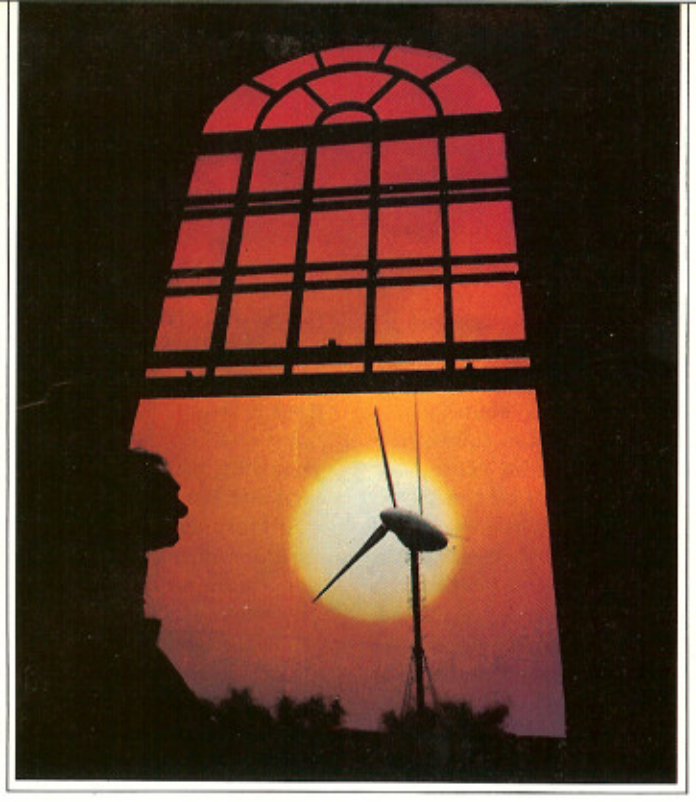


HERONEMUS THE WIND KING

Is one elephant more efficient than 20,000,000 fleas?

RON CHERNOW

When he thinks of the future, Captain William E. Heronemus, USN (Ret.) dreams of a pollution-free paradise fired by exotic machinery. He sees strange ships chugging through tropical seas, converting seawater into hydrogen fuel; tiers of wind wheels off the New England coast, banked like billboards on floating platforms and fueling onshore industries; submerged catamarans in the Gulf Stream off Miami, sucking up cold water from the ocean bottom and using it, along with warm surface currents, to power electric generators; and, finally, sailing ships drifting past these sea artifacts. Heronemus believes that such futuristic schemes would not merely mitigate the energy crisis but solve it.

"It would not be foolish at all to state that this country could be totally energized by solar energy and other renewable processes by the year 2000," Heronemus told a flabbergasted Senate subcommittee in 1973. "The economy need not slip the slightest bit, let alone slide into depression, if we wean ourselves away from the burning of precious fossil fuels."

RON CHERNOW's work has appeared in *Smithsonian*, the *New York Times*, *New York*, the *National Observer*, and *Mother Jones*, among other publications.

When Heronemus first started spouting such ideas in the early seventies, he was considered fit for a straitjacket, rather than for government funding. The fashion was to deride him as a fool. When he testified against a Connecticut atomic reactor in 1975, Congressman Mike McCormack of Washington launched into a blistering diatribe against him that Heronemus remembers well. "McCormack said, 'The good Captain doesn't really know what he's talking about. His colleagues give him no credit for credibility.' " He scratches his chin. "Now, that was just about the dirtiest low-down blow anybody has pulled."

Fortunately, Captain Heronemus's pipe dreams have a core of Yankee practicality; like a good seaman, he makes his blueprints snug and watertight. Heronemus is now professor of civil engineering at the University of Massachusetts in Amherst. An internationally noted expert in naval architecture and ocean engineering, he helped design America's nuclear submarine fleet during his 24 years in the navy. While Admiral Hyman Rickover perspired over the subs' nuclear propulsion systems, it was Heronemus who crafted the cigar-shaped hulls. The competition between the two often erupted into titanic budget battles.

In fact, Heronemus, 57, has never hesitated to step on

the corns of powerful people. He still tosses harpoons at Rickover: "We've got to get rid of Admiral Rickover if we want any significant change away from nuclear power." And he would like to see a sweep of Atomic Energy Commission holdovers from the Energy Research and Development Administration. Indeed, one could fill a notebook with caustic and iconoclastic public statements that Heronemus has made over the past few years. Here is a short, unexpurgated sampler:

- "The entire concept of a plutonium economy is insane. . . . The idea that the most toxic material on the face of the earth should be used to provide energy for humanity is one of the most absurd ideas of all time."
- "There simply is very little in us that will cause us to stand up on the right side of morality if we think such a stand will cost us money or comfort. And there is where the hostility toward expansion of solar power is really aroused. Because there is a growing sense that solar energy would allow us to be morally right without the inconvenience of inadequate energy or excessive energy prices."
- "In sum, those learned members of our Great Society who publish such tripe as 'Wind is for the birds' on the front page of the *New York Times* are simply demonstrating their ignorance . . . toward that which really is a key to energy, prosperity, and improved quality of life in the future."

After poring over such peppery speeches, it comes as a surprise to find that Heronemus is far from a blustery curmudgeon. A short man with iron-gray hair, blue eyes, and a boyish idealism, he is about as tough as baby food. He wears white shirts and black shoes, in the manner of ex-navy men, but his manner is anything but "military." Heronemus grew up in Wisconsin dairy country and his speech is still punctuated with plenty of "goshes" and "darneds." At moments, he looks and sounds like a graying Jonathan Winters. His somewhat bulbous nose and pungent wit toss in a spice of W. C. Fields.

If Heronemus's observations sound cantankerous, they would seem to spring, not from any malice, but from his passionate attachment to alternate energy—the ancient power of wind and sea. He was perhaps the first American engineer in recent years to advocate massive wind- and sea-powered systems as a true substitute for fossil fuels.

Not long ago, a pilgrim to Amherst anointed Heronemus the Wind King, and I confess that I had hoped to find the good Captain in a Winslow Homer nor'easter. Instead, I tramped up the University of Massachusetts's Orchard Hill on a sunny, windless April morning. Students prostrated themselves under the solar rays. At the top of the slope of colonial dorms, I came suddenly upon a space-age stepchild of Heronemus's imagination: Solar Habitat I. At the highest spot on campus, the small house squatted at the base of a blue mast that soared 60 feet into the air. ("It just happens to have some similarities to masts that have gone to sea," says the Captain.) On its south wall, solar collectors, looking like scrubbed blackboards, soaked up the bright sunshine. Atop the pole, a weird species of airplane propeller—white nose cone with three twisted yellow blades—waited for the wind to rev it up.

PHOTOGRAPHS BY DAN MCCOY

Before long, Heronemus emerged from the basement laboratory, squinting behind his horn-rimmed spectacles. He was looking anxious because his Wind Furnace was being reviewed today by its sponsor, the Energy Research and Development Administration. I asked him if he had an instinct that enabled him to specify wind speeds. "My only instinct is that whenever I want to show someone a wind generator, there's no wind," grumbled Heronemus. A few minutes later, as the ERDA project manager pulled up in his car, I felt a breeze on my neck. "Hey, whatdya feel?" laughed Heronemus, wiggling his fingers. He did a little dance. "So the ERDA project manager is here."

One of the Wind King's greatest contributions has been to show that fickle gusts can provide a steady flow of energy. The trick, he says, lies in "storables." In Solar Habitat I, the spinning propeller powers an electric generator, which

You wander through his labs and you'll find students working at all hours of the day and night.

Captain Heronemus's pipe dreams have a core of Yankee practicality; like a good seaman, he makes his blueprints snug and watertight.

heats up hot water tanks in the basement. This keeps the house toasty even on the darkest, calmest winter day. Though wind and sun shift capriciously from hour to hour, they remain rather consistent on a yearly basis.

Another great asset of his gizmo, Heronemus said, as his windmill whirred noiselessly above us and local reporters gathered round, was that it could decentralize America's power supply. He noted that of the 40 municipal lighting companies left in Massachusetts, only five giants still generate electricity; the other 35 buy wholesale. With the gigantic atomic power plants in particular, power generation is dependent on fewer and fewer facilities.

"We've got one of the largest poultry farms in the Northeast up the road here," said Heronemus, jutting out his chin. "If the power goes off, it can suffocate thousands of chickens." He rubbed his neck, smiling slyly. "I can remember Dixy Lee Ray [former head of the Atomic Energy Commission] making a speech to the effect, 'If you have a job to do that could be done by one elephant or 20,000,000 fleas, which would you choose? Well, of course you would choose the elephant.' Well, she was just absolutely wrong. Nature would take the 20,000,000 fleas. Because if one dropped dead, you'd still have 19,000,000 plus to carry on. If Hannibal had traded his elephants for some of those donkeys, history might have been entirely different."

At a press conference held amid a forest of hot water pipes in Solar Habitat's basement, Terry Healy, the man from ERDA, paid tribute to Heronemus:

"Professor Heronemus has long been a leader in wind energy, long before there was an ERDA. I think he's responsible in good measure for the amount of development that has been done today."

By unanimous consent, faculty and students involved in Habitat designated Heronemus as their spokesman. "I'm the ox that's going to be roasted" was his pre-press-conference quip. A bit sportier than usual, he was wearing a dark-greenish suit. His plaid tie stopped summarily around his belly button; it looked as if some snarling dog had bitten off the bottom. He started off by saying they had searched for the "magic mix" of solar and wind power, so that the house might be warmed on both stormy and sunny days. He estimated that the Wind Furnace—*sans* solar plates—could be marketed for about $6,000.

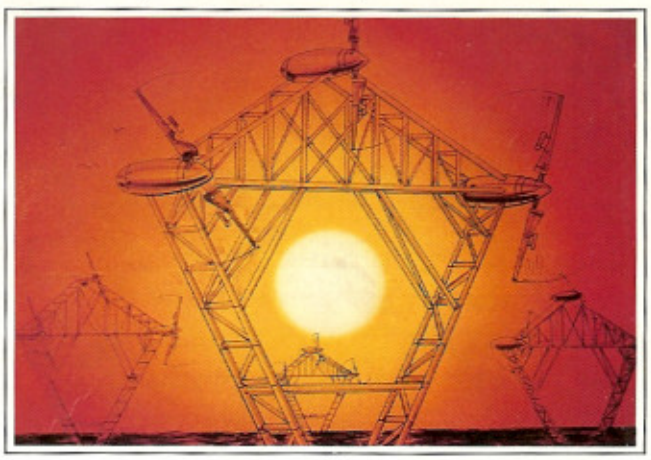
"There are at least 3,000,000 instances in the United States of America where this kind of a machine could be applied to a rural or remote dwelling." Heronemus folded his arms across his chest. "We think that *each* of these Wind Furnaces could save about 30 barrels of petroleum a year. Is this a drop in the bucket? I don't think there's another thing goin' that anybody's talkin' about that could save that much petroleum."

Heronemus's brusque style and salty humor have made him a great favorite on the lecture circuit. Everyone says the same thing: Heronemus loves to talk. Particularly in New England, a hotbed of antiatomic sentiment, he has become something of a cult figure among environmentalists—and through no effort on his part. In fact, he doesn't relish the memory of being trotted out at atomic power plant hearings and subjected to grillings lasting up to 12 hours. And Heronemus is no publicity monger. I had to chase him for several weeks, leaving a dozen messages, before he picked up his phone one morning and bellowed "Heronemus!"

"I suspect there was a time when Heronemus ate more chicken and peas at banquets than anybody else on campus," says Russel C. Jones, the genial dean of U Mass's School of Engineering. "He exudes a kind of enthusiasm and confidence that makes people think, 'By George, there *is* something there. It's not just a harebrained scheme.' More than once, he has threatened to build a massive tower outside my office so that he can check out some of his ideas. As I travel out among other folks in the academic world, Heronemus is the name they know."

Perched on a Pioneer Valley plateau, Heronemus's campus is blessed with fresh winds. It has enough vertical and horizontal buildings to please a Mondrian; the library tower stands out grandly against the Berkshire Mountains skyline. At the top of the engineering building, Heronemus's office is a true inventor's eyrie. A blackboard is chalked with strange doodles and designs. Grumman Aircraft has contributed an artist's rendition of his offshore windmills—gargantuan Y-bars with twin propellers at the tip, baroque storm clouds brewing in the background. There is a green-and-white plastic windmill—the kind that Don Quixote tilted lances at. And there is an assortment of handcrafted wooden miniature wind plants. All this paraphernalia coexists in an office crammed with cabinets, shelved reports, rolled ocean charts, and vivid blue relief maps of the Pacific and Indian oceans.

In a discussion with Heronemus, it soon becomes apparent that one cannot separate Captain Heronemus from Professor Heronemus. Example: as a submarine captain, he had always been fascinated by ocean "thermoclines"—



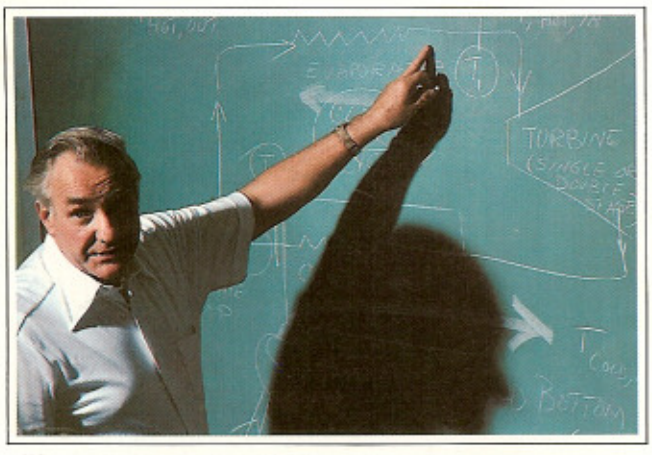
water layers of differing temperature, which tend to stay amazingly constant.

"You can put a submarine underneath a layer and just lie there," says our self-styled old submariner. "It's kinda like nuzzling up to a cloud. And it does two things for you. First, it keeps you from having to use power to maintain your depth. Number two, it also gives you a nice blanket against the enemy's sonar."

How in the world could this military arcana help the Professor? Well, as mentioned, the chief stumbling block for solar engineers has been *storing* sunlight. But the Captain knew that the warm upper layers of the tropical seas constitute the greatest reservoir of solar energy on earth. Another fact: if you plunge down to the bottom of tropic waters, you dive into the midst of near-freezing water that has traveled from the poles. Engineers here will begin to see the rudiments of a heat engine. If you take a substance like propane or ammonia or Freon—something with a low boiling point—the hot water can make it flash into gas and spin the blades of a turbine. The cold water, in turn, can condense the gas and start the cycle over again. In Heronemus's words, this electric power plant "would operate like a huge refrigerator in reverse."

These submarine power plants—actually double-hulled catamarans that would lie just beneath the sea's surface—could be fabricated in shipyards, towed to their sites, then tethered to the seafloor. Heronemus would like to put a 400-megawatt power plant of this sort in the swiftly surging Gulf Stream 15 miles east of Miami. When he handed me a complex diagram of this plant, I asked about the four towers poking above the water line. "We decided that we could open up fishing resorts out in the Gulf Stream—hotels," said Heronemus, tongue bulging in his cheek. "We'd probably make so much money in that that we'd quit selling electricity."

In fact, such a power plant, if successful, would be worth an Egyptian tomb of gold. The electricity could either be cabled to the beach or used to electrolyze seawater—that is, break it down into its components, oxygen and hydrogen, a wonderfully clean-burning fuel. Heronemus has high hopes for a "hydrogen economy"—with cars being fueled by hydrogen, food being cooked with it, etc. He would like to float about *4,000* such plants in a thin band of Gulf Stream stretching from the southern tip of Florida to east of Charleston, South Carolina.



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Here's how Heronemus summarized the potential of this submarine network a few years back: "The Gulf Stream alone would have the capability of providing the total U.S. energy requirements, 50 percent in the form of electricity and 50 percent in the form of hydrogen, the ideal direct-use fuel. And our analyses to date say that this could be done without any pollution of any kind—local, regional, or global."

For every scheme he hatches, Heronemus seems to cook up a dozen variants. He never ceases to recycle his own brainstorms, and he dotes on one alternate design for his solar-sea thermal power plants—the spar.

"Yes, we're back looking at a spar," said Heronemus. He picked up a yellow No. 2 pencil and let it dangle from his fingertips. "Only it's a great big spar buoy and the power plants are in compartments inside it. Hangin' out the bottom is a cold water inlet pipe"—his fingers wriggle down—"and at the top is a hot water inlet pipe"—they wriggle up. Heronemus says they would look like "great big jellyfish" from the surface.

All of a sudden, Heronemus looked heavenward, grimaced, and sprang to his feet. He snapped off the electric lights. Under the circumstances, I couldn't very well protest. We spent the rest of the time in energy-conserving shadow.

As the morning wore on, Heronemus spun fantastic visions of the floating industries of the future. He speculated that his sea thermal power plant might take the form of a self-propelled tanker.

"I could literally tow one down to the equator and let it loiter there in the doldrums, sucking up cold water and pumping hot water." Heronemus curled his shoulders into a pose of concentration. "Using the discharge from the pumps to keep me perkin' along, I could make electricity—which would in turn make hydrogen. And I could liquefy that hydrogen and put it into tank ships that are trailing astern. So instead of going to the Mediterranean and liquefying Libyan gas and bringing it back to Boston and Jersey, I'd go to the equator, liquefy hydrogen, and bring *it* home."

When Heronemus is recovering wisdom and technology that the West has forgotten, he often seems to be more advanced than anyone on the scene today. His faith in small-scale technology will be familiar to readers of E. F. Schumacher. In one of his most ambitious papers, he argues that "the same kind of nut who believes in the efficacy of wind power might predict a return to slow speed and thence a return to sail."

The idea has intrigued him ever since, as a midshipman, he sailed on the Naval Academy's beautiful mahogany yacht, a 90-footer with a wind-driven generator. That experience has now flowered in Heronemus's plan for Power Masts. These spars would rise 225 feet above a tanker deck and sport a stunning array of 17 wind wheels. With the high cost of oil, Heronemus believes that this would be the cheapest way to transport, among other things, Arabian crude. Five masts, he thinks, would do quite nicely for a 1,200-foot tanker, though he concedes that bunker oil would occasionally have to be burned in the windless tropics. (*Continued on page 20*)

"Human beings are fully capable of destroying themselves. You've got to make people believe that."

Listening to Heronemus, you begin to realize that although there are very real limits to oil, gas, coal, and uranium, there are no real limits to alternative energy, but only to human ingenuity and audacity. No part of America need be starved for energy. Take the case of New England, which is heavily dependent on foreign oil. Heronemus believes those windy maritime states could prove the richest of all. And he has concocted yet another grandiose system to meet the challenge.

In a spin-off from his submersible plant, Heronemus devised floating towers with wind wheels for generating power. Hydrogen would be stored in giant bladders or bags. Such an Offshore Wind-Power System in the Gulf of Maine, says Heronemus, could produce nine to 10 times as much electricity each year as is presently consumed in the six-state region.

Heronemus is not a dilettante. He will leave this world a deeply disappointed man if mankind doesn't turn to solar energy. According to all sources, his work has taken on the trappings of a sublime obsession.

"He comes up with great ideas that people want to try," says Dean Jones. "You wander through his labs and you'll find students working at all hours of the day and night, faculty members donating lots of extra time and effort to assist him in his projects."

One of Heronemus's graduate students, Sandy Butterfield, confirms this: "Heronemus works harder than anybody I know. He almost makes you feel guilty if you're not putting in 80 hours a week. He's an incredibly inspirational guy." Heronemus pleads guilty to being a "workaholic" and worries that he has shortchanged his wife and six children.

What drives the Captain? A lot of impetus behind his work seems to come from his fears about atomic power. As a former captain of nuclear submarines, he is more haunted by atomic mushrooms than the average mortal. And he can't see how atomic weaponry could be contained amid a rapid expansion of nuclear power plants. One of the last things he told me before I left Amherst was, "Human beings are fully capable of destroying themselves. You've got to make people believe that. Civilizations have destroyed themselves in the past." He also spoke of lifting the "curse of competition" from world fuel markets, a phenomenon that has added a bellicose note to global politics since the Arab oil embargo.

But Heronemus, it must be noted, never commits the sin of being *only* critical. He feels duty bound to offer alternatives to whatever he opposes. In solar energy, he sees a superb opportunity for the West to create bonds with the Third World. The West has the capital, the know-how; the poor countries often broil in solar radiation and are washed by tropical seas. The marriage between the two, he thinks, might be perfect. In this way, energy could become a source of world harmony, rather than friction.

In other incarnations, Heronemus would gladly be a minister, a lawyer, or an English professor. He doesn't know where he got his "awful conscience." What may ultimately distinguish him from other scientists is his stern morality. A strange thing to say. But he almost seems to consider our present waste of energy as sinfully profligate. He is driven to fits of anguish by loafing bureaucrats. And he abhors the idea that we will fill up the planet with nuclear weapons for the sake of profiting from reactor sales. Heronemus is nothing if not contradictory. A confessed capitalist and card-carrying Republican, he has reluctantly come to the conclusion that the nation's energy system should be nationalized—with all the perils inherent therein.

At the end of my Amherst stay, Heronemus was sitting and tossing out still more ways to harvest the sun's bounty: cultivating algae in tropical waters for their hydrogen and carbon content; gathering up brush and oily nuts in the Brazilian jungle as a ready-made fuel. I again sat rapt at the breadth of his vision. But Heronemus himself seemed somewhat beleaguered. He had been disappointed by his meeting with the ERDA man and feared that his funding would once again dry up. This protean figure has constantly had to scrounge for funds. Again and again he has originated some scheme, only to have a big corporation land the contract for it.

"The whole Offshore Wind-Power System is a very good example," says Duane Cromack, project coordinator for the Solar Habitat. "Heronemus proposed that in 1972. It was scoffed at then. Then a request for a proposal came out from ERDA for a study for offshore wind power. And we submitted a proposal under that. But Westinghouse got the contract."

Maybe we shouldn't be surprised or upset. Isn't it always the fate of the maverick to be damned for blasphemy only to find his ideas later embraced as gospel truth? Perhaps Heronemus will soon be obscured by his own success in stimulating interest in alternate energy. He has helped to persuade the world that sun-and-sea power is not some old submariner's pet lunacy.

Still, it hurt to see Heronemus so dejected that day. You get to feel for the man very fast. It may be that boyish innocence lurking beneath the brittle crust. Or maybe it's because you wait for that wonderful laugh, when he bends at the knees and throws back his head in glorious joy. Perhaps it's just that he's so unusually sensitive and intense for a man with gray hairs.

"Solar energy took the place of the faith of the naval officer," said Heronemus when asked if he felt the same sense of mission he had in the navy. "I guess I'm just that kind of a guy. I like to march behind a flag." He stuck his tongue into its familiar cheek pouch. "I guess I also kinda like to carry the flag." ●