**Letter to the Academy of Sciences on Fusion Review.**

The US fusion program needs a new experiment to augment the available experimental facilities. Such new experiment could well be the mirror. Mirror research would permit the US program to play a leadership role.

The world’s magnetic fusion program is dominated by toroidal devices. This is a historical accident. In the late 60s the Kurchatov tokamak T-3 produced breakthrough results that included achieving 1 KeV electron temperature. The consequence was a proliferation of tokamaks around the world, culminating in ITER.

While toroidal devices are valuable research tools in the physics of fusion plasmas, their complex geometry makes the replacement of the first wall a lengthy and complicated process. Unless materials can be developed that can survive 14 MeV neutron fluxes of megawatts per square meter for decades, toroidal devices are not viable as commercial reactors. This is where the mirror comes in.

In the last 10 years the Budker Institute has developed the Gas Dynamic Trap mirror to the point that it has recently duplicated the original T-3 results of 1 KeV. This performance has opened another option for fusion power in the linear mirror. Its linear geometry makes the replacement of the first wall a comparatively simple matter. Because of this, the mirror has an important role to play in the development of a commercial fusion reactor. In the short range, the mirror can be an important neutron source for materials studies of the first wall, as well as a source of high power plasmas for plasma wall interaction studies. The Russians have shown that a simple extrapolation of the 1 KeV results leads to a GDT- based source capable of a neutron flux of several megawatts per square meter. This is enough to test first wall materials and blanket components. Because of its modest size, consumption of tritium is small.

At the present time US supplies research personnel to fusion programs in other countries, but not to the Budker Institute where the GDT is located. By establishing a modest mirror program in the US and collaborating with the Budker Institute on the Gas Dynamic Trap, the United States has an opportunity to reclaim its role as one of the leaders in the development of a practical magnetic fusion reactor.

Walter L. Sadowski, Chief, Fusion Theory Branch, retired, Office of Fusion Energy Sciences, US Department of Energy