Texas University To Build First Nuclear HTR Research Reactor!

by Marjorie Mazel Hecht

The first U.S. fourth-generation nuclear reactor will be built at the University of Texas of the Permian Basin as a teaching and test facility, according to an agreement signed on Feb. 22 between General Atomics and the University. The GT-MHR is a modular high-temperature gas-cooled reactor, which uses a direct-conversion cycle that is 50% more efficient than the conventional nuclear steam cycles in producing electricity. (The initials stand for Gas-Turbine Modular Helium Reactor.)

In the GT-MHR, the high-temperature heat created by nuclear fission is conveyed by the helium gas to directly turn a turbine that produces electricity. The GT-MHR is similar to the South African Pebble Bed Modular Reactor. The difference is that the GT-MHR has its fuel particles stacked in rods arranged in a prismatic core, instead of the tennis-ball-size fuel pebbles of the PBMR. The GT-MHR and the PBMR both have the same passive safety systems that automatically shut down the reactors, without human intervention, if there are any problems.

The University and General Atomics, along with local county participants and the company Thorium Power, have already started work on a pre-conceptual design (an initial study) for the project, which is expected to take six months. The project is named HT^3R, and pronounced "heater," which stands for high-temperature teaching and test reactor. If all goes according to plan, the HT^3R should be operating in six years—2012. It will be a 10- to 25-megawatt-thermal reactor, depending on the determination of the pre-conceptual design study.

HT^3R is important not just for West Texas, but nationally and internationally, because it will be a teaching and research facility to train a new generation of engineers and scientists in nuclear technologies. It will carry out testing and development of gas turbines, materials, fuel cycles (such as thorium), and will also demonstrate the feasibility of using the 950°C high heat for applications such as hydrogen production and desalination.

A West Texas Nuclear Park

The University is located in Andrews County near Odessa, an area that is the country's largest onshore oil and gas production center—the Permian Basin. The local communities are fully behind the project, and are thinking of it as part of what will become a West Texas Nuclear Park. There is already a low-level nuclear waste facility in the area, and a uranium enrichment plant is soon to be licensed nearby in New Mexico, on the border.

"We want to help lead the country and the world into the hydrogen economy," project manager Dr. James Wright said in a press statement. "Japan and China are the only countries in the world with high-temperature helium-cooled test reactors, and each is working to generate hydrogen from such systems as an alternative energy source."

How the project came about, and what its vision is, were described by Wright in an interview for the Spring 2006 *21st Century Science & Technology* magazine. Wright stressed the strong local support for the project: The communities of Midland, Odessa, and Andrews County each donated $500,000 for the pre-conceptual design study; and local philanthropists and institutions, including the Rural Electric Company, have put up another $250,000.

As for the funding for the construction of the project, Wright told *21st Century:* "We are going to seek funding in several places in the Federal government, but we expect probably a third of this to be financed by private sources—non-Federal-governmental sources. The state of Texas and the communities here have already demonstrated that they're real proponents of this technology. We've already anteed-up $3 million. There's no other area of the country that has said that we believe that this is so important that we're going to put $3 million into it. . . .

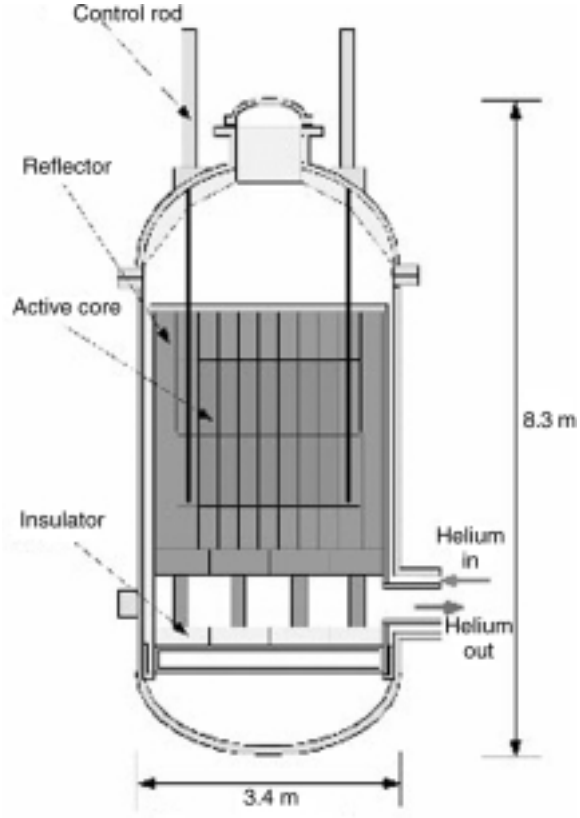
"I can't say enough about any of the citizens here in West Texas, because they put their money where their mouth is. Rather than 'not in my backyard,' they say, 'We'll pay you to come to our backyard.' So the communities here are really unique."

The Need for Nuclear

In the interview, Wright reviewed the dire energy situation in the United States, and the need for nuclear power. "By 2040," he said, "our current nuclear plants will be decommissioned, and nuclear capacity is about 20% of our electricity. Furthermore, by 2040, an additional 26% will be decommissioned from coal and gas-fired plants. What people don't understand is that all these plants have a finite lifetime, and we're not going to be able to afford to put in all these coal and gas plants. We're going to have to put in a lot more than that 20%

FIGURE 1

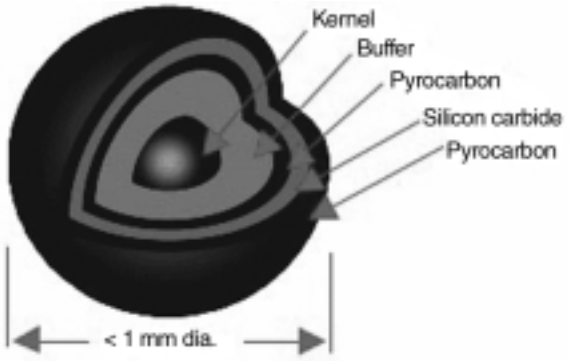
The GT-MHR University Research Reactor Schematic



The GT-MHR University Research Reactor design has the same characteristics as the full-scale reactor: It uses a helium coolant, a graphite moderator, tiny ceramic-coated fuel particles, and the same passive safety characteristics. The fuel particles are stacked in vertical rods, which are arranged in hexagonal graphite blocks in the reactor core. The core is all ceramic, which permits very high temperature operating conditions. No meltdown is possible.

FIGURE 2

Coated Particle Fuel for the GT-MHR



Source: Illustrations courtesy of General Atomics.

The outer layers of the fuel particle are ceramics, which provide "containment" for the nuclear fuel at the center. The temperature limit of the coating is higher than the temperature that can be achieved by the fuel particle, even in the most severe accident conditions. No fission products can be released.

Note that the diameter of the particle is just 1 mm.

nuclear; we're going to have to put in 30 to 40% nuclear to keep the cost down. . . . By using high-temperature plants, you have a higher efficiency, so actually you need to build less thermal capacity in order to get the same electrical capacity."

The U.S. energy plan includes building a high-temperature reactor at the Idaho National Laboratory, which would be coupled with hydrogen production, but the program is still in the idea stage. The HT^3R will be a "little brother" to whatever reactor design is eventually built, providing research and development experience.

General Atomics has another GT-MHR project in Russia, now in an engineering stage, to build a full-size prototype reactor that will burn weapons plutonium. It could also be up and running in six years, if the funding were available. General Atomics also recently announced a joint research program with the Korea Atomic Energy Research Institute for the production of hydrogen using helium-cooled reactors.

The enthusiasm for the West Texas project should spur other U.S. universities to look ahead to a nuclear renaissance and reopen the research reactors that were shut down under anti-nuclear pressure in the past two decades, or even better, to build new fourth-generation reactors to train the engineers and scientists the country will need.

Read More About 4th-Generation Reactors

- **South Africa's PBMR Ready To Power an Industrial Take-Off**

  Jonathan Tennebaum reports on an international conference in London to discuss the fantastic economic potential worldwide of South Africa's Pebble Bed Nuclear Reactor.

  EIR, Feb. 10, 2006

- **Inside the Fourth-Generation Reactors**

  Marjorie Mazel Hecht reports on how the modular high-temperature reactors work, with profiles of both the General Atomics GT-MHR and the South African PBMR.

  21st Century Science & Technology, Spring 2001