Nuclear Research

Fusion power to propel space travel

by Dr. Friedwardt Winterberg

The EIR *is happy to be able to present in this column an excerpt from an address given last month at a Fusion Energy Foundation conference in Los Angeles by Dr. Friedwardt Winterberg, a pioneer in America's inertial confinement fusion program. Dr. Winterberg is noted for his revolutionary approach to pellet design for inertial confinement fusion systems.*

There have been four great technical breakthroughs accomplished in this century. Three have been already accomplished, the fourth will be accomplished, and probably in this decade. The first of these great breakthroughs was, of course, manned flight; the second was the discovery of fission and nuclear energy; the third breakthrough was the landing of a man on the Moon—the accomplishment of the Apollo Project.

The last great breakthrough of this century—at least the last one we can foresee (we do not know yet, there may be another force coming)—is the breakthrough toward fusion power, which will come, I would say, not later than 1985.

This breakthrough will allow for the abundant and cheap production of electricity.

But power generation is only one side of fusion. The other side is its significance to space flight.

What is the great problem we face today as far as space flight is concerned? As the Apollo Program has shown, we are now able to land man on another planet in the solar system. However, we cannot do so with a very large payload—and the Moon, which is like a small planet, is very nearby to us.

Now if we were to go to Mars with chemical propulsion, then you would be confronted with some very tremendous problems. It could not be accomplished in the matter of days or a week, as in the case of the Apollo Program; it would take years. . . . That is very risky.

With chemical propulsion, therefore, I would say that going beyond the Moon is not possible for man, but only for unmanned probes.

As we know from rocket theory, you can increase the rocket velocity to as much as three times more than the exhaust velocity if you have a multistage rocket. But you cannot increase it substantially. To escape the gravity of the Earth you must attain a rocket velocity of about 12 kilometers per second (7.5 miles per second). So, if you have a multistage rocket in which each stage can attain about three kilometers per second, you put four or five stages on top of each other, you can escape the Earth's gravity field and head for the Moon. So chemical propulsion suffices to get free of the earth—because you need a relatively low velocity.

However, the most you can attain with rocket propulsion is a speed of 10 to 20 kilometers per second. This may seem very fast when you think of traveling at such a speed, tens of miles per second. But this is not a speed that can permit us to travel to Mars, say, in a time which is less than the order of years—which is a long time.

Of course, the trick in getting to Mars in a short time, maybe only a matter of weeks, is to use a higher exhaust velocity. You must obtain a level of propulsion, which only a fuel with a much higher combustion temperature can produce.

The answer is thermonuclear. In a thermonuclear reaction, the temperatures are not a few thousand degrees, as in a chemical combustion; they are millions of degrees, a hundred million degrees typically.

Then, we get an exhaust velocity not of a few kilometers per second but a few thousand kilometers per second.

That is, the rocket can attain, with the same payload, thousands of times larger velocities.

The kind of fusion reaction with which our fusion rocket would be propelled will consist of many little explosions, like many miniature hydrogen bombs. For example, one of the fusion concepts, inertial fusion, uses laser beams to ignite a small hydrogen bomb, so small that you can confine it in a container for power production. Magnetic fusion, for reasons I shall not go into, is not very suitable for rocket propulsion. Inertial confinement fusion, however, is ideally suited for these purposes.

In inertial confinement propulsion, beams of particles ignite fuel pellets, each pellet perhaps the size of an aspirin tablet. But as it explodes, it will typically produce the energy equivalent of 10 tons of TNT. These pellets will be ignited, say, every second. Their fireball will be reflected as exhaust by a magnetic mirror, and the spacecraft will be propelled.

The idea of this kind of rocket propulsion has a long history. First the idea of propelling a rocket by a sequence of explosions of some type is itself very old.

And it was very typical that after fission was discovered, some Los Alamos scientists pointed out that one could in fact propel a rocket by a sequence of exploding atomic bombs. This was extensively studied under the name of Project Orion, but it was eventually abandoned, because the idea seemed unworkable and to some too risky given the state of technology, at that time.