

§9. Internationalization in Fusion Research – INTOR Workshop –

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A real international collaboration in fusion research for Japan started in the late 1970s via two independent routes. One is the United Nation's INTOR workshop, which was an international design activity for the next generation fusion device after the big tokamaks such as TFTR, JET and JT-60 under the auspices of IAEA (International Atomic Energy Agency). Another is the US-Japan collaboration program on energy researches, which was initiated by the Fukuda-Carter meeting in May 1977. Although the two international collaborations in fusion research started independently, they were strongly influenced by the US energy policy in the age just after the "Oil Shock" several years before. Detailed analysis will be left for future work. In this report, start-up processes of the INTOR workshop are described based on the NIFS FSA archives.

The construction or proposal of large tokamaks (TFTR, JET, JT-60, T-15) started in the middle of 1970s. In the same time, design study for the experimental reactor as a next step device had been promoted in each country. In Japan, for example, design activity for Fusion Experimental Reactor (FER) was carried out at Japan Atomic Energy Research Institute (JAERI). However, a roadmap to a commercial reactor was not clear yet in spite of its huge construction cost. D. Rose of MIT, USA proposed an international collaboration in the next phase fusion research. A meeting (so-called Rose meeting) was held at MIT on October 27-28, 1977. T. Hiraoka attended the meeting as a representative of the Director of JAERI. Based on the discussion at the meeting, D. Rose sent a letter to the Director General of IAEA to promote international collaboration in fusion research. The IAEA DG sent a letter (dated as January 17, 1978) to the members of International Fusion Research Council (IFRC) asking for a comment to the Rose's proposal. USSR was most active and immediately proposed a construction of next generation Tokamak device under the international framework in March. At the IFRC meeting in May 10-12, 1978, a decision was made to establish a "Sub-Committee Meeting on International Fusion Collaboration", in which K. Husimi attended as a Japanese representative. The sub-committee meeting was held in June for discussion, especially on the Soviet proposal, when S. Mori from JAERI attended as a representative of K. Husimi. The chairperson was R. S. Pease (UK), and H. Kakihana attended from IAEA as the Deputy Director General. It was recommended to set up a periodic workshop.

At the sub-committee meeting, it was proposed that either Japan or USA should be a chair country. The topic was discussed at the Atomic Energy Commission's

Advisory Committee on Nuclear Fusion, Japan (Kakuyugo Kaigi). K. Husimi pointed S. Mori to be a chairperson. The 10th IFRC meeting on August 21-22, the decision at sub-committee meeting was approved. R. S. Pease, as a chairperson of IFRC, sent a telex (dated as September 14, 1978) to S. Mori to be a chairperson of the workshop. Then the IAEA Director General approved the Zero Phase Workshop, which did not commit machine construction, in September. Finally S. Mori was pointed as a chairperson, and thus Japan became the chair country. It was an epoch-making event in this age that a Japanese took a leadership for the international big project.

The first steering committee meeting was held in November 20-23. The members were W. M. Stacy, Jr. (USA), B. B. Kadomtsev (USSR), G. Grieger (EC), and S. Mori (Japan). The tokamak reactor that would be the subject of the examination had been designated the United Nations International Tokamak Reactor (UNITOR). The steering committee agreed that the first priority was the crystallization of the technical objectives and characteristics of the proposed apparatus. The final workshop report was requested to include:

1. Assessment of the plasma physics and technological bases for the design of such a device.
2. Identification of the objectives.
3. Recommendation of a reactor concept.
4. Identification of major uncertainties that must be solved before the construction.
5. Identification of the resource requirements and schedule.
6. Technical and scientific feasibility of constructing such a device in the late 1980s or early 1990s.

Later, the name of the machine was changed to INTOR (International Tokamak Reactor).

The first workshop started in December. Four Japanese, S. Mori, T. Hiraoka, S. Sako, T. Tajima, attended the workshop. The workshop was held four times in a year with two-week intensive work for each time. Much homework had been carried back to each home country, where many researchers contributed to solve the issues for the next workshop. A year later, a final report for the Zero Phase Workshop was published, suggesting a necessity to continue the international collaboration as a Definition Phase (later, it is called Phase One workshop). The suggested major parameters were, Major radius of 5.2 m and minor radius of 1.3 m with elongation k of 1.6.

Finally the INTOR workshop continued for 10 years till 1988. S. Mori took a leadership for all these periods. The design parameters had been changed step by step, but the machine size was kept compact in all the period, which was the principal policy of the steering committee. They thought that the size and thus the cost of the machine have to be limited from the viewpoint of commercial purpose. It is important to note that the workshop activity became a base of the international collaboration framework in fusion research such as the ITER project, although the INTOR machine itself was not constructed. (NIFS10KVXP002)