cleanup technologies, but critics, including last year's Galvin Commission, have blasted DOE for the poor quality of science and technology behind these efforts (*Science*, 27 January 1995, p. 446). That assessment led Congress last year to direct DOE's Office of Environmental Management to spend $50 million on a new basic research program to be managed jointly with DOE's Office of Energy Research, which already runs basic science programs. DOE also enlisted the National Research Council (NRC) to set up a temporary Committee on Building an Environmental Management Science Program to offer suggestions. "There was a concern that DOE's technology-development programs were focused on near-term development and technology demonstration," says a Senate staffer. "But in order to [complete the cleanup], R&D will be necessary."

When DOE put out a request for proposals for the program last February, citing the need to "bridge the gap between broad fundamental research ... and needs-driven applied technology development," it caused a scientific traffic jam: 2200 preproposals and 810 proposals. The ideas were peer-reviewed first for scientific merit, then screened by DOE managers for relevance to actual problems. "The committee is pretty impressed with how [DOE was] able to carry this off," says Kevin Crowley, study director for the NRC panel. "It was a crash effort from beginning to end."

The projects being funded are aimed at understanding fundamental processes that have direct ties to the problems DOE faces. Ceramics engineer Delbert Day of the University of Missouri, Rolla, for example, will use his $625,000 grant to look at new kinds of glass for vitrifying nuclear waste. Day says he has used seed money to show that the work could have practical use, but that such results, although preliminary, might scare off the National Science Foundation because it might be seen as applied research. Columbia University radiation biologist Howard Lieberman, whose work has been funded mainly by the National Institutes of Health, has received a grant to extend to human systems his yeast studies of genetic markers for susceptibility to DNA damage. The results, he says, could be used to screen cleanup workers to find those at high risk for cancer. "We really needed to get it off the ground in a big way, and now we've got it," Lieberman says of his $750,000 grant.

This summer the House and Senate have separately proposed spending $50 million for the 1997 fiscal year, which begins on 1 October; that is $12 million more than the Administration had requested. DOE officials are optimistic that the program will continue over the next decade. Such sustained support, they say, is essential to attract the topnotch researchers they are seeking.

The academy panel is now working with DOE on the next solicitation, which officials hope will generate ideas from a broader range of topics. Carol Henry, of DOE's Office of Science and Risk Policy, says that while plenty of preproposals targeted traditional kinds of environmental problems such as chemical contamination, too few focused on problems unique to DOE, such as the 177 tanks at the Hanford site filled with mixtures of chemical and radioactive waste. "Some scientists found [the solicitation] very difficult to respond to," notes environmental engineer Frank Parker of Vanderbilt University in Nashville, Tennessee, who is heading an advisory board set up by DOE to carry on the academy panel's work. In addition to tapping into the top tier of academic scientists, DOE officials hope to find a way to involve young investigators, perhaps with special grants.

At the same time, DOE wants to make sure that the basic research ends up being used to solve problems on site. Parker says his group has taken on the "extraordinarily difficult" task of finding ways to measure whether the research is yielding practical payoffs, as well as examining ways to translate results into technologies, perhaps by building in links with the Office of Environmental Management's technology programs. How these efforts play out will determine whether science can provide the answers to one of this country's biggest technological problems.

–Jocelyn Kaiser

CHESS

Web Pits One Against the World

While one world chess champion, Gary Kasparov, gears up for a widely anticipated rematch with IBM's Deep Blue, the world's most formidable chess computer, a rival champion has been engaging in some techno-chess of his own. On 26 August, grandmaster Anatoli Karpov used the World Wide Web to take on everybody in the world—and drubbed all comers. Karpov's opponents didn't play individually; instead, they played one game collectively. That made the result of "Karpov v. World" a foregone conclusion, say chess experts.

The masses made each move with the help of a computer provided by Telecom Finland, the Finnish telecommunications company in Helsinki, which sponsored the match. Anyone with access to a Web browser could suggest a move; after 10 minutes, the computer tallied the responses and picked the most popular one. Although more than 400,000 Web-surfers watched the spectacle, only about 200 people voted for each move. Karpov then keyed in his response from a terminal at the Helsinki Intercontinental Hotel.

Although Karpov won handily, the world, playing by committee, managed a competent if humdrum game. "It was a quite normal game," said Eero Raaste, a Finnish chess commentator. "A national master could lose this way ... or a candidate master." Not, however, a champion grandmaster.

Karpov, playing black, opted for his favorite Caro-Kann defense. In move 6, the world voted, by a mere 2% margin, to defend a vulnerable knight rather than attack with it. White played conservatively, and Karpov took the offensive. A blunder on the 16th move sealed the world's fate. From then on, there was little room for white to maneuver; it was forced to parry threat after threat. Eventually, Karpov's attacks tore a hole in white's harried defenses. After move 32, the world surrendered. The duel had lasted more than 4 hours.

Technology has provided more powerful opponents for Kasparov, who won the world championship from Karpov in 1985, then surrendered it to him by default after becoming embroiled in an argument with FIDE, the ruling body of chess. (Kasparov then founded his own chess association and now holds its title.) Deep Blue, the latest in a steadily improving train of silicon opponents, handed Kasparov a surprising defeat during a series of six games in February (*Science*, 2 February, p. 599). Kasparov finally mastered the upstart computer—but not before Deep Blue became the subject of innumerable magazine articles on the ascendancy of machines over humans.

Bits and gambits. Chess on the Web; world is white.

That's still an open question, although Kasparov's encounter next May with an even more powerful version of Deep Blue may settle it, at least as far as chess goes. But Karpov has proven one proposition: Democracies can't play chess.

–Charles Seife

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