troduced. Researchers will use a crane to raise the ring about a meter and a half above the vessel floor, then switch on a magnet at the top of the chamber. Its field, while too weak to interfere much with the ring's, is strong enough to levitate the ring at the chamber center. There the coil should float for up to 8 hours, warming slowly, before it must be lowered and recooled.

In addition to being simple, levitated dipole reactors could also be safer than other fusion schemes. Tokamaks and most other reactor designs fuse the hydrogen isotopes deuterium and tritium. These reactions generate copious neutrons, which deposit heat in the reactor walls. The heat generates power, but the neutrons ultimately render the reactor components radioactive, resulting in tons of hazardous material that must eventually be discarded. Because neutrons pose severe biological hazards, a tokamak reactor would also need to be heavily shielded.

Dipole-based reactors, with their high plasma-confinement efficiency, should be able to generate higher temperatures and pressures, enabling them to burn more advanced fuels. These fuels mainly produce not neutrons, but energetic photons and electrically charged particles. The photons would heat the reactor, producing power, while the charged particles remain trapped in the magnetic fields. Dipole-based reactors must use these advanced fuels—neutrons, which can't be confined with magnets, would inevitably pierce the magnet, heating it until it ceased to function as a superconductor. As a bonus, the fusion products are less likely to make the reactor components radioactive or threaten bystanders.

The fuel most frequently touted for a levitated dipole reactor is a mixture of deuterium and He^3, a helium isotope containing two protons and one neutron. He^3 is scarce on Earth, although conventional fission reactors produce enough He^3 to conduct scientific experiments. But to fuel levitated dipole power plants, Kesner proposes that we eventually may have to mine the moon, where He^3 is relatively plentiful. Kesner can afford to relax about the source of fuel for his reactor, as commercial energy production based on D-He^3 fusion is several decades away—at best.

Meade, for example, thinks plenty of problems with the levitated dipole concept could yet emerge. He believes that tokamaks, or devices related to them, are still the best bet for future controlled fusion machines. "Nevertheless," he says, "I think LDX is a wonderful research tool to help us understand the stability issues of plasma confinement in other machines and, of course, in astrophysics." And after the recent ITER troubles, says Steve Fetter, a professor at the University of Maryland School of Public Affairs who studies energy and environmental policy, long-term research efforts like LDX are what the magnetic fusion field needs. "At this stage, it is better to let a hundred flowers bloom rather than focus so narrowly on the tokamak," he says.

In any case, few physicists expect fusion to be a viable energy source before the middle of the next century. Levitating a half-ton magnet may seem like an impressive feat of engineering sleight of hand, but it's a small trick compared to bottling the fusion genie that powers the sun and stars—the ultimate goal of plasma physicists like Kesner, Mauel, and their LDX colleagues.

–JAMES RIORDON

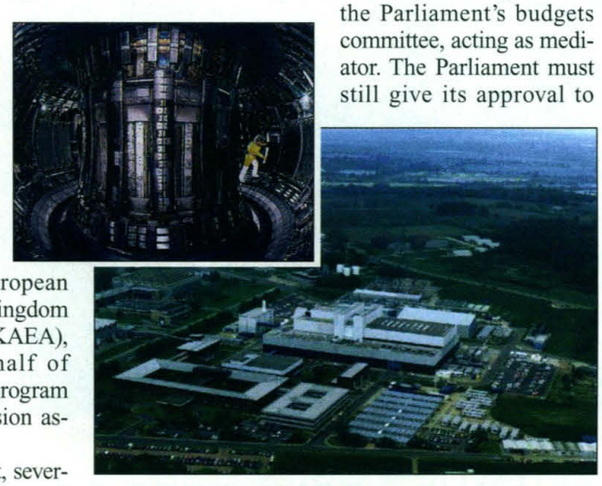
James Riordon is a science writer in Greenbelt, Maryland.

FUSION'S FUTURE
EUROPE

JET Staff OKs Pay Settlement

The end is in sight for a 20-year-old dispute over disparities in pay and working conditions at Europe's premier fusion laboratory, the Joint European Torus (JET) near Oxford, U.K. Last month a majority of the 217 professional U.K. staff members voted to accept a 24 million euro (US$24.7 million) compensation package. Half of the money is expected to come from tightening JET's 1999 operating budget, including reducing the number of hours the machine will be running.

The out-of-court settlement clears the way for changes in the management of JET, which since 1979 has been Europe's major contributor to the international effort to design a next-generation fusion machine. In January responsibility for the facility will be transferred from the European Commission to the United Kingdom Atomic Energy Authority (UKAEA), which will run it on behalf of the commission's Euratom program and Europe's 17 national fusion associations.



Pay up. Deal compensates for pay disparity at JET.

Fearing a costly settlement, several associations had threatened to pull out if the dispute wasn't settled. The UKAEA had said that it couldn't afford to operate the facility alone and that it needed an agreement this month in order to prepare properly for the new management scheme. "Now I think our doubts will fall and we will take part," says Roberto Andreani, head of the Italian fusion association.

Historically, all of JET's professional staff members have been commission employees, except for U.K. nationals, who remained on UKAEA's payroll and salary structure. As a result, U.K. staff members worked side by side with nationals from other European countries who, as an inducement to sign up, earned higher salaries and were promised preferential treatment when applying for other Euratom posts. The U.K. staff complained to the European Court of Justice, which in 1996 found that this practice was discriminatory and ordered the commission to change its employment practices and negotiate a settlement. The European Parliament tried to mediate, but the staff turned down a 9 million euro offer and decided to go back to the European court.

The cases were unlikely to be heard until the middle of next year, however. So once again the European Parliament stepped into the breach, with Detlev Samland, chair of the Parliament's budgets committee, acting as mediator. The Parliament must still give its approval to transfer public money to pay for the settlement, but little opposition is expected. "The Parliament has always considered that there has been a discrimination," says one Parliament official.

As for financing the settlement, some 9 million euros were set aside after the 1996 compensation offer, and an operating reserve contains another 3 million euros. The remainder will be drawn from JET's 80 million euro operating budget this year. In addition to a freeze on hiring, the lab's electric bill, a major expense, will be pared by reducing the hours of operation. "JET will have to walk for the rest of the year, at best," says Francis Troyon, chair of the JET council.

–JUDY REDFEARN

Judy Redfearn writes from Bristol, U.K.

CREDITS: JET JOINT UNDERTAKING