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The Ignition Physics Study Group*

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In the U.S. magnetic fusion program there have been relatively few standing committees of experts, with the mandate to review a particular sub-area on a continuing basis. Generally, ad hoc committees of experts have been assembled to advise on a particular issue. There has been a lack of broad, systematic and continuing review and analysis, combining the wisdom of experts in the field, in support of decision making. One consequence of this lack of discussion was the negative community response to the TFCX proposals. The creation of MFAC was the first step to improving the quality of debate, in terms of the continuity and breadth of such discussions.

In 1985 the Office of Fusion Energy took a further step towards solving some of these communications problems, by proposing the Ignition Physics Study Group (IPSG) to support the Compact Ignition Tokamak (CIT) design studies. The principle OFE staff involved have been Dave Nelson and Walt Sadowski (APP), Curt Bolton, Steve Eckstrand, Tommy James, and John Willis (Confinement), and Phil Stone (D&T). The IPSG complements the Technical Planning Activity (TPA), headed by Charlie Baker of Argonne National Laboratory, which was established earlier, with the additional task of providing an analysis of the total program, and through the analysis, a methodology to aid in planning.

I was particularly pleased to be asked to set up this activity because of previous rewarding experiences in a similar situation in the European program, which I will comment on later. To provide broad support to the CIT, the IPSG was divided into three main activities: Theory, coordinated by Harold Weitzner, New York University; Experiment, coordinated by Ron Stambaugh, GA Technologies; and Computer Modeling, coordinated by Doug Post, Princeton Plasma Physics Laboratory. Group leaders were found for each area of an activity, see the table. During the first eighteen months the IPSG supported the CIT effort, responding to requests of OFE and the ITOC steering committee, chaired by Harold Furth, for data bases and community assessments of tokamak behavior and operating limits. In each group a review was made of the status of its area and an analysis was presented. Significant contributions were made on alpha physics, diagnostics, startup, beta and safety factor limits, density limits, transport, scrape-off layer characteristics, and ion cyclotron heating. With the establishment of a strong physics team on the CIT, the emphasis has changed to supplementing their work, while providing comparable support to the new Engineering Test Reactor (ETR) initiative and its ETOC steering committee, chaired by Ken Fowler.

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During its first year the IPSG activity expanded to include collaboration with foreign laboratories. These interactions, notably with the Garching Asdex group, the JET group, and the JAERI and Monbusho tokamak programs, have been most rewarding. The IPSG workshops and analyses complement the bilateral discussions, increasing the depth and breadth of the exchanges of information. For example, through this collaboration, it was possible to assemble, on short notice, a detailed summary and analysis of the European, Japanese, and U.S. plans for ion cyclotron heating. This is important for establishing whether the data base for the CIT can be obtained in a timely fashion. A similar assessment is planned for current drive in support of the ETR and the ongoing U.S. program.

There is an interesting parallel to the European fusion program in which, during the 1970's, there were advisory committees for each area – tokamaks, mirrors, heating and fueling, etc. The committees reviewed their respective areas on a continuing basis, and provided information to the Euratom Fusion governing committee, the Group de Liaison, to assist in decision making. These advisory committees were important for two reasons: they were a forum for experts to discuss the status of an area, review future plans, and thereby influence the longer term program; and the regular meetings were a way to break down the barriers between the laboratories, encourage collaboration, and maximize the use of the limited resources. I was fortunate to have been the JET representative on the Heating and Fueling Advisory Group. It was a valuable education. In the early days, while it was the case that the neutral injection experts were at odds with the RF heating experts, such disagreements were a minor affair compared to the skirmishes between the positive and negative ion experts, and between the ion cyclotron and lower hybrid afficionados. In turn, this combat was insignificant in comparison to the holy war between the various lower hybrid factions. It was suggested that if there were a modest length wall, which carried a frequency scale from zero to 100 gigahertz, and all of the fusion RF experts in Europe were asked to line up by their preferred frequency, none would have been able to touch hands.

However, after the group had been meeting for some years, typically four times a year – reluctantly travelling to Paris, Rome, Oxford, Munich, Aaachen, Stockholm, and Grenoble, to be liberally oiled by the host laboratory in gourmet restaurants, and out of courtesy forcing down large quantities of the local brew – the friction was reduced to such a low level that significant contributions were made to streamlining the European program. The JET project, which earlier had emerged from similar discussions in the tokamak committee, was a significant unifying factor, providing a focus for multi-national programs in heating and fueling.

In the European system the various components were described, irreverently, by a past chairman of my advisory group as falling into two categories – Church and State. Within each category there was its own set of governing bodies:

CHURCH		STATE
European Parliament	↔	National Governments
Euratom	↔	Atomic Energy Commissions
Groupe de Liaison	↔	Committee of Directors
Advisory Groups	↔	Laboratory Scientific Committees

By analogy, Doe would be classified as Church, while the national laboratories, universities, and industry would be the States, hence,

CHURCH		STATE
OFE Committee of Directors	↔	Laboratory Management
MFAC	↔	Laboratory Fusion Program Management
?	↔	Laboratory Fusion Scientific Committees

but until the initiation of the TPA and the IPSG there were few Church equivalents of the scientific committees of the individual laboratories.

The IPSG provides one forum for the systematic discussion of fusion science, complementing the other exchanges of information, and providing a most important continuity in this critical area. In a similar manner to the European program, this continuity of discussion and the focus provided by a national effort (CIT) and international effort (ETR) are helping to lower those barriers which previously were an impediment to rational debate.

IGNITION PHYSICS STUDY GROUP
ORGANIZATION CHART
(MARCH 1987)

IPSG

CHAIRMAN	J. SHEFFIELD (ORNL)
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ION TRANSPORT - EXPERIMENT	K. BURRELL (GAT)
ELECTRON TRANSPORT - THEORY	(P. LIEWER [CAL. TECH]) - D. ROSS (U. TEXAS)
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BETA LIMITS	R. STAMBAUGH (GAT)
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ROTATION/ELECTRIC FIELD	S. SCOTT (PPPL)
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SYNCHROTRON RADIATION	D. POŠT (PPPL)
BOUNDARY PHYSICS	N. OHYABU (GAT)
IMPURITY CONTROL	M. PETRAVIC (PPPL)
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