I hardly need to point out to this audience that these performance criteria pose enormous physical problems. No container material can withstand temperatures of the kind cited, and the density of the plasma actually represents a vacuum. Under these fantastic conditions, means must be provided for introducing the reactants and removing the energy produced. The most promising way at the moment to achieve these objectives is to heat and confine the plasma (without any contact with the walls of the container) by means of strong magnetic fields.

Many kinds of devices have been constructed throughout the world to study plasma confinement. In the United States the AEC is sponsoring major experimental work at Lawrence Radiation Laboratory, Los Alamos Scientific Laboratory, Oak Ridge National Laboratory, Princeton Plasma Physics Laboratory, Massachusetts Institute of Technology, the University of Wisconsin, and Gulf General Atomic Incorporated. This work is currently being budgeted at about $28 million annually. On a worldwide basis, over $150 million annually is being invested in fusion research, principally in Great Britain and the USSR, with the Soviet Union having the most manpower and money devoted to this effort.

What progress have we made in reaching the criteria for controlled fusion? Figure 1 gives an idea of where we stand today as to temperature, density, and confinement time in comparison to our goals. As the figure shows, the target values for these three criteria are roughly 100 million degrees Kelvin, 10^{15} ions per cubic centimeter, and one second or so, respectively.

There is a permissible trade-off between confinement time and ion density, in that the product of these two numbers should be about 10^{14} and each number can be varied accordingly. We can see that, although individual U.S. or British fusion devices have attained at least one of the desired performance criteria, the USSR Tokomak T-3 device has the best overall performance—so good that the U.S. program is being revised radically to take advantage of the successes of the Russian work. These recent international advances have given the scientists and engineers involved in controlled fusion the feeling that at last they are off a plateau of progress and that they will now move with increased speed toward the full attainment of their goals. Obviously the difficulty that