BACKGROUND

Controlled fusion (the fusing of the isotopes of hydrogen so as to convert mass into energy) has in recent years become the most vigorously pursued new energy concept. The worldwide effort devoted to fusion research and development exceeded one billion dollars in 1977 and is currently approaching an annual expenditure of 2 billion dollars. The current budget for fusion R & D in the United States is of the order of $700 million; a large effort is proceeding in the USSR and very significant programs are funded as well in Japan and the European Community through Euratom. (Sweden, Switzerland, Netherlands, Belgium and Denmark are all active in the European program.) Smaller nations such as Australia, South Africa, Spain, Brazil, and Argentina are also becoming involved.

The reasons for this high degree of effort is that controlled fusion holds forth the promise of an inexhaustible energy supply from a universally available fuel (deuterium) with a process which is relatively harmless to the environment compared to other energy technologies. A more detailed description of the fusion process is attached in Appendix A.

The international effort is pursuing, in parallel, two major approaches. One approach is through the use of magnetic fields to confine the reaction and external heating techniques to achieve the required temperatures. The leading contenders in this class are the Tokamak and the magnetic mirror. The other approach, inertial confinement, is based on the rapid delivery of energy to the fuel so as to initiate the reaction before instabilities become important. The laser is the leading technique for the rapid delivery of the required initiating energy although experiments with electron beams and ion beams are also in progress. In addition, a number of major technology programs aimed at special requirements - material properties, tritium handling, superconducting magnets, neutral beam and radio frequency heating systems, etc. are very active.

Steady progress has been made in controlled fusion experiments and it is confidently expected that conditions for net energy production will be demonstrated by 1982 in facilities currently nearing completion. For example, in an experiment at Princeton, N.J., during the summer of 1978, temperatures in excess of 60 million degrees, well above that required for ignition of the fusion reaction, were obtained. There appears to be little doubt that all the necessary conditions for energy production will be achieved in the American Tokamak Fusion Test Reactor (TFTR) scheduled to start operation in 1981 and in other major facilities now under construction in Western Europe, the Soviet Union and Japan.

With the problem of confinement and heating essentially resolved in facilities now under construction, the emphasis in the International Fusion Program is shifting from research to engineering and technology. Recent thought in international circles has been directed to cooperative efforts which might lead to an earlier initiation of the power producing phase of the fusion program than if individual countries were to proceed on their own. A group with representatives from the USA, USSR, Japan and Euratom,