

researchers on loan from the U.S. military and visiting scientists. The unit has also struggled to maintain grant support, especially as a shrinking defense budget has squeezed funding for arbovirus research.

In addition, says Monath, "it has been difficult for Shope to sustain strong support for this effort within his own department." U.S. Army hantavirus researcher Connie Schmaljohn describes the situation more bluntly: "The people above them just didn't recognize their value," she says. "Half the higher level administrators didn't know it existed." A Yale spokesperson disputes that charge, saying that the university "has been supportive of the unit for 30 years." Recent instability at the Department of Epidemiology and Public Health, which oversees the unit, has aggravated the situation, according to several sources.

YARU, which operates mostly on grants from the National Institutes of Health (NIH), the U.S. Army, and the World Health Organization (WHO) that totaled about \$2 million in 1993, houses some 450 virus cultures, as well as reagents, antibodies, and antigens for studying arboviruses. In addition to Shope and Tesh, the lab employs three investigators who will not be moving to Galveston. A lot of history will be going with it. Begun with a grant from the Rockefeller Foundation, YARU has "a long, glorious history," notes Meegan. "It has been at the front line [of infectious disease research] for 30 years."

The unit's most recent media splash, however, was an embarrassment. In August, visiting scientist Jean-Paul Gonzalez didn't report that he had broken a vial of the dangerous Sabia virus until 12 days after he showed symptoms of the disease. Gonzalez has recovered, and a CDC report on the accident is due out this month. But the origins of the move to Galveston predate this incident, say Texas officials, who began negotiating with Tesh last year.

Galveston sought the Yale unit to bolster its new Center for Tropical Diseases, opened last year with help from the Texas-based Kleberg Foundation. The center, part of WHO's network of tropical disease centers, will focus on intracellular diseases, particularly in Latin America. The YARU recruits will help "expand the depth of the center" and build international collaborations, says Assistant Director Michael McGinnis.

Tesh will arrive in March or April, McGinnis says; Shope has not yet made a formal agreement to come to Galveston, but university officials expect him to join them sometime next summer. The status of the collection is also up in the air: Yale officials are prepared to discuss with Shope and Tesh the transfer of YARU's virus collection and some of the unit's grants to Galveston, says a university spokesperson.

—**Jocelyn Kaiser**

PLASMA PHYSICS

Magnetic Fusion Tops Limit at Princeton

MINNEAPOLIS—Like race car mechanics grinding valves and polishing cylinders to squeeze out a few extra horsepower, physicists and engineers at Princeton University's Tokamak Fusion Test Reactor (TFTR) have pushed their machine beyond its design specifications to set a new record for fusion energy output. Even better, said TFTR researchers when they announced the latest results here on 7 November at a meeting of the plasma physics division of the American Physical Society, their fusion machine is running more smoothly than ever.

In a packed hall so large that his transparencies had to be shown on three separate screens, Princeton physicist Kevin McGuire announced that a hot, magnetically confined plasma in TFTR had produced 10.7 megawatts of fusion power, surpassing the 6-megawatt mark set late last year (*Science*, 24 December 1993, p. 1966). Along the way to the new record, McGuire added, the Princeton group found that the deuterium-tritium plasmas they have been testing—the same mixture of hydrogen isotopes likely to fuel the first working fusion power reactors—are "better [behaved] in almost every respect" than plasmas of pure deuterium, the staple of fusion experiments until last year. TFTR recently won a 1-year reprieve from the funding cutoff that would have shut down the facility at the end of this year, and Steve Eckstrand, TFTR program

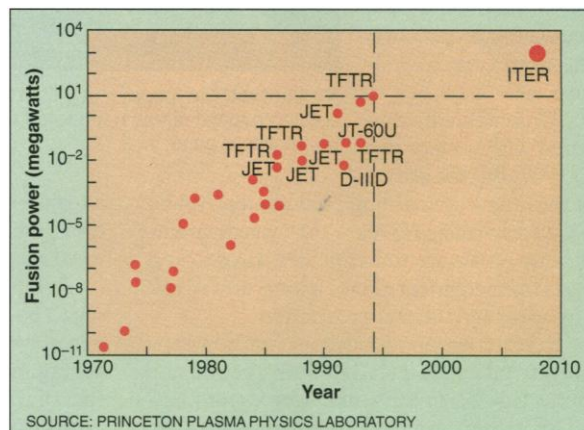
manager in the Department of Energy's (DOE's) office of fusion energy, says "the results have certainly borne out [the decision]."

If TFTR had been kept within its design specifications, the machine would have been limited to about 9 megawatts of power. But after re-evaluating the machine's earlier performance and its safety criteria, TFTR physicists decided this fall that they could turn up the heat. They pushed the doughnut-shaped device's magnetic field 8% beyond the specifications and its neutral-beam injectors—which heat the plasma trapped within the field to hundreds of millions of degrees—to 20% over the specs. The result was the unprecedented burst of power, which peaked for a tenth of a second.

All the while, the plasma remained gratifyingly well-behaved. In fact, McGuire said at the meeting, the amount of thermal energy stored in the plasma, the length of time the energy could be confined, and the temperature and density of the plasma have all gone up over the past year as researchers

wrung more power from TFTR in successive tests. And the levels of radioactivity leaking out of the reactor from the deuterium-tritium reactions were surprisingly low, according to Richard Hawryluk, head of the TFTR project. Part of the reduction reflects a lower-than-expected rate of tests, but the reactor's structure also cut radioactivity leakage by at least a factor of 10 below the original conservative projections, said Hawryluk.

The TFTR team will have at least a year to build on these successes. The facility had been scheduled to be shut down at the end of 1994 to make way for Princeton's next major fusion experiment, the Tokamak Physics Experiment (TPX), which is meant to sustain fusion reactions for minutes on end. In Au-



On track. The rising output of magnetic fusion experiments in Princeton (TFTR), the United Kingdom (JET), Japan (JT-60U), and San Diego (D-IIID) is raising hopes about the proposed International Thermonuclear Experimental Reactor (ITER).

gust, however, Congress reapportioned the fusion budget, reducing TPX's share and freeing up enough money for TFTR to continue operating. Hawryluk says TFTR scientists will use the extra time to study physics issues such as instabilities in the plasma and the behavior of the alpha particles, or helium nuclei, that are the "ash" of fusion. These high-energy particles would play a crucial role in a working reactor: keeping the plasma hot enough to sustain fusion when the external heating is turned off.

Keeping TFTR running is a good investment, Hawryluk adds, because except for the Joint European Tokamak in the United Kingdom, which is expected to break Princeton's records by 1996, experiments with reactor-grade plasmas will be scarce once TFTR shuts down. "We have a facility that is really running well," says Hawryluk. "I think it's important to get the maximum out of it."

—**James Glanz**

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