

Project ELF Finally Wins a Vote

But the Navy's 25-year battle to build an antenna for submarine communication is far from over; researchers say it is rapidly becoming obsolete

Two years ago the Navy became so discouraged about the prospects for building an extremely low-frequency (ELF) radio antenna to communicate with submarines that the chief of naval operations simply dropped the idea from the budget. The Navy had sought the antenna since 1958, three states had rejected it, and its future looked dim. The Reagan Administration responded sharply. The President and the Secretary of Defense quickly threw a blanket over the naked admission of defeat, saying it had been a mistake: the Navy really did need the antenna it had promoted for so long and was going to get the money for it.

Today the Navy is well along the way to building that antenna, now called Project ELF, having just won a major land-use decision in Michigan. Yet those who know the history of opposition to the project know that it will not end quietly. The state of Wisconsin has already filed for an injunction to stop ELF, and other opponents are rewriting their old legal briefs for the next round of battle.

Since 1981 when the President intervened, the program has been revised slightly and given new funds. The total cost is put at \$231 million. Before its revival it was known as the "austere ELF" program, and was limited to a small facility with 28 miles of antenna near a town in northern Wisconsin called Clam Lake. In the final year of the Carter Administration, the Clam Lake facility was shut down and put on standby. Under the new mandate, the Wisconsin facility has been reopened as part of the greater Project ELF, which is to include 56 new miles of antenna to be built on state forest lands across the border in the Upper Peninsula of Michigan.

To understand the concerns about ELF, it is necessary to know something about its basic design. ELF's antenna will be an electrified grid, similar to a high-tension powerline, carrying up to 300 amperes of power and sending a binary message modulated between two extremely low-frequency signals at 72 and 80 hertz. Because of the tremendous length of the transmitted wave (around 3000 kilometers), ELF penetrates the ocean and can be detected by submarines running at operating depth. Normal high-frequency transmissions do not

penetrate this far. Today submarines must rise near the surface or deploy near-surface antennas to receive messages. The value of ELF is that it could allow submarines to receive brief commands at depth, diminishing the chances of detection. The fault is that its signal (at least in the present plan) would be weak and slow, conveying information at a very low rate. This is an important point, for the reach and rate of communication can be improved, up to a point, by increasing the quality of the signal. The quality of the signal may be boosted by enlarging the antenna. Built into the con-

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cept, therefore, is an incentive for expansion. Thus, while the Navy denies that this is so, local opponents of ELF suspect that the Michigan expansion may be the first of many add-ons. The reason this worries people is that early versions of ELF called for an antenna thousands of miles long.

Opposition to the project has been intermittent but intense. Governors of both Wisconsin and Michigan have tried to block it, as have federal and state legislators. Despite this, the Navy won an important local victory on 15 July. Michigan's Natural Resources Commission, which holds ultimate authority over state lands, granted easements to the Navy so that it could start putting up antenna lines this fall. In doing this, the commission rejected the advice of Michigan's governor, James Blanchard, and Senator Carl Levin (D), both of whom sought to block ELF. Blanchard said it would be "a terrible waste of taxpayers' money," and that other less controversial means of communicating with submarines could be built.

The chairman of the commission, Jacob Hoefer, says his panel really heard no evidence to support denial of the easements. The vote was 5 to 0, with two recent gubernatorial appointees (presumably hostile to ELF) not present. According to Hoefer, there have been three independent reviews of the Navy

proposal, including an inquiry by eight divisions of the state department of natural resources. None turned up signs of a threat to health or the environment, the commission decided.

There was a good deal of testimony about the antenna's potential use as an aid to waging nuclear war, possibly making it easier for the United States to launch a first strike. But, "People are confused about the responsibilities of the commission," Hoefer says. "We're not in a position to establish foreign policy or assess nuclear strategy. . . . The decision to build ELF was made by the federal Congress." He had no option, he says, but to grant the Navy's request. He guesses that the Navy would have sued over a denial in any case.

Almost immediately, the governor of Wisconsin, Anthony Earl, authorized a suit against the Navy. On 20 July, Wisconsin's attorney general sued in U.S. District Court for an injunction stopping work on ELF, arguing that there had been significant changes in the proposal since it was last reviewed in an environmental impact statement in 1977. Federal law does require a "supplemental" statement in some cases when substantial new information is available. The attorney general demanded that such an impact statement be written, and he released a press notice saying that many new health studies have been conducted on ELF radiation since 1977: "The citizens and environment of Wisconsin may be subjected to known or unknown harm or risks of harm if the defendants are not enjoined from proceeding. . . ." Little of the work will take place in his state, but the governor felt he had a duty to intervene in any case.

Governor Blanchard, whose state will house a piece of ELF for the first time, refrained from taking action, although he has let it be known that he is itching to sue. Press spokesperson Susan Carter says firmly that "this is not a token opposition." The reason Blanchard is not litigating is that he thinks he can accomplish more by "working behind the scenes," attempting to defeat ELF's funding in Congress, Carter says.

The latest developments are perfectly in keeping with ELF's long tradition. It has probably suffered more false starts and near deaths than any big federal

project, being one of the oldest still sustaining itself in an agonized half-life. Like its cohorts in limbo—the breeder reactor, the MX basing scheme, and the nuclear waste depository—Project ELF has acquired legendary status, drawing supporters and enemies interested as much in the symbolic as the substantive aspects of the battle. As with the others, its distress shows that Washington's writ is weaker in the states than it once was, even when national security is invoked.

For some residents of Upper Michigan and Wisconsin, ELF may be nothing worse than an unattractive and suspicious thing they would rather not have nearby. But the professional voice of opposition, Stop Project ELF, based in Madison, Wisconsin, stresses other points. Many of the arguments have come up before and are likely to reappear in the impending court hearings.

The major doubts about ELF are essentially of two kinds: is it likely to be dangerous to man or beast, and is it worth building? There are no clear answers. But the information available now suggests that the present scheme for a small ELF (84 miles of antenna) presents no significant new health or environmental hazards. That, at any rate, is what a panel assembled by the National Academy of Sciences concluded in a report issued in 1977. The report recommended, however, that certain little-studied areas of electromagnetic effects be looked into and that an environmental monitoring program be launched so that unanticipated effects would not be missed. The Navy has begun a monitoring program.

The major differences between the antenna studied and approved by the Academy and the one planned in Michigan are that the actual project will be less than one-tenth the size, and the lines will be strung aboveground rather than buried. The Navy claims that this just means less earth will be disturbed, but the opponents speculate that different and undefined risks could be associated with unburied lines.

Some of the new health studies cited by Stop Project ELF and issued since the 1977 Academy report have to do with suggested links between power lines and cancer. These papers, few in number, are fairly ambiguous or open to challenge. For example, in one of the most frequently cited studies, the investigators (epidemiologists) never troubled to measure the intensity of the supposed cancer-causing electromagnetic fields they were interested in. They estimated the exposures by looking at wires outside the houses. On this basis they made

distinctions between high and low electromagnetic fields, leading to the conclusion that high-exposure homes produced more cancer victims. The technique seems analagous to judging the radiation hazards of a nuclear plant by counting the number of fuel deliveries arriving at the front gate.

While Navy officials have not rebutted these studies in detail, they have noted the flaws and said that the conclusions are more relevant to the electric industry than to ELF, which will operate at a



Michigan Governor James Blanchard

ELF: "a terrible waste of taxpayers' money."

lower power and different frequency than many high-tension lines. If the governor of Wisconsin really is concerned about electromagnetic fields, one Navy consultant says with a wry smile, he should declare an emergency and remove all power lines from populated areas.

Project ELF seems more open to question on efficacy than on safety. Even if one is convinced of the need for a deep-sea link with submarines, it is not clear that this is the best way to go about it. The Navy says that ELF is the best *available* way, and that is all it needs to know.

"The Navy is very much embattled," says an MIT scientist who has consulted on the project in the past. "I don't think you'll find them eager to discuss alternatives." Indeed, because of Wisconsin's lawsuit, a spokesman said recently, the Navy does not want to say anything about ELF that might affect the court proceeding. In the past, the Navy has considered several alternatives to the giant antenna, including a portable, rotating, cryogenic magnet; high-frequency radio "heaters" that could be used to modify the natural current in the ionosphere, creating ELF waves; and a blue-

green laser capable of penetrating the sea. All have been rejected; the Navy wants a system it can build this year.

While the Navy may be correct that many of these schemes are untested, says a physicist who has worked on one of them, it should take care not to ignore their relevance for the system it does build. Dennis Papadopoulos, a physicist at the University of Maryland who worked on the high-frequency heater scheme, argues that recent experiments conducted by A. J. Ferraro of Pennsylvania State University have demonstrated that this technique does produce ELF waves (in the 1000-hertz range). They did not suit the Navy's purposes, Papadopoulos says, but they did prove that fairly simple devices might have an impact on ELF communication. An enemy might use them to jam a transmission, degrading the already low signal-to-noise ratio inherent in messages sent by the planned 84-mile ELF antenna.

In addition, according to Papadopoulos, high-frequency generators in theory should be capable of producing much stronger signals through a laser-like system of amplification which he has described in papers submitted to the Defense Department. This technique has not been proved. But Papadopoulos thinks that it ought to be studied thoroughly, and he notes that at a recent conference in Austria, where these concepts were discussed, seven interested Soviet scientists were in attendance. "It's unusual to get even one these days," he says.

A Department of Defense (DOD) expert responds by saying that an antijamming capability has already been built into Project ELF. He adds that the high-frequency heaters are no longer being studied because they are inefficient and vulnerable to attack. (The original buried-cable concept for ELF was considered invulnerable; the new version is not. But at least Project ELF is efficient, the DOD says.) In addition to the blue-green laser, which is not going to be available in this decade, the DOD is funding research on just one other ELF broadcasting device: a vertical antenna suspended from a balloon. It is invulnerable in the sense that it is easy to transport and can be quickly deployed after an attack. Research has just begun on this idea, which the DOD insists is not an alternative but a complement to a ground-based antenna.

Thus Project ELF creeps forward, weighted down by a controversial past, moving toward a completion date that could very well coincide with its obsolescence.—ELIOT MARSHALL