLOGY
(i) noted the note by the Secretariat 'The Roadmap to Fusion Energy Following the Decision to Site ITER' [IEA/CERT(2006)6REV1], the importance of the ITER project for the international fusion programme, and the contribution of the FPCC and the related IEA Implementing Agreements to such a programme;
(ii) invited the FPCC to consider the CERT comments on the draft and recommended to submit the final paper to the IEA Governing Board".

He also recalled that at its meeting in October 2005, the IEA Committee on Energy Research and Technology (CERT) had invited the FPCC to report on the implications of the ITER construction for the international fusion roadmap and the FPCC activity. To meet the CERT request, the FPCC Chair and Vice-Chairs, in collaboration with the Secretariat, have prepared a short report "The Roadmap to Fusion Energy Following the Decision to Site ITER", for the summary of which and the conclusions please see the box above.

Mr Seki's presentation was very well received by the CERT members. The CERT Chairman, Mr G. Campbell, and many CERT delegates expressed deep appreciation for Mr. Seki's presentation with particular emphasis on the roadmap that made clear when fusion is expected to contribute to the electricity generation and the steps that are needed to achieve this target. Delegates' comments and questions concerned 1) the participation of non-IEA member countries (Russia, China and India) in the ITER project, 2) the uncertainty regarding the fusion energy cost estimates in the light of the internalization of the energy production external costs, 3) the role of the IFMIF project, 4) the role of the IEA Implementing Agreements, and 5) the energy policy implications of fusion energy.

After Mr. Seki's presentation, the FPCC delegates expressed a number of comments and considerations. Most of the discussion focussed on the fusion roadmap and the target of connecting a DEMO power plant to the electricity grid in some 30 years from now, the so-called fast-track that is the basis of the EU/JA Broader Approach. Delegates agreed that a fast track is absolutely necessary to get a DEMO power plant connected to the grid in some 30 years but most of them stressed that the target is very ambitious and needs considerable additional resources to be achieved. They agreed that the summary paper for the IEA Governing Board should provide the policy makers with a realistic message on fusion energy potential, schedule and resource needs. The Secretariat will try to summarise the outcome of this articulated discussion in a first-draft summary paper for the IEA Governing Board (GB) that will be circulated for comments to the FPCC members. The FPCC Delegates agreed that the summary paper for the GB should be complemented by a short publication/brochure with some more details on fusion energy, to be published by the IEA.

The Chairman invited the representatives of the ITER Parties, namely of the European Union, Japan and the United States of America (the Republic of Korea, the Russian Federation and India did not attend the 35th

FPCC meeting) to offer updates of the ongoing work in their countries to prepare for ITER construction and related activities.

Mr. Itakura, Director, Office of Fusion Energy, Ministry of Education, Science and Technology (MEXT), Japan, offered a comprehensive presentation on the Broader Approach (BA) Projects in Japan. According to the JA-EU Joint Paper of May 2005, the ITER Host Party and the non-Host Parties should contribute equally to the BA projects implemented in, and decided by, the non-Host Party. As a consequence, MEXT proposed to the EU candidate projects that are being discussed in the course of bilateral meetings to agree on details and cost sharing for implementation. The projects include:

1) the International Fusion Energy Research Centre (IFERC) with three projects,
   a) the ITER Remote Experimental Centre,
   b) the Computational Simulation Centre, and
   c) the DEMO Design Research and Development Coordination Centre;
2) the Satellite Tokamak realized by up-grading JT-60; and
3) IFMIF-EVEDA (Engineering Validation and Engineering Design Activities for the International Fusion Materials Irradiation Facility).

These projects will be implemented at the Japanese site of Rokkasho, with the JT-60 upgrade at the site of Naka. The Broader Approach activities will be open to all ITER Parties.

Mr Jacquinot , France, provided information on the ongoing work at the ITER site of Cadarache including

1) preparation for hosting the ITER construction and the ITER team;
2) creation of an ad-hoc ITER France Agency;
3) preparation for licensing aspects and for heavy-load transportation;
4) finalization in June 2006 of the public debate aimed at creating the social background for the public acceptance of the facility;
5) confirmation of the French national fusion R&D programme;
6) preparation of a network of national labs to contribute to the ITER project; and
7) the establishment of a Federation of national Universities and a Master in Fusion Science for education purposes.

Mr. Paidassi, EU, provided information on the ongoing activity at the European Commission for

1) the definition of the 7th Framework Programme including the ITER construction, accompanying activities, DEMO and the longer term activities;
2) the preparation of legal and administration instruments within the European Union to participate in the ITER project;
3) the installation of the EFDA team in Barcelona, Spain; and
4) the search for a proper candidate for the position of the Deputy ITER Director General, in charge of the construction of the facility.

Mr. Oktay, USA, presented the ongoing activities in the United States. The US ITER Project Office (USIPO), a partnership of national laboratories (ORNL and PPPL), is established to manage the hardware procurements, cash contributions, and staffing of the US members of the ITER team, The US Burning Plasma Organization (USBPO) is established to co-ordinate the US activities in support of science and technology R&D for ITER. The US budget for the ITER project is $ 1.122 billion of which $ 25 M appropriated in FY 2006, and $ 60 M requested for FY 2007. Most of the US fusion energy program elements such as major facilities (DIII-D, C-MOD, NSTX), small facilities at universities, advanced computing, plasma science and technology, and fusion materials can contribute to ITER project. Mr. Oktay also stressed the positive role of the IEA Agreements in a wide range of collaborations and topics relevant to ITER, as well as the role of the IAEA and the International Tokamak Physics Activity (ITPA), a major contributor to ITER Physics. He noted the recent technical completion of the ITER Agreement, and the satisfaction of the US fusion community with this progress.

Mr. Klinger, Germany, offered a presentation on the role of existing devices in on-job training forITER engineers and technologists. He said that a new generation of superconductive and long pulse devices (either in operation or under construction) is now emerging, and suggested that a new IEA Implementing Agreement may help focus on these key topics. He also stressed that the construction of these new devices requires specific know-how as well as experts who are not easy to be found on the current job market and that an international effort is required to train technical staff. An important role is played by the devices in operation or under construction such as the German stellarator facility Wendelstein 7-X. the facility already hosts engineers from EURATOM, CEA, ENEA for specific training oriented to ITER needs. This experience can be exploited by suitable programs such as the EURATOM ITER Training Fellowship.

The IAEA representative, Mr. Mank, presented the IAEA activities on fusion. He recalled the IAEA objective to strengthen worldwide cooperation on nuclear fusion and to support new and alternative fusion confinement concepts. He emphasized IAEA's role in fostering the ITER project, and the IAEA support to education and co-operation programmes with developing countries. He also recalled that the IAEA and its Director General Mr Mohamed El Baradei have been awarded with the 2005 Nobel Prize for Peace "for their efforts to prevent nuclear energy from being used for military purposes and to ensure that nuclear energy for peaceful purposes is used in the safest possible way". Mr. Mank announced the 21st IAEA Fusion Energy Conference to be held in Chengdu, China, on 16 – 21 October 2006.

Items to be considered for inclusion in the ITER ITA Newsletter should be submitted to C. Basaldella, ITER Office, IAEA, Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria, or Facsimile: +43 1 2633832, or e-mail: c.basaldella@iaea.org (phone +43 1 260026392).

Printed by the IAEA in Austria
May 2006

06-16331