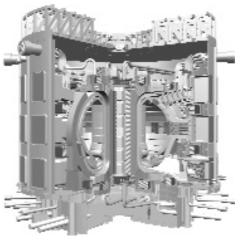

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A FAST TRACK APPROACH TO FUSION ENERGY

Editor's Note:

We see increasingly frequent references to a "Fast Track" approach to fusion energy and to the possible role of ITER in such a strategy. The term "Fast Track" has its origin in an initiative taken by the Belgian Presidency of the European Research Council last autumn to investigate whether it might be possible to accelerate the development of fusion, setting a goal of energy production with 20-30 years.

A top level Working Group chaired by Professor David King, Chief Scientific Adviser to the UK government, was charged to examine the question. With the permission of Professor King, the experts' conclusions, which were presented to the European Research Council in December 2001, are reproduced below.

Conclusions of the Fusion Fast Track Experts Meeting held on 27 November 2001 on the initiative of Mr. De Donnea, President of the Research Council

Experts participating in the meeting:

Prof. David KING (Chairman)
Prof. Angelo AIRAGHI
Prof. Harald BOLT
Dr. Joaquin CALVO
Mr. Bernard FROIS
Mr. Marcel GAUBE
Dr. Lars HÖGBERG
Mr. Gabriel MARBACH
Mr. Steven WALSGROVE

We examined a possible fast track towards fusion energy production with reference to the tentative roadmap elaborated in 2000 by the panel in charge of the assessment of the Euratom programme (see figure). This roadmap foresees three successive generations of devices, the Next Step (ITER in the international context), DEMO achieving net electricity production about 35 years after the decision to construct ITER, and PROTO. This would lead to the beginning of large-scale electricity production on a timescale of about 50 years. The roadmap also shows that the parallel development of appropriate fusion materials and the demonstration of the environmental and safety case supporting wide use of fusion power should be completed in time for DEMO.

We have reached the following conclusions on the topics listed in the mandate established by the Research Council Presidency. We would be happy to hold a second meeting on these issues if requested to do so by the Council Presidency.

1. The ITER project is the essential step towards energy production on a fast track. The engineering design has been finalized, and a modest upgrading could readily be achieved over the life of ITER, by fully exploiting the inherent flexibility of the present ITER design in demonstrating the technical feasibility of fusion power on a 20-30 year timescale. The tests of breeding and energy extraction blanket modules prototyping the full size blanket for DEMO should receive particular attention.

2. Future commercial systems are likely to be energy injected, and not self-sustained. Since the DEMO generation is energy-injected, current thinking is that in a fast track approach, the DEMO and PROTO generations could be combined into a single step that should be designed as a credible prototype for a

power producing fusion reactor, although in itself not fully technically and economically optimized. This would depend strongly on the development of adequate materials, as discussed in item 4 below.

3. The emphasis in the research work on ITER should be on demonstration of sustained fusion power production and extraction; ITER will serve as an enabling research machine regardless of the design of later commercial reactors. Within the EU fusion programme the fusion associations should concentrate on the accompanying R&D for ITER and plasma physics. Other European facilities such as stellerators and spherical tokamaks should address possible improvements of concepts and of designs for future reactors.

4 The mission of fusion materials science is to provide solutions for a sustainable, environmentally benign and economically attractive energy technology. In addition to the essential information provided by ITER on plasma facing materials an appropriate high-energy, high intensity neutron source such as the International Fusion Material Irradiation Facility (IFMIF) is required to test and verify material performance when subjected to extensive neutron irradiation of the type encountered in a fusion reactor. In a fast track approach, the detailed engineering design of IFMIF should be completed during FP6. Before that the irradiation test requirements should be examined to identify the extent to which relevant studies could be done on the neutron spallation sources available now and in the foreseeable future in Europe or elsewhere. In combination with such irradiation experiments, the theoretical modelling of radiation damage and of the structural evolution of materials is instrumental to the understanding and the control of underlying processes. Such material studies could also contribute to progress and innovation in other areas such as aeronautics and space, energy systems and advanced processing. Proper co-ordination with other EU programmes in materials research should be explored.

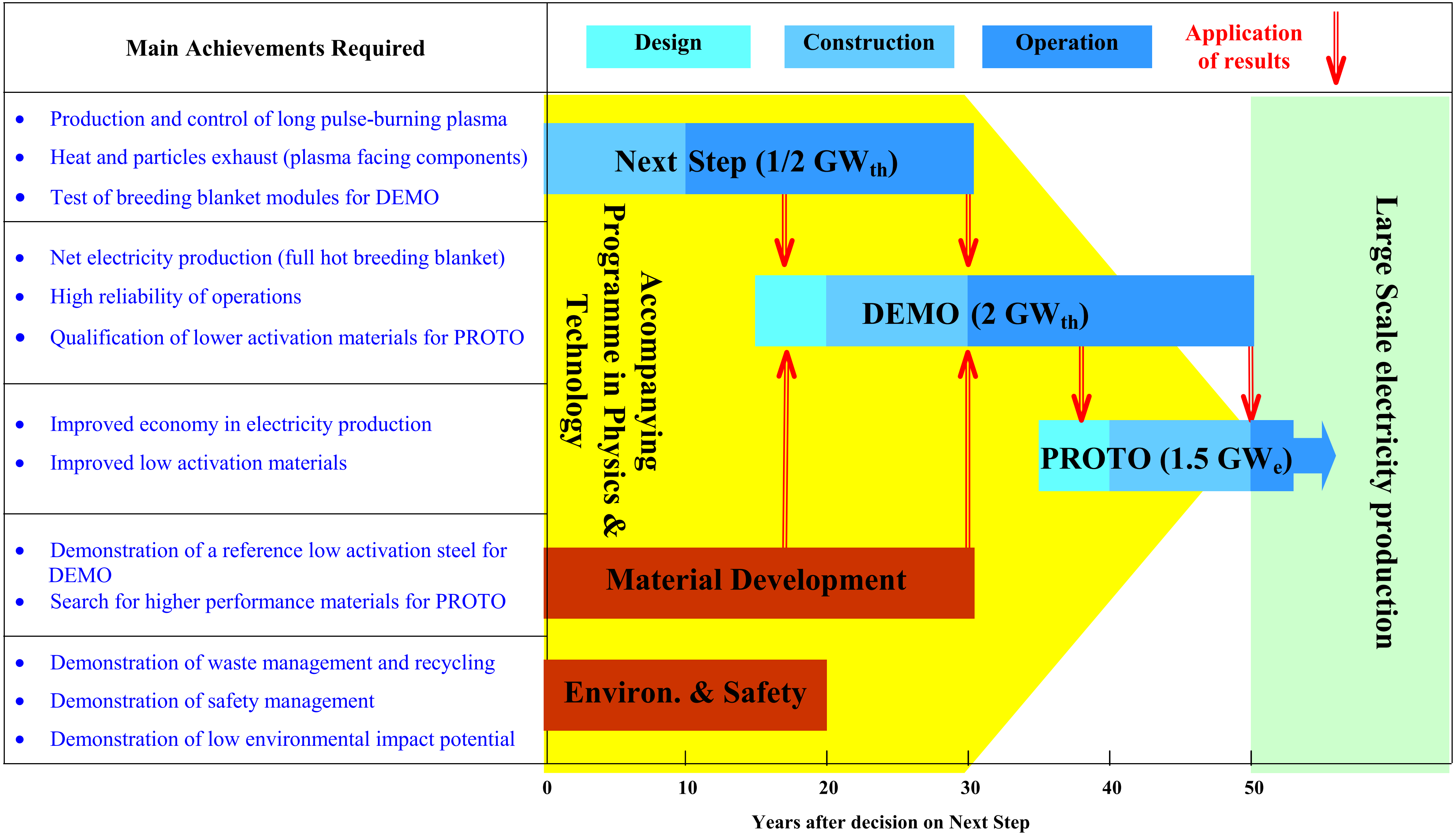
5. From the above it is concluded that the following elements are of key importance to achieve a faster track towards fusion energy production:
   - Construction of ITER should start as soon as is reasonably achievable. As a first step, the present mandate of negotiations with the EU international partners regarding the ways of establishing an ITER Legal Entity should be soon extended in order to address ITER cost sharing and site dependent issues.
   - The two major international ventures on fusion energy development, i.e. ITER and IFMIF should proceed in a co-ordinated way, with the realization of ITER starting in parallel with the detailed engineering design of IFMIF.
   - Regarding the use of existing fusion devices, mostly devoted to plasma physics, in particular the use of the JET facilities, it is important not to interrupt abruptly their programmes as long as they can efficiently continue to contribute to improving the knowledge base needed for the next steps and to developing the necessary experience in operating fusion machines. JET should be phased out progressively according to the schedule of ITER realization and to availability of financial resources.

   These elements of a faster track towards fusion energy production will require additional resources in the first leg of the track, in particular during FP6 and FP7, as more activities need to be carried out in parallel. Eventually the total amount of public funding to reach the long term objective could be reduced substantially if it proves possible to omit one generation of fusion devices. These additional resources for the first leg of the track should be sought also by expanding international collaboration. A clear lead from Europe could be expected to generate a positive response from both existing and potential ITER partners.

6. At the present stage of fusion energy research, industry is mostly involved through the construction of fusion devices and through its participation in the ITER design. From this point of view most of the financial resources required for the construction of ITER should go to industry. The role of industry in the engineering of fusion devices should grow significantly during the realization of ITER, and later of DEMO/PROTO. The direct involvement of the electricity producers, the utilities, should increase progressively along the route to energy production. However, in order to drive the programme most efficiently towards power production it will be important to harness the energies of individuals within the industrial communities including engineering companies, component manufacturers and electricity producers to assist in managing all the phases of the programme. The existing framework where utilities and industry can bring in their views on fusion energy research should extend further their activities in order to ensure that fusion developments meet industrial requirements for energy production.

Brussels, 5 December 2001

Tentative Roadmap of Achievements starting from the decision to construct the Next Step



Extracted from:
"Five Year Assessment Report related to the specific programme: Nuclear energy covering the period 1995-1999" June 2000

Dr. Peter Robert BARNARD

In memoriam

Dr. Peter Barnard, Chairman and Chief Executive Officer of Toronto-based Iter Canada, passed away on August 29 at Toronto's General Hospital, at age 64. He had been struggling with prostate cancer for the past four years, though those who knew him never noticed any decrease in his boundless energy and enthusiasm during those years.

His unwavering commitment to family, friends and his work never ceased. With strength, marvelled at by all, he continued to pursue his passions and his responsibilities. His was a selfless pursuit to put others first and to counsel numerous individuals and assist many varied groups in realizing their dreams.

Peter received his Ph.D. in Mechanical Sciences from Cambridge University, England, and was a graduate of the Advanced Management Program at Harvard University. He had a long and distinguished career in management and consulting, including a three year stint as Chairman of Ontario Hydro Technologies (1994-1997).

He was the driving force behind Iter Canada, a not-for-profit organization founded in 1997 for bringing to Canada the large international research and development project, ITER, with commercial fusion energy as its goal.

Due to his failing health, he missed the latest ITER Parties' negotiations session in France, but received a note from the Japanese delegation that read, in part, "The Japanese Delegation, which today presented their bid, is so much aware that the ITER process owes such a great deal to your dynamism, personal engagement and never ending optimism. All the more, we are finding it particularly sad that you are missing."

The words and implications of this sentiment are exemplary of Peter's influence on all and speak for all of us.

Items to be considered for inclusion in the ITER CTA Newsletter should be submitted to B. Kuvshinnikov, 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).

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