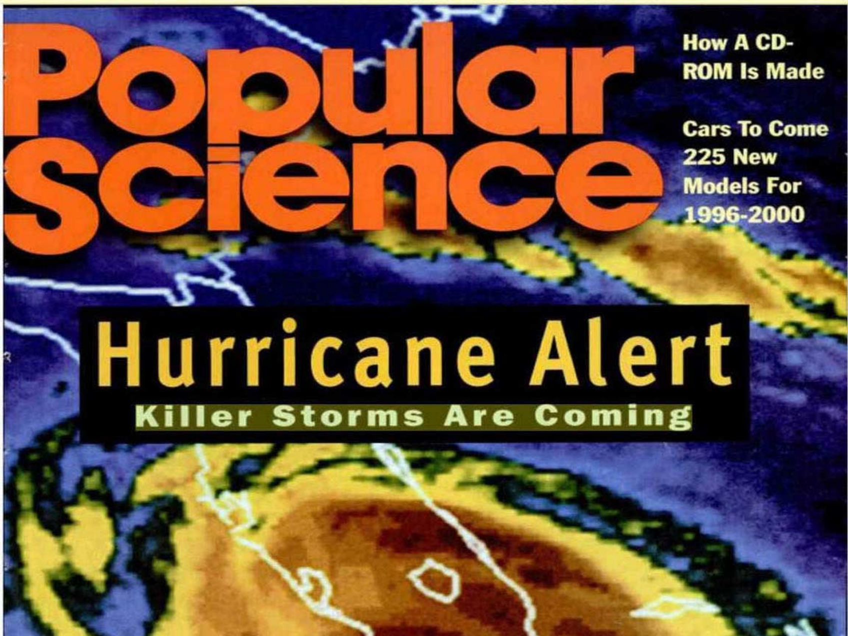
Popular Science

How A CD-ROM Is Made

Cars To Come 225 New Models For 1996-2000



Hurricane Alert

Killer Storms Are Coming

EXCLUSIVE: THE SECRET AGENDA OF A MILITARY PROJECT IN ALASKA

SEPTEMBER 1995
$2.95
CANADA $3.50

09>

0 70989 35662 7

Popular Science

THE WHAT'S NEW MAGAZINE

SEPTEMBER 1995

A TIMES MIRROR MAGAZINE

FOUNDED IN 1872

VOLUME 247

NUMBER 3

DEPARTMENTS

EDITOR'S NOTE 4

READERS TALK BACK 6

IN BALANCE 8

WHAT'S NEW 10

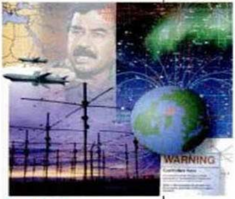
NEWSFRONTS

- Science & Technology 23
- Computers & Software 32
- Home Technology 37
- Automotive 40
- Electronics 46

LOOKING BACK 108

82

Globe-Spanning Telescope

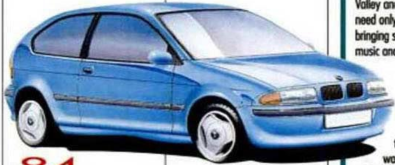


78

Mystery in Alaska

65

Hurricane Alert



84

Cars to Come

72

The Making of Multimedia

FEATURES

HURRICANE ALERT

65

Imagine storms the size of Hurricane Andrew slamming into the East Coast with unbridled fury and almost yearly frequency, for a decade or more. Impossible? Try probable, says William Gray, the world's leading hurricane prognosticator. According to Gray, a cycle of severe devastation is at hand.

THE MAKING OF MULTIMEDIA

72

These days, the process of creating a CD-ROM is part Silicon Valley and part Hollywood. Anyone who doubts the synergy need only meet Dr. Virgil Reality, a zany professor adept at bringing stuffy scientific principles to rib-tickling life, aided by music and movielike animation.

MYSTERY IN ALASKA

78

A new research installation is beaming powerful radio energy into the upper atmosphere. Officially, the project will explore conventional uses of the air waves, but a secret agenda has exotic military goals as well. Is the project safe? Some scientists question the wisdom of transmitting enormous amounts of energy into the ionosphere without further discussion and study.

GLOBE-SPANNING TELESCOPE

82

From Hawaii to the Caribbean, 10 radio telescopes form a giant eye on the sky that has already yielded the most compelling evidence yet for the existence of black holes. Performing as if it were a single 5,000-mile-long observatory, the array is a thousand times as powerful as the more celebrated Hubble Space Telescope.

CARS TO COME

84

Our annual preview peers toward the year 2000 to chart the continuing course of automotive evolution. The next five years will bring stylistic distinction, increased electronic sophistication, and improvements in passive safety. We detail changes for carmakers from Acura to Volvo.

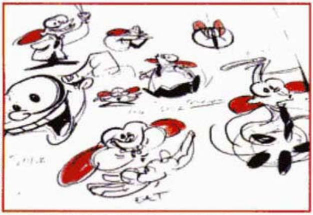
Copyrighted material

EDITOR'S NOTE

ATMOSPHERIC UNCERTAINTIES

A strange and little-known Pentagon project called the High Frequency Active Auroral Research Project (HAARP) is now under construction in an isolated region of Alaska. HAARP will employ huge antennas to direct intense beams of focused electromagnetic energy at the ionosphere. Scientists envision the beam burning "holes" in the ionosphere and creating an artificial lens in the sky that could focus large bursts of electromagnetic energy to higher altitudes.

HAARP's purpose is a mystery. The project was cited as one of the "Top 10 stories the media missed in 1994" by Project Censored, a nationwide survey of journalists. Its existence first surfaced publicly in Alaska in 1993, when the FAA began instructing pilots to avoid HAARP's electromagnetic radiation. According to author Mark Farmer, speculation about HAARP's purpose ranges from notions of government mind-control beams to UFO downlinks. In fact, documents obtained by POPULAR SCIENCE indicate that HAARP is a spooky mixture of high-energy radio-physics employed for exotic military surveillance purposes.



DRAWINGS PROVIDED BY 7th LEVEL

The science of CD-ROM: The animated antics of Virgil Reality are the focal point of a multimillion-dollar digital technology development effort to produce the latest computer-based "edutainment."

On June 5, Allison, the first hurricane of the season, hit the Gulf Coast and quickly churned down to a barely notable tropical storm. But according to Dr. William Gray, Allison may have been the opening bell on the fiercest hurricane season in decades. Widely considered to be the preeminent expert on hurricane prognostication, Gray says that conditions and timing are right for a return to the highly active—and destructive—hurricane seasons of the 1950s and 1960s. This time, however, destruction could be far greater because we've overbuilt coastal areas from the Gulf of Mexico to Cape Cod. So if the combined effects of El Niño in the Pacific and the rainfall cycles in Africa produce the storms Gray expects, this hurricane season could well be one of great destruction and tragedy.

Predicting the weather may be only slightly trickier than reading the public's taste for entertainment. And when you throw in a healthy dose of fast-moving digital technology, you've really got a high-tech gamble. That's what Contributing Editor Chris O'Malley found when he went behind the scenes with the folks at a multimedia software company to learn how a CD-ROM title is created.

The Universe According to Virgil Reality will be on store shelves by the holidays. On your computer screen, you'll be guided through sophisticated science concepts by a wacky animated character whose modus operandi is humor and music. What O'Malley found in the production studios, however, was serious digital business. And not all of it by the book. "It's clear that the road to convergence will be lined with some fascinating scenery, if not always smooth pavement," comments O'Malley.

Finally, POPULAR SCIENCE is now up on the World Wide Web as part of the Electronic Newsstand (http://www.enews.com/magazines/popsci). In addition to a selection of articles and products from the current issue, you'll find What's New Daily, which contains up-to-the-minute reports not found in our print edition. To come: interactive forums where you can communicate with guest speakers, talk to the editors, and chat with other readers. We welcome your input as we create this new version of POPULAR SCIENCE.

EDITOR - IN - CHIEF

Popular Science

Editor-in-Chief Fred Abatemarco
Editor Richard L. Stepler
Executive Editors Arthur Fisher, Cecilia Wessner
Art Director W. David Houser

Managing Editor Candace Golanski
Senior Editors Michael Antonoff, Stuart F. Brown, Mariette DiChristina, Dan McCosh, Dawn Stover
Associate Editor Robert Langreth
Copy Chief Bob Sillery
Staff Photographer John B. Carnett
Assistant Editor Suzanne Kantra Kirschner
Graphics Production Coordinator Kim O'Reilly
Editorial Assistant Wendi E. Black
Administrative Assistant Marcie Mason
Picture Editor Cynthia van Roden
European Correspondent David Scott
Far East Correspondent Dennis Normile
Contributing Editors Robert Gannon, Judith Anne Gunther, Michael Morris, Chris O'Malley, Don Sherman, P. J. Skerrett, Bill Sweetman, Mark D. Uehling
Editorial Interns Andrew Sage, William L. Thieriot, Alan Zibel

Popular Science Properties
President Patricia G. Campbell
Vice President & General Manager Nancy C. Walker
Vice President & Editorial Director Fred Abatemarco
Vice President & Publisher Ron Bernstein
National Sales & Marketing Manager Michele Folman
Eastern Advertising Office: Sales Manager Michele Brown; **National** **Manager Platinum/Heartland Sales** Ed Baker; Claudia Ryan, Barry H. Weinberg, Valerie Ambrister, Brenda Charles (212) 779-5000; **Midwest Advertising Office: Manager** John Zeman; Hans Theisen, Dawn Zabel (312) 337-7896; **West Coast Advertising Office: Manager** Craig Lee (310) 315-4380; **Detroit Advertising Office: Manager** Keith D. Cunningham; **Direct Response Manager** Diane Pahl; Lynne Gushman (810) 350-3800
Marketing/Research Director Ross Rurlani
Promotion Manager Taryol Latimer
Business Manager Tony Buzzeo
Advertising Coordinator Ellie Norton
Consumer Marketing Director Dan Dynan
Director, Classified Operations Richard Goldberg
Manufacturing Operations Director Gerald Palacios
Production Director Laurel Kurnides
Production Manager Marie Guenveur
Associate Quality Control Manager John Francesconi

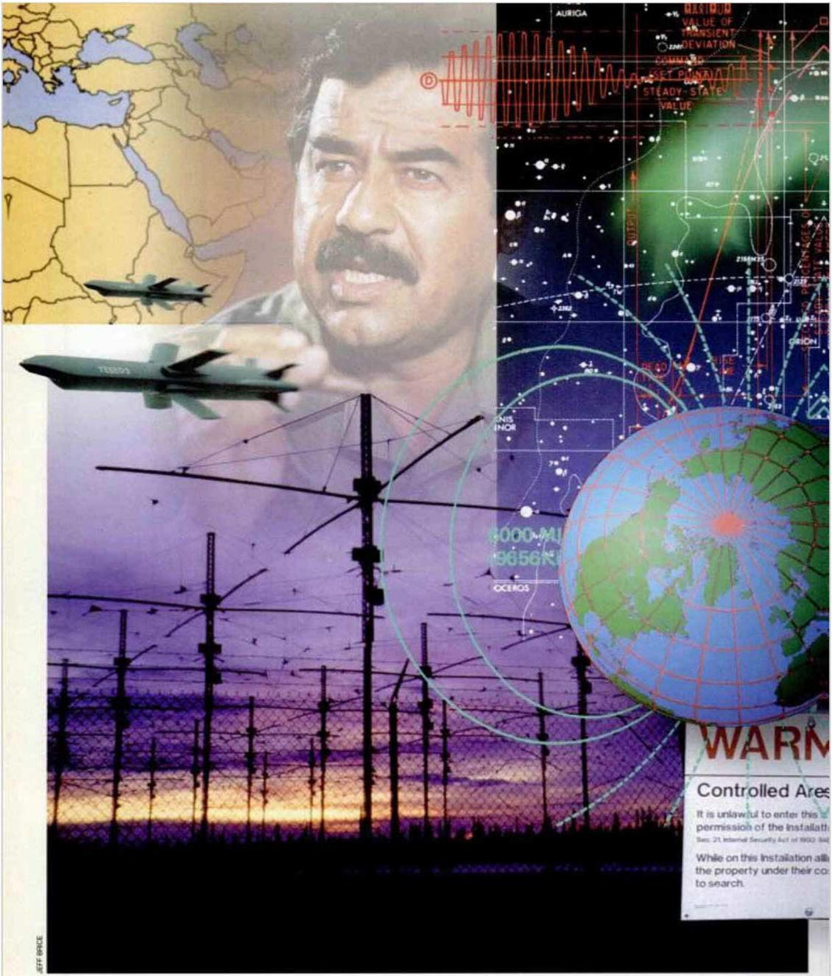
Times Mirror Magazines

Chairperson Ann E. Dilworth
President & Chief Executive Officer Francis P. Pandolfi
Executive Vice Presidents Patricia G. Campbell, James L. Kopper
Senior Vice Presidents George Bell, Scott W. Kabak, Michael J. Haugh, Nicholas H. Niles
Vice President/Accounting Nicholas A. DeCarlo
Vice President/Multimedia Jack Horstmeyer
Vice President/Database Diane G. Potter
Vice President/Manufacturing Kit Taylor
Vice President/Consumer Marketing Paul D. Wolff
Associate Group Publisher Deb Lees
Executive Director/Conservation Council David B. Rockland, Ph.D.
Director/Public Relations Linda W. Boff
Director/Corporate Sales Stephen R. Burzon
Director/Corporate Research Stephen R. Frost
Director/Telemarketing Richard Goldberg
Director/Corporate Marketing Ellen Pedersen

Photocopy Permission Permission is granted by *Popular Science*® for libraries and others registered with the Copyright Clearance Center (CCC) to photocopy articles in this issue for the flat fee of $1 per copy of each article or any part of an article. Send correspondence and payment to CCC (21 Congress St., Salem, Mass 01970); specify CCC code 0161-7370/95/$1.00—0.00. Copying done for other than personal or reference use without the written permission of Popular Science® is prohibited. Address requests for permission on bulk orders to Beth Barber, L.A. Times Syndicate, Intl., 2 Park Ave., New York NY 10016 for foreign requests. For domestic requests, write or call Reprint Management Services, Inc., 147 West Airport Rd., P.O. Box 5363, Lancaster, PA 17606-5363; 717-560-2001 (FOR ARTICLE REPRINTS ONLY). Popular Science® is a registered trademark of Times Mirror Magazines, Inc.

POPULAR SCIENCE **Business and Executive Offices:** 2 Park Ave., New York NY 10016. **Editorial Offices:** Address contributions to Popular Science, Editorial Dept., 2 Park Ave., New York NY 10016. We are not responsible for loss of unsolicited materials. They will not be returned unless accompanied by return postage. Microfilm editions are available from Xerox University Microfilms Serial Bid Coordinator, 300 N. Zeeb Rd., Ann Arbor MI 48106. **Subscription Inquiries:** Send new or renewal subscriptions or change of address (send both new and old addresses) to Popular Science, Box 5100, Harlan IA 51537. Allow six to eight weeks for change of address. If you have a subscription problem, please write to the above address. **Subscriptions:** U.S. and its possessions, 1 year $13.94; 2 years $24.97; 3 years $34.97. For Canada, add $7 per year (includes GST). For Foreign, add $8 per year. Subscriptions processed electronically. **Postmaster:** Send change of address notices to Popular Science, Box 5100, Harlan IA 51537. Popular Science entered as second-class postage paid at New York NY and additional mailing offices. Canada Post Canadian Publications Mail Product Agreement No. 56219. Canada GST Registration Number R-122988066. Popular Science (ISSN 0161-7370) is published monthly by Times Mirror Magazines, Inc., 2 Park Ave., New York NY 10016.

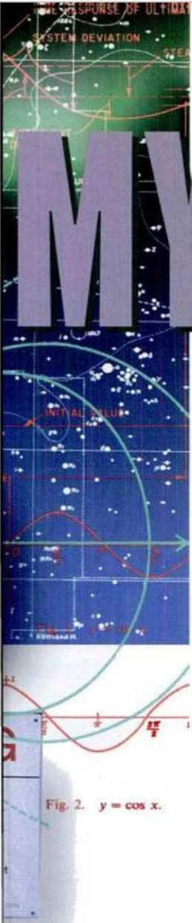
Printed in the U.S.A.


AURIGA
MAXIMUM VALUE OF TRANSIENT DEVIATION
COMMAND SET POINT
STEADY-STATE VALUE
OUTPUT
ORION
6000 MI
9656 KM
OCEROS
WARN
Controlled Area
It is unlawful to enter this
permission of the Installation
While on this Installation all
the property under their co
to search.

JEFF BRICE

A new research installation is beaming powerful radio energ
conventional and exotic military uses of the air waves are i

Copyrighted material



MYSTERY IN ALASKA

BY MARK FARMER

into the upper atmosphere. Exploring
goals.

At a remote facility ringed with barbed wire, a brand-new array of 36 antennas rises from the black spruce forest that stretches hundreds of miles across central Alaska. Completed last December and now undergoing testing, the antenna field is the visible part of a powerful and sophisticated high-frequency radio transmitter designed to transform areas of the upper atmosphere into the equivalent of huge lenses, mirrors, and antennas.

This little-known Pentagon-sponsored radiophysics project, called the High-Frequency Active Auroral Research Program (HAARP), is officially intended to expand knowledge about the nature of long-range radio communications and surveillance using the fluctuating ionosphere [see "Way Up in the Ionosphere], the portion of the upper atmosphere extending from 35 to 500 miles above Earth's surface.

According to program manager John L. Heckscher of the Phillips Laboratory at Hanscom AFB, Massachusetts, potential military applications of the HAARP research include developing Department of Defense technology for detecting cruise missiles and communicating with submarines. "Although HAARP is being managed by the Air Force and Navy, it is purely a scientific research facility that poses no threat to potential adversaries and has no value as a military target," he says.

But that's just the publicly announced part of the program. HAARP also has a secret agenda: pursuing more exotic military goals, such as locating deeply buried weapons factories thousands of miles away—and even altering the local weather above an enemy's territory.

A 1990 internal document obtained by POPULAR SCIENCE says the program's overall goal is to "control ionospheric processes in such a way as to greatly improve the performance of military command, control, and communications systems." It provides a description of the following applications:

- Injecting high-frequency radio energy into the ionosphere to create huge, extremely low frequency (ELF) virtual antennas used for earth-penetrating tomography—peering deep beneath the surface of the ground by collecting and analyzing reflected ELF waves beamed down from above.
- Heating regions of the lower and upper ionosphere to form virtual "lenses" and "mirrors" that can reflect a broad range of radio frequencies far over the horizon to detect stealthy cruise missiles and aircraft.
- Generating ELF radio waves in the ionosphere to communicate across large distances with deeply submerged submarines.

And, patent documents filed during an earlier research effort that evolved into the HAARP program outline further military applications of ionospheric-heating technology:

- Creating a "full global shield" that would destroy ballistic missiles by overheating their electronic guidance systems as they fly

Copyrighted material

through a powerful radio-energy field.

- Distinguishing nuclear warheads from decoys by sensing their elemental composition.
- Manipulating local weather.

When the full HAARP facility is constructed, it will include several sensing and analysis systems. At its heart is the antenna field, which now is a demonstration version of a larger planned array named the ionospheric research instrument (IRI), which will include 360 antennas. The IRI is designed to temporarily modify 30-mile diameter patches of the upper atmosphere by exciting, or "heating," their constituent electrons and ions with focused beams of powerful, high-frequency radio energy. A household analogy would be a microwave oven, which heats dinner by exciting the food's water molecules with microwave energy.

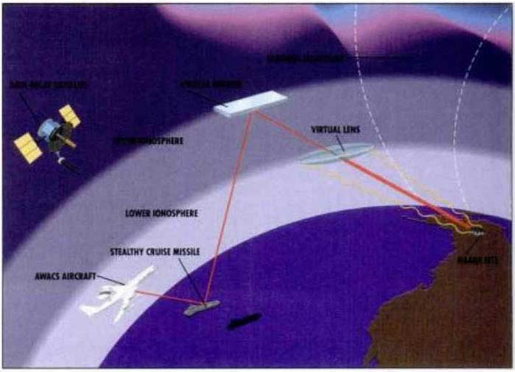
Earth-penetrating tomography is a startling potential use of ionospheric heating. The method would work by beaming radio energy into the Auroral electrojet, the curved, charged-particle stream formed at high latitudes where the solar wind interacts with Earth's magnetic field. The radio energy then disperses over large areas through ductlike regions of the ionosphere, forming a virtual antenna that can be thousands of miles in length.

Such an ELF antenna can emit waves penetrating as deeply as several kilometers into the ground, depending on the geological makeup and subsurface water conditions in a targeted area. Aircraft or satellites stationed overhead would then collect the reflected ELF waves and relay them to computers at a processing station, where subsurface inhomogeneities that trace the outlines of structures such as underground weapons facilities can be imaged. North Korea and Iraq, where buried nuclear weapons labs are believed to exist, would be prime candidates for earth-penetrating tomography surveillance.

Virtual lenses and mirrors will be generated in the ionosphere, if the IRI works as intended. By precisely warming a patch of the lower ionosphere, the IRI reduces its density relative to the surrounding atmosphere. An "ionospheric lens" thus formed can in turn focus a radio beam into the upper ionosphere [see drawing]. Normally, most high-frequency radio waves broadcast from the ground are absorbed or scattered in the lower ionosphere, and few of them reach such high altitudes.

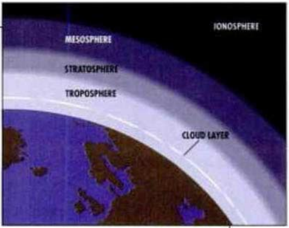
Next, the focused radio beam excites a patch of the upper ionosphere to form a virtual mirror. Finally, a radio-communication signal broadcast by the IRI, focused through the lens and reflected from the mirror, can be directed far over the horizon.

Virtual lenses and mirrors could also be used to scan a blanket of very low frequency (VLF) radio waves transmitted by an over-the-horizon radar. Although they reflect little VLF energy, stealth



Heated ionospheric "lens" and "mirror" created by HAARP antenna focus and reflect a radio-energy beam to detect a stealthy cruise missile from above. An AWACS plane collects the signals.

ILLUSTRATIONS BY K. DANIEL CLARK



WAY UP IN THE IONOSPHERE

The atmosphere near Earth's surface is composed of a soup of neutral atoms and molecules of various gases, mostly nitrogen and oxygen. Things are different in the rarefied ionosphere, where the Sun's ultraviolet and X-ray radiation transforms these particles into ions and free electrons through the process known as ionization.

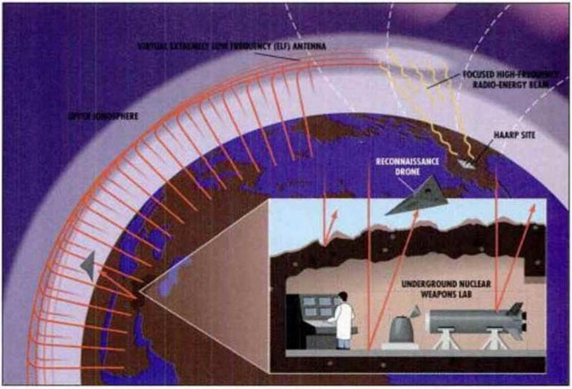
Radio communications are profoundly affected by the ionosphere, which can variously reflect, distort, or absorb radio signals, depending on their frequency and other conditions. Sometimes listeners around the world can hear a high-frequency, shortwave broadcast that has repeatedly "bounced" off the ionosphere. Similarly, AM radio broadcasts that don't carry very far during the day can sometimes be received much farther away at night, when the ionosphere's reflectivity increases.

The ionosphere is a notoriously changeable medium for radio transmission. It varies with the day-night cycle, in response to perturbations in Earth's magnetic field, and particularly during periods of sunspot activity, when high-frequency and very low frequency radio communication may become impossible, and power-grid failures on the ground can even occur.

Since there are so few atmospheric particles in the ionosphere, our normal concept of temperature doesn't work. Up there, temperature is an expression of how excited or "hot" the electrons are. Electron temperatures range between -130°F and 302°F across the ionosphere's four layers, which extend from 35 to 500 miles in altitude.

The local heating effect of the HAARP transmitter is expected to raise electron temperature by 40°F, according to the Air Force, and to endure as long as three months.—*M. F.*

Copyrighted material


VIRTUAL EXTREMELY LOW FREQUENCY (ELF) ANTENNA
FOCUSED HIGH-FREQUENCY RADIO-ENERGY BEAM
UPPER IONOSPHERE
HAARP SITE
RECONNAISSANCE DRONE
UNDERGROUND NUCLEAR WEAPONS LAB

Underground bomb lab is detected by using an extremely low frequency (ELF) ionospheric "antenna" formed by beaming radio energy into the Auroral electrojet from the HAARP site in Alaska.

aircraft can appear from above as "holes in the blanket," thus betraying their position.

Proprietary phased-array transmitting, steering, and pulsing techniques built into the IRI will permit rapid aiming of the radio-frequency beam in any direction, and at angles as low as 30 degrees above the horizon. This "oblique heating" ability enables HAARP to form virtual lenses or mirrors at distances of more than 1,000 miles from the transmitter.

Deeply submerged submarines can receive secure messages through ELF radio communication. But the antenna needed to generate a desirable transmission frequency such as 30Hz must be more than 1,200 miles long. Real estate parcels this shape are hard to come by on the ground, but not in the air. As in the case of earth-penetrating tomography, high-frequency radio energy transmitted into the Auroral electrojet can form a submarine communications ELF antenna thousands of miles long. Consequently, HAARP can beam ELF waves at nearly any portion of the Northern Hemisphere by using oblique heating.

The full global shield is an exotic proposal for an Earth-encompassing shell of high-speed electrons and ions that would be generated by a much more powerful version of HAARP. Any missile or warhead passing through the protective shell would explode. Or, a "soft-kill" weapon system using ELF waves produced by HAARP heating could be used to overload power-distribution grids and destroy unshielded microelectronics using electromagnetic pulse energy similar to that released by a high-altitude nuclear explosion.

Real nuclear warheads and decoys, or the constituent materials of unfamiliar satellites, could be remotely distinguished in flight by bathing them in accelerated electrons. Analyzing the electromagnetic signal returns would reveal their elemental composition.

Weather manipulation may be possible by building an ionospheric heater a thousandfold more powerful than HAARP. Differential heating of areas of the atmosphere could induce local weather conditions, such as floods or droughts, useful to the military. Smooth seas might suddenly be raked by treacherous squalls, creating or denying a tactical advantage.

Other elements that will be installed at the HAARP facility include a 120-foot diameter incoherent-scatter radar dish, a Laser Detection and Ranging Device (LIDAR), a magnetometer, and other optical and infrared instruments designed to analyze low-level light emissions induced in IRI-heated regions of the ionosphere. In all, HAARP's assemblage of transmitters, receivers, computers, and advanced signal-processing methods places it on the cutting edge of high-energy radio-physics research.

The program is managed by the USAF Phillips Laboratory and the Office of Naval Research. Equipment is supplied by Advanced Power Technologies, a Washington, D.C.-based subsidiary of E-Systems of Dallas, a longtime maker of electronics used in ultrasecret projects such as signals-intelligence satellites and the President's E-4B "doomsday plane," which is designed to serve as an airborne White House in the event of nuclear war.

Initial work on HAARP was begun in the mid-1980s by Atlantic Richfield Corp.'s subsidiary, ARCO Production Technologies Corp., and its then-president, physicist Bernard Eastlund. ARCO wanted to find an on-site demand for the enormous amounts of Alaskan natural gas it owns. So it cooked up an energy-intensive idea.

Eastlund worked under contract for the Defense Advanced Research Projects Agency (now called ARPA) and was awarded three patents—one of which was classified until 1991—for inventions dealing with ionospheric modification. One of the most grandiose systems described in his patents is a 40-mile square, HAARP-like radio transmitter that would have used huge amounts of electric power generated by turbines burning natural gas drawn from the vast North Slope reserves. "Full global shield" was conceived to wipe out the guidance systems of missiles in flight anywhere in the world.

"I founded and led the ARCO program until 1987," Eastlund says. "About that time Edward Teller visited Robert Hirsch, the ARCO vice president who had hired me. I don't know the direct results of that discussion, but shortly thereafter new [secret] initiatives began which I was not privy to, and I declined further involvement."

Teller is a co-designer of the hydrogen bomb and was the arch-proponent of the now-abandoned X-ray laser—the centerpiece of Ronald Reagan's Star Wars missile-defense program. Asked about his involvement in the beginnings of HAARP, Teller responded "I have no idea about that. I don't remember anything about it."

Although it is much smaller than a "full global shield" system, Eastlund says, "HAARP is the perfect first step toward a plan like mine. Advances in phased-array transmitter technology and power generation can produce the field strength required. The government will say it isn't so, but if it quacks like a duck, and it looks like a duck—there's a good chance it is a duck."

Advanced Power Technologies presi-

[Continued on page 93]

Copyrighted material

Mystery in Alaska

[Continued from page 81]

dent Ramy Shanny declined to comment on Eastlund's claims. And the Defense Department is making no effort to dispel the impression that Eastlund's story might sound a bit like science fiction. "HAARP certainly does not have anything to do with Eastlund's thing, that is just crazy," says Heckscher. "What we have here is a premier scientific research facility with military applications."

Richard Williams, a physical chemist and consultant to the Sarnoff Laboratory at Princeton University, sees things differently. "Eastlund is an intellectual ace and a technologically savvy guy," he says, "though there is a bit of Dr. Strangelove in him."

Speculation and controversy surround the question of whether HAARP's 1.7 gigawatts (1,7 billion watts) of effective radiated power in the 2.8- to 10MHz frequency range might cause lasting damage to Earth's upper atmosphere. By comparison, the energy level is more than 3,000 times greater than the biggest commercial AM radio transmitters.

"HAARP will dump enormous amounts of energy into the upper atmosphere. We don't know what will happen," says Williams. "My concern is its effect on a global scale—you can't localize the effects. With experiments on this scale, irreparable damage could be done in a short time. The immediate need is for open discussion. To do otherwise would be an act of global vandalism."

Eastlund himself observes that "There has never been a transmitter of this power in this frequency band. It would be wise to assess its impact."

The 440-page HAARP environmental-impact statement filed by the Air Force says that the normally upward-directed IRI transmissions can raise the internal body temperature of nearby people; ignite road flares in the trunks of cars; detonate aerial munitions that use electronic fuses; and scramble aircraft communications, navigation, and flight-control systems.

Program officials insist that the facility will operate safely during the four or five 14-day transmitting "campaigns" scheduled yearly. An integral part of the HAARP design is a system programmed to automatically cease transmitter operation if nearby aircraft are detected. The chain-link fence is designed to keep visitors from ending up in the path of a low-angle beam.

For decades, high-frequency heaters around the globe have been operated by researchers studying how the injection of radio energy affects the ionosphere, and the process by which the upper atmosphere recovers from the disturbance. These include transmitters in Tromso, Norway, which are operated by Germany's Max Planck Institute; Nizhny-Novgorod, Russia, and Dushanbe, Tadzhikistan, which are manned by Russian scientists; and U.S. facilities at Arecibo, Puerto Rico, and Fairbanks, Alaska.

HAARP's power output—nearly twice that of any other ionospheric heater—combined with the rapid beam-steering ability and broad frequency range of its transmitter, will permit the IRI to modify higher-altitude areas of the ionosphere from greater distances than ever. A bank of six 2.5-megawatt, 3,600-horsepower diesel generators powers the IRI prototype, while the rest of the facility taps electricity from a nearby power line.

Some prominent experts are unmoved by talk of HAARP's possibly dire effects. The dean of American space sci-

NordicTrack burns more fat.

Nothing else trims body fat like a NordicTrack.

If you want to quickly achieve a leaner, firmer body, you need the original NordicTrack® ski exerciser. Independent studies show that NordicTrack burns more fat than steppers, treadmills and stationary bikes. Unlike these ordinary exercisers that work only your lower body, NordicTrack conditions your entire body at once for maximum results in minimum time.

Trim and tone your entire body in just 12 weeks!

A recent clinical study shows you can see amazing results with NordicTrack in just 12 weeks:*

- **Reduce your body fat weight by 30%!**
- **Trim 3.8" off your stomach, 2" off your thighs and 2.3" off your hips!**
- **Lose 18 pounds!**

Fact is, NordicTrack is so effective, you can get a slimmer body in as little as 30 minutes, four times a week! And while you're burning up to 1,100 calories per hour, you'll gain energy and endurance. So you'll feel as great as you look.

See for yourself why NordicTrack is the best way to get a leaner, healthier body!

NordicTrack®
The World's Best Aerobic Exerciser®

*Average results shown. Individual results may vary.
©1995 NordicTrack, Inc., A CML Company • All rights reserved.

NordicTrack brings the best aerobic exercise to your home.

NordicTrack delivers the best simulation of cross-country skiing, which fitness experts rank as the most effective aerobic exercise. Only NordicTrack has the patented flywheel and one-way clutch system for the smoothest, low-impact ski motion. So it's easy on your body and enjoyable to use. That's probably why 7 in 10 NordicTrack owners continue to use their machines even after five years!

30-DAY IN-HOME TRIAL

NordicTrack Pro® model shown

FREE VIDEO & BROCHURE
CALL: 1-800-441-7891
Ext. 28015

☐ Please send me a FREE video & brochure
My main fitness goal is (check one) ☐ Weight loss
☐ Shaping & toning ☐ Cardiovascular fitness ☐ Overall health
Name ____________
Street ____________
City ____________ State ____ Zip ____
Phone ( ) ____________
Call or send to: NordicTrack, Dept. 28015
104 Peavey Road, Chaska, MN 55318-2355

Mystery in Alaska

[*Continued from page 93*]

entists, James Van Allen, professor of physics at the University of Iowa and discoverer of the Earth-girdling radiation belts that bear his name, says "Every time you turn on a radio transmitter you modify the ionosphere. HAARP will perturb the ionosphere markedly for an hour, or maybe even a day, or perhaps at most a month. I don't see any deleterious effects other than on local communications."

Van Allen says five decades of research have given him a feeling for the minute scale of influence humans have on the cosmos. "There is nothing that we as men can do that does not pale in comparison to the forces of nature."

Alfred Y. Wong, professor of physics at UCLA and director of the high-power active-stimulation ionospheric heater—HAARP's little brother—located in Fairbanks, Alaska, simulates ionospheric conditions in an atmospheric chamber at his Los Angeles laboratory. The device subjects electrons and ions to high-frequency radio heating, replicating the effects of HAARP. "We understand most of the fundamental mechanisms that underlie ionospheric heating. In chamber simulations we've conducted very detailed studies with reproducible results. We put probes in the chamber to study this. We found no negative effects," he says.

Wong believes HAARP could be used for environmental mitigation efforts, such as accelerating chlorine atoms into interplanetary space to prevent them from degrading Earth's vital upper-atmospheric ozone layer. Though he acknowledges potential offensive military uses of HAARP, Wong believes no harm will occur from its operation. "I don't see any problems, only surprises," he says. "That's why we do research."

Others harbor a strong distrust of the program. A local organization called No HAARP firmly opposes the project on environmental and communications-disruption grounds. "This is not good science," contends retired ARCO Production Technologies employee Clare Zickuhr, who leads the group. "They have no idea what this thing could do to the ionosphere. To put this in the hands of the military scares the hell out of me."

HAARP has proceeded full-steam ahead since its inception in 1990. The total amount of money spent over the past six years exceeds $58 million and may reach nearly $200 million by the end of the decade, when the installation is scheduled to be completed. The effort is a "congressional special-interest program," meaning that supporters in Congress request funds for it on behalf of the Air Force and Navy.

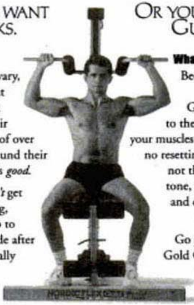
Sen. Ted Stevens (R-Alaska) is a staunch supporter of the program. Other Alaska state officials, however, have not been briefed about HAARP by the military. Asked about the program, a spokesman for Gov. Tony Knowles replied, "We have no idea what you are talking about." State Rep. Jeanette James, whose district surrounds the HAARP site, has repeatedly asked Air Force officials about the project and has been told "not to worry," she says. "My gut feeling is that it is frightening. I'm skeptical. I don't think they know what they are doing."

This is not the last we will hear of HAARP. Whether or not the program's sponsors understand its long-term effects, they appear to feel that the potential for useful military payoffs makes it worth taking some political heat—although they may not have expected to attract any attention way out back in Alaska's sub-Arctic taiga.

TAKE THE NORDICFLEX GOLD CHALLENGE.

GET THE BODY YOU WANT
IN JUST 12 WEEKS.

OR YOUR MONEY BACK.
GUARANTEED.



What have you got to lose?
While individual results may vary, recent studies clearly show that people who added NordicFlex Gold* strength training to their daily activities lost an average of over 7% body fat, and 2 inches around their waists, in just 12 weeks*. That's *good.*

Of course, you lose if you *don't* get involved with strength training, also. You can expect to lose up to 6% of lean muscle every decade after age 30. And by 45, you normally will have lost 15% of the strength you had at 29. That's *not* good.

What have you got to gain?
Because the unique resistance system of the NordicFlex Gold *automatically* responds to the force you apply, you work your muscles to fatigue. No adjustments, no resettings. *You* control the action, not the machine. You gain body tone, strength and power — fast and effectively, with less muscle trauma than free weights.

Go ahead, take the NordicFlex Gold Challenge. You'll feel great, look terrific and grow the power to be your best in just 12 weeks.

SOLID GOLD GUARANTEE
Set your goals. Then see how NordicFlex Gold can help you look, feel and be your best, and give you increased strength and power. If not satisfied after 12 weeks, send it back for a full refund of your purchase price, less shipping charges. Call for details.

CALL ONE OF OUR FITNESS CONSULTANTS TO ANSWER ANY QUESTIONS OR TO SEND YOU A FREE BROCHURE.
1-800-441-7890
EXT. 18KI5
Or Write: NordicFlex Gold, Dept. 18KI5, 104 Peavey Road, Chaska, MN 55318-2355

NORDIC FLEX Gold

*Results of a 12 week NEFLI study, which is an educational adjunct of NordicTrack. Individual results may vary. Some participants may have used NordicFlex Gold in conjunction with aerobic exercise and a sensible diet.
©1995 NordicTrack, Inc., A CML Company • All rights reserved.