

NOAH SHACHTMAN BUSINESS 07.20.09 12:00 PM

STRANGE NEW AIR FORCE FACILITY ENERGIZES IONOSPHERE, FANS CONSPIRACY FLAMES



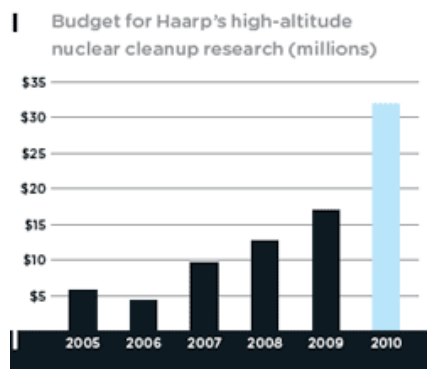
Photo: CORBIS

Todd Pedersen had to hustle—the sky was scheduled to start glowing soon, and he didn't want to miss it. It was just before sunset, a cold February evening in deep-woods Alaska, and the broad-shouldered US Air Force physicist was scrambling across the snow in his orange down parka and fur-lined bomber hat. Grabbing cables and electronics, he rushed to assemble a jury-rigged telescope atop a crude wooden platform.

The rig wasn't much, just a pair of high-sensitivity cameras packed into a dorm-room refrigerator and pointed at a curved mirror reflecting a panoramic view of the sky. Pedersen had hoped to monitor the camera feed from a relatively warm bunkhouse nearby. But powdery snow two feet deep made it difficult to string cables back to the building.

As darkness closed in, Pedersen tried to get the second imager working—with no luck—and the first one began snapping pictures. A few minutes before seven, throbbing arcs of green and red light began to form on his monitor, eventually coalescing into an egg shape. Other shards of light shimmered, gathered into a jagged ring, and spun around the oval center. "This is really good stuff," Pedersen cooed. This wasn't just another aurora borealis triggered by solar winds; this one Pedersen made himself. He did it with the High Frequency Active Auroral Research

Program (Haarp): a \$250 million facility with a 30-acre array of antennas capable of spewing 3.6 megawatts of energy into the mysterious plasma of the ionosphere.



Source: *Darpa Budget Estimates*

Bringing Haarp to fruition was, well, complicated. A group of scientists had to cozy up to a US senator, cut deals with an oil company, and convince the Pentagon that the project might revolutionize war. Oh, and along the way they sparked enough conspiracy theories to make the place sound like an arctic Area 51.

But the shocking thing about Haarp isn't that it's a boondoggle (it's actually pretty worthwhile) or that it was spawned by a military-industrial-petrochemical-political complex (a hallowed government tradition). It's that, all too often, this is the way big science gets done in the US. Navigating the corridors of money and power is simply what scientists have to do.

In 1901, Guglielmo Marconi received a simple radio signal sent from across the Atlantic Ocean—dot-dot-dot, again and again, the letter S repeated in Morse code. Leading scientists of the day had said such a transmission was impossible: Earth's surface is curved, and radio waves travel in straight lines. The dots should have shot out into space. Instead, they traveled from Cornwall, England, to a 500-foot antenna Marconi hung from a kite in Newfoundland. A previously unknown, electromagnetically charged layer of the atmosphere was reflecting the signal back down to earth.

At any given moment, the sun is bombarding our planet with 170 billion megawatts of ultraviolet, x-ray, and other radiation. Those waves collide with atoms of air—nitrogen, oxygen, and so on—stripping away electrons like spring rain eroding a snowbank. The result: positively charged ions drifting free. At high altitudes, those ions are far enough apart that it can take hours for them to bind with a free electron. Called the ionosphere, these undulating bands of charged particles stretch from 50 to 500 miles above the earth—too high for weather balloons and, in large part, too low for satellites. Researchers who study it jokingly call it the ignorosphere.

For decades, researchers who wanted to bother with the ignorosphere did what Marconi had done—they built an emitter, pointed it straight up, and watched to see what would happen next.

Those researchers learned that the ionosphere contains plasma, charged gas clouds that are more common in stars than on Earth. They saw that regions of the ionosphere expand and contract depending on their position over the planet, the tilt of Earth toward the sun, and the time of day. (At night, for instance, one of the ionosphere's layers disappears entirely.)

But by the 1980s, US atmospheric radio science had dead-ended. "We had become a very small field, and we wanted to try to revive it," says Konstant Papadopoulos, a plasma and space physicist at the University of Maryland. "We needed a modern facility."

Papadopoulos, now a white-haired, deeply tanned 70-year-old who goes by the name Dennis, had worked on and off with the government since he left his native Athens in the 1960s. He knew his way around the federal science-funding machine. Many of his fellow ionospherists had similar experience swaying the folks with fat wallets. So this loose band of radio scientists began a campaign of persuasion in support of a new research center. "We'll sell it," Papadopoulos remembers thinking. "We'll sell it in good faith, but we'll sell it."

One of the first ideas came mid-decade from Bernard Eastlund, a physicist working for oil-and-gas conglomerate Atlantic Richfield. Arco had the rights to trillions of cubic feet of natural gas under Alaska's North Slope. The problem had always been how to get that gas to the port at Valdez. Eastlund had a better idea: Use the gas onsite to fuel a giant ionospheric heater. Such a facility, he wrote in a series of patents, could fry Soviet missiles in midflight or maybe even nudge cyclones and other extreme weather toward enemies. That's right: weaponized hurricanes.

Arco's executives presented the idea to Simon Ramo, one of the godfathers of the US intercontinental ballistic missile program. Ramo passed it on to the under secretary of defense, who in turn gave it to the Pentagon's advanced research arm, Darpa, and the DOD's secretive science advisory board, code-named Jason. Tony Tether, director of Darpa's strategic technology office, gave Arco a contract to conduct a feasibility study. Arco brought on board none other than Dennis Papadopoulos as a consultant.

Papadopoulos wasn't very impressed. Eastlund's tricks wouldn't work even if the site were in the right place along Earth's magnetic field—which it wasn't. But the ad hoc coalition of radio scientists did like the idea of setting up a new heater in Alaska. In those upper latitudes, the ionosphere intersects with Earth's magnetic field and becomes scientifically interesting.

Luckily, the senior senator from Alaska, Ted Stevens, enjoyed a reputation for inserting projects into the federal budget to benefit his home state, most notoriously a \$223 million bridge from the town of Ketchikan to, well, not much of anyplace. In 1988, the researchers sat down with Stevens and assured him that an ionospheric heater would be a bona fide scientific marvel and a guaranteed job creator, and it could be built for a mere \$30 million. "He provided some congressional money, some pork money," Papadopoulos says. "It was much less than the bridge to nowhere." Just like that, the Pentagon had \$10 million for ionospheric heater research.

Now the scientists had some startup cash, but they also needed hardware—and for that, they had to enlist the military. In a series of meetings in the winter of 1989-90, the field's leading lights, including Papadopoulos, pitched the Navy and the Air Force. Haarp, they asserted, could lead to "significant operational capabilities." They'd build a giant phased antenna array that would aim a finely tuned beam of high-frequency radio waves into the sky. The beam would excite electrons in the ionosphere, altering that spot's conductivity and inducing it to emit its own extremely low frequency waves, which could theoretically penetrate the earth's surface to reveal hidden bunkers or be used to contact deeply submerged submarines.

That last app caught the military's attention. Communicating with subs thousands of miles away, under thousands of feet of ocean, requires ultralow frequencies, and that requires whomping-big antennas. To do it, the Navy had built an array in the upper Midwest that transmits its signal through bedrock, but its construction required razing 84 miles' worth of hundred-foot-wide path through wilderness, including a national forest. It drove local environmentalists crazy. But who would protest an ephemeral antenna in the sky?

Of course, the scientists said, you'd need a brand-new, state-of-the-art ionospheric heater to see if any of this was even feasible. The Pentagon somewhat reluctantly went for it—and began using Stevens' earmarked cash to fund the appropriate studies.



Haarp's array can beam up to 3.6 megawatts of energy into the sky. *Photo: Joao Canziani*

In 1992, the Navy handed out a \$21.6 million contract. The deal didn't go to an established engineering outfit or defense firm. It went, instead, to Arco, for which Papadopoulos was a consultant.

For more than a year, planning proceeded largely out of public view. Then, in 1993, an Anchorage teachers' union rep named Nick Begich—son of one of Alaska's most important political families—found a notice about Haarp in the Australian conspiracy magazine *Nexus*.

When Begich was 13, a Cessna carrying his father, a Congressional representative, disappeared. Neither the plane nor its passengers were ever recovered. Over the years, Begich became obsessed with uncovering mysteries. Between gigs as a gemologist, miner, school supervisor, and Chickaloon tribal administrator, he regularly lectured on government mind-control technology. So you can imagine his reaction when he began looking into Haarp: the weather-control patents, the Pentagon proposals for long-range spying, the oil company schemes. Senator Stevens had even suggested that the ionosphere could end our dependency on fossil fuels. "At any time over Fairbanks," Stevens said on the Senate floor, "there is more energy than there is in the entire United States." Begich had hit the conspiracy jackpot.

In 1995, he self-published a book, *Angels Don't Play This HAARP*. It sold 100,000 copies. He started giving speeches on Haarp's dangers everywhere, from UFO conventions to the European Parliament. Marvel Comics, Tom Clancy, and, of course, *The X-Files* made the facility an ominous feature of their narratives. A Russian military journal warned that blasting the ionosphere would trigger a cascade of electrons that could flip Earth's magnetic poles. "Simply speaking, the planet will 'capsize,'" it warned. The European Parliament held hearings about Haarp; so did the Alaska state legislature.

Begich told his audiences that Haarp was a high-powered weapon prototype. Forget spying underground with low-frequency waves—Haarp was so strong it could trigger earthquakes. And by dumping all those radio waves into the ionosphere, Haarp could turn a miles-wide portion of the upper atmosphere into a giant lens. "The result will be an absolutely catastrophic release of pure energy," he wrote. "The sky would literally appear to burn."

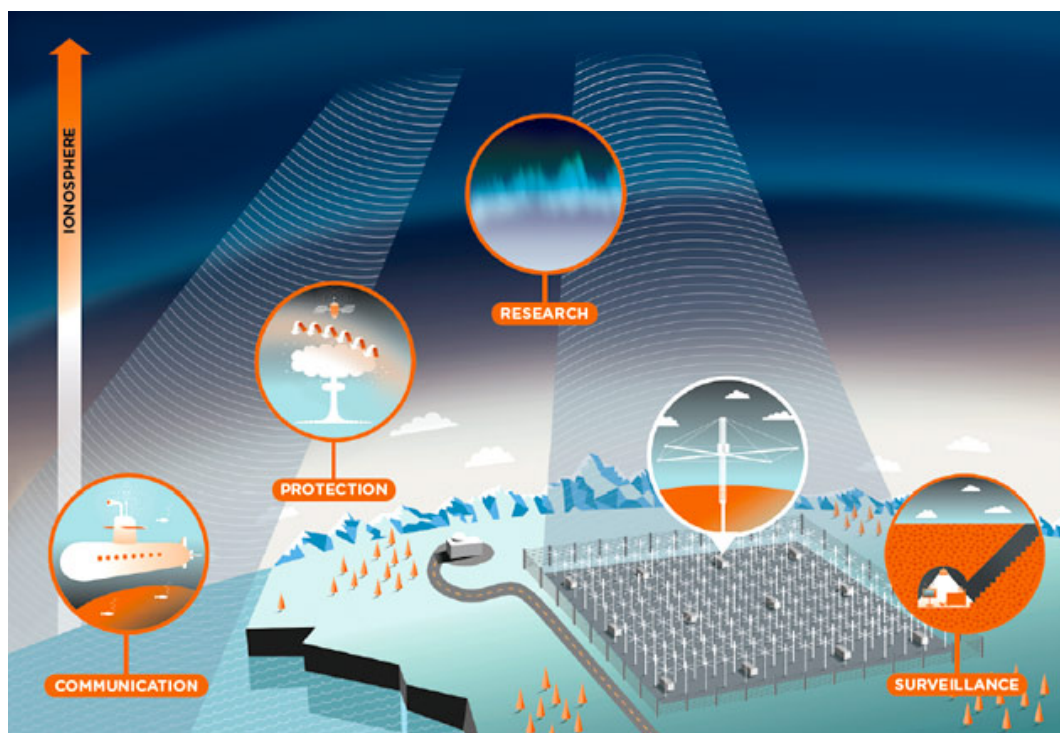
The military's response only amped up the conspiracists. When program managers swore that the facility would "never be used for military functions," Begich would trot out military reports touting satellite-blinding research plans or then-secretary of defense William Cohen's suggestion that "electromagnetic waves" could alter the climate and control earthquakes and volcanoes remotely.

Begich's agitating didn't delay the project too much. (Government research projects slip deadlines and bust budgets just fine on their own.) But by 1999, when Haarp's first 48-antenna array was finished, the project's cost was on its way to tripling the original feasibility study estimate, and the military was getting antsy. Sure, the initial experiments had been scientifically impressive, detecting ionization in the atmosphere caused by a gamma ray flare from a neutron star 23,000 light-years away and finding bunkers 300 feet below the earth's surface. But the Pentagon wanted to know when its overpriced conspiracy-magnet would produce that battle-ready technology they'd been promised.

The Haarp team was caught in an expectations trap. In theory, the Pentagon should spend a lot of money on basic research. That's how you come up with the Internet and stealth jets. But in practice, the generals and Congress want science that's useful *now*. Papadopoulos understood this instinctively: You have to sell it. Looking at the sleep cycles of fruit flies? Why, that might someday lead to indefatigable supertroops! Building nanometer-long hinges? You're developing artificial muscles that could let soldiers leap buildings! But it was tough to make that kind of case for Haarp. "It's like, I talk to my mom and she says, 'When are you gonna build something?'" says Craig Selcher, Haarp program manager for the Navy. "Mom," he answers, "I'm trying to unlock the secrets of the universe!"

So the ionospherists formed a panel to find a new purpose for Haarp. Tether, who funded the original Arco studies and had consulted on the project, was named chair.

Months later, the group had its rationale, and it was ambitious to say the least: post-nuclear space cleanup. By the late '90s, Cold War fears had been replaced by worries that a rogue state could get a nuke. If Pyongyang set off a bomb in orbit, it would fry crucial satellites. Theoretically, ultralow-frequency waves in the ionosphere would knock the particles out of their natural spin, sending them tumbling down into the lower atmosphere to be harmlessly reabsorbed. The Pentagon loved the idea. But it would need a lot of testing—which could only be done at Haarp. "You could actually see the lightbulb flick on," says Ed Kennedy, a former Haarp program manager. "This was something Haarp could actually help solve."



Haarp's Mission

The heart of the High Frequency Active Auroral Research Program is an ionospheric heater that shoots electromagnetic energy into Earth's atmosphere. Five generators pump out 2.9 megawatts each; 180 antennas convert the electricity into high-frequency radio waves and send

them into the ionosphere, which turns them into low-frequency waves. Why? Research. An energized ionosphere could be used for all sorts of cool stuff.

- Communication Haarp can bounce signals off the ionosphere with wavelengths long enough to penetrate deep into the ocean and communicate with submarines.
- Protection Researchers are testing whether ionospheric waves could nudge H-bomb-generated electrons out of the magnetosphere, shielding orbiting satellites.
- Atmospheric Research At about 125 miles up, Haarp's waves can energize free electrons, which collide with neutral atoms to produce a glow like the aurora borealis.
- Surveillance How low-frequency waves are absorbed and reflected by the earth can reveal what's underneath—including hidden bunkers.

Illustration: Rafael Macho

Of course, the facility would need 180 antennas and a lot more money. But as the panel was winding down in 2001, cash stopped being a problem. Tether became head of Darpa, taking charge of nearly \$2 billion a year for research. He put together a deal for the Air Force, Navy, and his agency to fund Haarp's construction—with some congressional pork, of course. Again, Arco's construction subsidiary (by then renamed and sold to giant defense contractor BAE Systems) was selected to handle most of the hardware, a \$35.4 million job that would balloon to \$118.5 million. And Papadopoulos still had his separate military funding for ionospheric heating research. In a field as small as radio science, it's almost impossible to avoid such overlap. By 2007, Haarp was running at full strength. But it was still mysterious. Neither the public nor the press had been allowed inside since the array became fully operational.

The highway leading to Haarp dips and rises like a sine wave. Two hundred miles northeast of Anchorage, the Tok Cutoff bobs over the Gulkana and Gakona rivers, past trailer homes and rusting pickups. A black spruce forest stretches to a volcanic peak on the horizon. Even for Alaska, this is lonely land. At mile 11.3, there's a junction with an unmarked driveway. It ends at a gate topped with spikes. "Warning," a sign announces, "US Air Force installation. It is unlawful to enter this area without permission of the installation commander."

Tomorrow, for one day only, the military will grant the public access to Haarp for the first time since 2007. Today, I'm getting a sneak peek. I say my name into a call box. The gate draws to the left. Ahead, against the slate-gray sky, resting on a small hill surrounded by trees, is a windowless six-story building: Haarp's control and power center. Inside, five 3,600-horsepower diesel-electric generators, each powerful enough to drive a locomotive, produce the energy that Haarp channels into the heavens.

Every few hundred yards along the road, the forest is cleared and fenced off into 150-square-foot plots. Each contains instruments ranging from enigmatic to just plain odd. Four golden crosses are planted in one, to help a radio receiver measure ionospheric absorption. In another is a white telescope dome and a gray tangle of poles used to observe the ionosphere's

properties. Above the barbed wire of a third clearing, I can see a wispy, twisted skeleton of wire and fiberglass.

But the most striking sight at Haarp is the facility's largest array: 180 silver poles rising from the ground, each a foot thick, 72 feet tall, and spaced precisely 80 feet apart. Every pole is topped with four arms like helicopter rotors; metal and Kevlar wires connect the poles to one another, to the earth, and to a wire mesh suspended 15 feet above the ground. The result is an aluminum cat's cradle, calibrated to the millimeter, that spreads out over 30 acres. Geometric patterns form and reform in every direction, Athenian in their symmetry. It looks like a bionic forest. A cemetery for a cyborg army. Or an infinite nave in a futuristic outdoor church. Even the scientists get rhapsodic when they describe the array. "You stare up at the stars and listen to the wind in the guy wires," Kennedy says. "It's as close to a religious experience as you're ever going to get."

The ultraprecise calibration allows the array to broadcast a beam as narrow as 5 degrees of sky or as broad as 60. All told, the facility can pump 3.6 megawatts through its phased-array radar into the sky, accelerating electrons and heating the ionosphere—all within a tightly controlled set of parameters. Marconi used the ionosphere, unwittingly, to reflect and carry radio signals; Haarp can stimulate the ionosphere to create anything from direct current to visible light, spanning 15 orders of magnitude on the electromagnetic spectrum. "The science used to be purely observational, with no knobs to turn," Navy researcher Selcher says. "Now you can apply the scientific method."

During a few weeks in October 2008, for example, the site hosted 31 investigators conducting 42 different sets of experiments—imaging ionospheric irregularities, examining the "ion outflow from high-frequency heating," creating artificial northern lights. Physics students flock to Haarp in the summer. Ionospheric papers are back in the scientific literature. Even the space-based nuclear clean-up experiments are teaching us lessons about the Van Allen radiation belts. Online, the tinfoil-hatted chatter about Haarp drones on—it's blamed for everything from Katrina to last year's earthquake in Sichuan, China. But after decades of pushing, radio scientists finally have the experimental facility of their dreams.

Yet Haarp's future is unclear. Defense budgets are shrinking, and the facility costs \$10 million a year to operate. Haarp's patron at Darpa, Tony Tether, has left his job. The project's godfather, Ted Stevens, was defeated in the 2008 Senate election by the mayor of Anchorage: Mark Begich, Nick's little brother. "I'll have his ear," Nick promises.

So the radio scientists may have to look for funding again, which probably means a whole new set of rationales. You can imagine how the conspiracy crowd will react. And the scientists, in their eagerness, can end up feeding the paranoia. Papadopoulos, for example, says he wants to do another round of subterranean surveillance experiments. "Personally, I believe it can reach 1,000 kilometers. It can't reach Iran, if that's your question," he laughs. "But if I put Haarp on a ship, or on an oil platform, who knows?" Not that he has concrete plans for such tests in Alaska, let alone in the Persian Gulf—though he does mention a facility in Puerto Rico as a possibility.

But he has already said enough. Papadopoulos just wants to do science. But for suspicious minds, the implications are there: With just a bit more funding, a few more experiments, Haarp can still be a place haunted by sinister agencies with three-letter initials and spectral lights that appear in the sky and then vanish without a trace.

Contributing editor Noah Shachtman (wired.com/dangerroom) wrote about Net-centric warfare in issue 15.12.

GALLERY

Inside Alaska's Answer to Area 51
