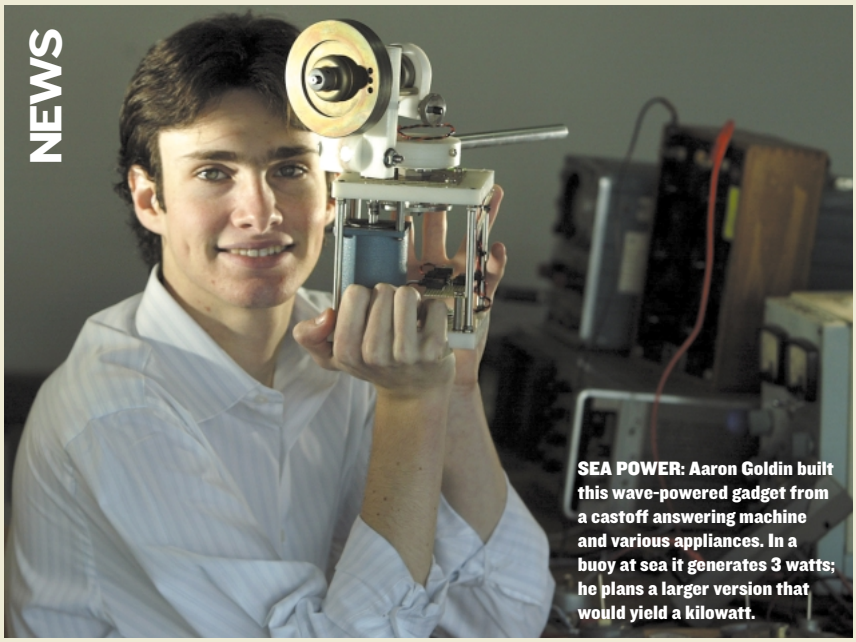

SEA POWER: Aaron Goldin built this wave-powered gadget from a castoff answering machine and various appliances. In a buoy at sea it generates 3 watts; he plans a larger version that would yield a kilowatt.

Wringing Watts From Waves

A high schooler's invention turns water motion into "juice"

Generating electricity from wave power is an old idea that gained new life when the quest for alternative energy sources began in the 1970s. Now 17-year-old Aaron Goldin has found an elegant way to do the job with a buoy, a gyroscope, and a generator.

In December, the invention won Goldin the US $100 000 grand prize in the Siemens-Westinghouse Competition in Math, Science & Technology.

Goldin is a high school student from Encinitas, Calif., and hardly an old hand at science competitions. His only other science contest entry, submitted when he was in the ninth grade, was for a study of ant colonies. (It showed that 100 ants gather noticeably more than 10 times as much food as 10 ants, implying that even insects benefit from economies of scale.)

After spending the past two summers working at the Scripps Institution of Oceanography in La Jolla, Calif., Goldin turned his parents' garage into an engineering lab. The fruit of his labor, the "Autonomous Gyroscopic Ocean-Wave-Powered Generator," is cobbled together from parts scavenged from an old tape recorder and other household appliances.

The result, dubbed Gyro-Gen, achieves efficiency through simplicity. When wave motion causes the buoy in which the device is encased to roll, gyroscopic precession causes the disk in the gyroscope to rotate. The disk turns a crank on a generator, which delivers about 3 watts of power. Goldin points out that, unlike several other wave-power devices now being tested, his requires no hydraulics or other intermediate system to transfer power to the generator.

What can you do with 3 watts? You might charge a battery or electrolyze water into hydrogen and oxygen that could be stored for later use in a fuel cell. But Goldin's main hope is to develop a scaled-up version that will yield a kilowatt. He has retained a patent lawyer and will spend this summer trying to build another prototype.

"I think he has a nice idea," says Annette von Jouanne, a professor of power electronics and energy systems at Oregon State University in Corvallis, a leader in wave-power research. "We would certainly welcome him into our program."

Straightforward engineering projects are rather rare in science-fair competitions, but Goldin went with what he knew. "It's just what I've been exposed to," he said. "I haven't had nearly as much lab experience as engineering." Goldin's father, an EE, encouraged his son from an early age, often by helping him take apart old VCRs and appliances. "I'd always have a new gadget, widget, motor, or something to play with," the high schooler says.

—WILLIE D. JONES

Preliminary design work has also begun on replacing the signals and their relays on the No. 7 line, which runs across midtown Manhattan and passes Shea Stadium on its way to its terminal in Flushing, Queens.

"The two biggest obstacles to changing out the signals are funding and finding a way to install the new technology in a subway system that runs 24 hours a day, seven days a week," says Charlie Seaton, a spokesman for the transit authority.

For years the city has been loath to raise fares to pay for upgrades in the subway. By the early 1980s, when federal and state funds allowed the transit authority to make improvements, its first priority was to clean things up. Stations were refurbished, and rickety and graffiti-covered trains were replaced by air-conditioned models. Meanwhile, in the tunnels and signal rooms, it was still 1932.

Even a few billion dollars extra wouldn't solve the problem, because the subway's always-on service requirement limits the rate of work. When a company decides to replace mainframes with networked servers, it sets the new system up in parallel and shuts down the old system only after a safe period. Since subway control systems are right on the tracks, they cannot be replaced without disrupting service.

Many of the roasted relays and wires were not technological descendants of the originals but the originals themselves

"And you wouldn't believe the pressure we were under from local politicians and advocacy groups when we shut down the L line on weekends" for the modernization, said Seaton.

To repair any part of the subway requires shutdowns, which must be done mainly at night and on weekends. To upgrade the entire system would take 35 years, the transit authority estimates. Of course, by then, it will again be out of date.

How much would a system-wide signals upgrade cost? Seaton wouldn't venture even a guess.

But any New Yorker could tell you: "Fuhgeddaboutit."

—WILLIE D. JONES

AARON GOLDIN