GEORGIA TECH RESEARCH

News Release
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GEORGIA TECH PROFESSOR HEADS
U.S. FUSION RESEARCH TEAM

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For Immediate Release

ATLANTA, Ga. - By the mid-1990's, an experimental power plant could be producing nuclear energy by joining atoms instead of splitting them.

This is the assessment of a Georgia Tech nuclear engineering professor who heads an American team of scientists working to make nuclear fusion a reality.

"The promise of this technology is that it may be able to generate electricity economically with a fuel source which is practically limitless," says Dr. Weston Stacey Jr. of Georgia Tech. "The problem is that the project is immensely complex and expensive. That's why the United States is working with Japan, the Soviet Union and the European Community nations to develop fusion."

This group of scientists is investigating the feasibility of a reactor which joins atoms of "heavy hydrogen," known as tritium and deuterium. If they can be fused, the resulting new atom will be so unstable that it will disintegrate, releasing energy. In contrast, today's nuclear power plants rely on fission, a process which produces power by splitting uranium atoms.

Finding a way to fuse tritium and deuterium in a reactor has been one of the greatest challenges in scientific history. Both atoms are positively charged, a characteristic which makes it hard to get them close enough to be joined. Scientists believe that these atoms must approach each other at high speed to accomplish fusion. To get tritium and deuterium moving fast enough for this to happen, the reactor chamber must contain a deuterium-tritium gas which is about 100 million degrees centigrade, a temperature hotter than the sun.

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The heat and radiation of this gas (called a plasma) will create a major problem for the designers of the first fusion reactor. If the gases were to touch a wall of a reactor, they would scorch it and cool off so much that further fusion would be impossible.

"Recent experiments have given us reason to believe plasmas can be successfully heated and confined," Stacey says. "We intend to contain the gases with magnetic fields. The reactor will be doughnut-shaped and the magnetic forces will keep the plasma moving in a circle, without touching the containment walls. Construction of the necessary large electromagnets will be a major technical challenge."

Scientists do not view fusion as a cure-all for the world's energy problems but as one of a limited number of sources to be tapped as fossil fuel reserves run dry. Hydrogen is one of the earth's most common elements and the cost of tritium and deuterium should be small. This factor is offset by the substantial expense required for building and maintaining a fusion reactor. Nevertheless, Stacey believes that the overall cost of fusion-generated electricity could be comparable to the cost of electric power produced by coal and nuclear fission systems in the early 21st Century.

Fusion and fission have one advantage over coal in that neither pollute the air as a matter of course. Both generate radioactive wastes, but those produced through fusion are shorter-lived. It is too early to tell whether one fusion plant would be more or less subject to minor malfunctions than a conventional nuclear power plant, since the fusion reactor design is still in a conceptual stage. However, a fusion reactor would have certain inherent safety advantages; for example, the nuclear reaction could not conceivably be reinitiated after an accident, as is hypothetically possible for fission reactors.

The pricetag for developing an experimental fusion reactor will be around $15 to $20 billion, taking into account the cost of research and development as well as the cost of the reactor. However, that cost won't be borne totally by the United States if its scientific collaboration with other nations continues. The joint effort is known as INTOR, an acronym which stands for International Tokamak Reactor. This organization's work is sponsored by the International Atomic Energy Agency under the auspices of the United Nations. Representatives of the participating nations meet in Vienna, Austria, four times a year to share their findings and chart future directions for research.

Each member country simultaneously maintains an independently-operating effort to design an experimental reactor, and Stacey heads the team of scientists and engineers investigating critical fusion issues as part of the United States program known as FED -- for Fusion Engineering Device. The FED work is proceeding on a similar course to INTOR's.

So far, INTOR has focused on technical feasibility studies. The group has developed conceptual designs of a Tokamak reactor and currently is refining its plans.

"After working together for three years, we have a high degree of confidence that fusion is scientifically feasible," says Stacey. "Most of the people involved in this research also believe we can build a reactor which can accommodate the high temperatures and other conditions required for fusion. It's really only the commercial feasibility of fusion which is in question at this point, and that looks reasonably promising."

Later this year, the INTOR group will complete its conceptual design work and determine whether a reactor is feasible, a prospect which now appears likely. At that stage, political leaders from the United States, Japan, the Soviet Union and the European Community nations will decide whether to continue their partnership and design the reactor together. Stacey expects that the technological basis for building a working reactor can be established by the mid-1980's. If the collaboration ends, each country will proceed with its own fusion research program.

"Whether INTOR goes on with its work or not, it's been an incredibly valuable experience for American scientists to build on," he says. "It's offered us a wonderful way to learn because of the breadth of ideas we've been exposed to and the critical scrutiny our ideas have been subjected to."

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