**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 in a time scale of about 50 years. The Roadmap also shows that the parallel development of appropriate fusion materials and the demonstration of 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 (see annex). 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 finalised, 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 optimised. This would depend strongly on the development of adequate materials, as discussed in 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 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 to which extent relevant studies could be done on 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 in 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 results 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 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 improve the knowledge base needed for the next steps and develop the necessary experience in operating fusion machines, JET should be phased out progressively according to the schedule of the ITER realization and to the 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 done in parallel. Eventually the total amount of public funding to reach the long-term objective could be reduced substantially if it proves possible to save one generation of fusion devices. These additional resources for the first leg of the track should be sought also by expanding the 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 is important to harness the energies of individuals within the industrial communities including engineering companies, component manufacturers and electricity producers to assist in managing all phases of the programme. The existing fora 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

**20.11.2001**

*Draft Mandate for Fusion Fast Track Working Group:*

***Mission***

Assess scope and ways of organising the programme with a view to producing a "fast track" roadmap for fusion, with the clear goal of energy production within 20-30 years.

***Terms of reference:***

- assess feasibility of fast track scenario enabling goal (including ITER) to be met and address corresponding fusion budget questions in and beyond FP6
- assess acceleration of materials work, with appropriate neutron source
- assess options for how to organise the EU programme involving industry/utilities to ensure that ITER and materials projects are as relevant as possible to the goal of energy production from fusion power within 20-30 years
- consider ways of maximising co-ordinated international activity on ITER and a neutron source for materials, including increased participation of third parties (e.g. US)

***Specific tasks for consideration at first meeting (with a view to interim report back to Council Presidency before Council of 10 December 2001):***

1. First assessment of a fast track schedule
2. Acceleration of materials work alongside work on ITER

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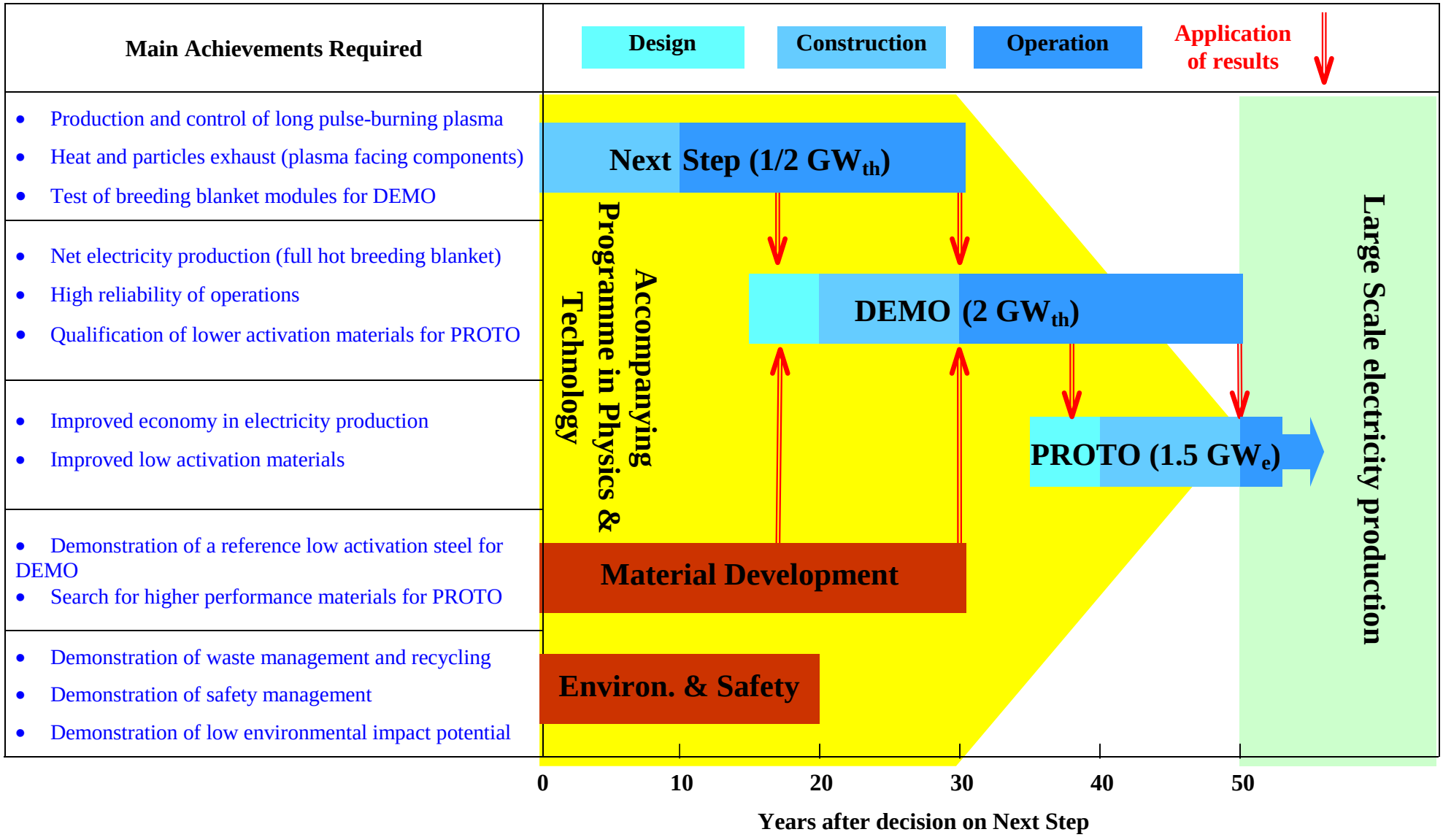
**Tentative Roadmap of Achievements starting from the decision to construct the Next Step**




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