

ANNUAL PATENT REPORT: 150 COMPANIES RANKED

MIT'S MAGAZINE OF INNOVATION

TECHNOLOGY

REVIEW

MAY 2003

WWW.TECHNOLOGYREVIEW.COM

REINVENTING LIGHT

THE PRIZE:

- \$40 BILLION MARKET
- AVERTING POWER SHORTAGES
- NEVER CHANGE A LIGHT BULB AGAIN

Mind-Machine Merger

Printable Transistors

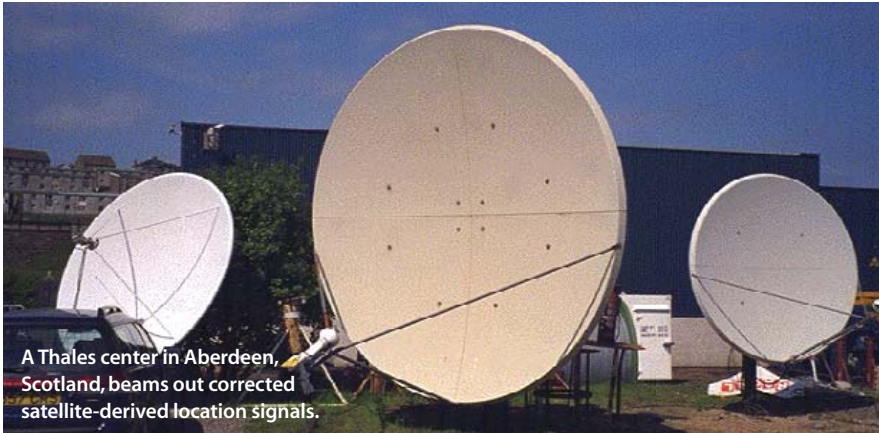
Surveillance Nation—
Part Two

USA \$4.99 • CANADA \$6.99



PLUS

Combating Anthrax
Staying Anonymous Online
Curbing Music Piracy



A Thales center in Aberdeen, Scotland, beams out corrected satellite-derived location signals.

FIXING THE LOCATION FIX

Ten-centimeter GPS resolution is quite close to being here

SOFTWARE | Hikers and drivers who use satellite-derived location information may not need to know their latitude and longitude down to the decimeter. But phone company workers digging near fiber-optic cables, drillers working on offshore oil-and-gas rigs, and farmers tracking crops row by row do need that kind of accuracy. Right now, though, they depend on expensive, localized ground-based reference-and-correction systems to get high precision from the 24 satellites of the Global Positioning System (GPS), run by the U.S. Department of Defense.

That's about to change. Thales, the French aerospace giant, says it has developed the first GPS-correction service that's accurate to within 10 centimeters virtually everywhere on the planet—compared to the one-meter precision guaranteed by similar existing services. "This makes something that was once very difficult much easier, because you won't need expensive equipment," says Andrew Barrows, president and founder of

Thales double-checks the coordinates reported by the satellites. Then it corrects for atmospheric disturbances that might alter signals' travel time and for known errors within the clocks aboard each satellite. Finally, the company maintains 85 ground-based reference stations worldwide. The correct coordinates of these fixed stations are known, and they are continually compared against the coordinates reported by GPS. By this summer, Thales expects to beam ultracorrected GPS signals from outposts in Singapore and Aberdeen, Scotland, to paying customers.

The system will help farmers spread seed and fertilizer only where needed and even track individual plants for research. The technology should be a special boon for offshore oil-and-gas drilling industries, which need precise information to map their work locations and can't install fixed-reference stations at sea. And it could help utilities map existing rights of way and workers dig without disturbing buried cables.—*David Talbot*

MACHINING MELODIES

ARTIFICIAL INTELLIGENCE | The marriage of computers and music has spawned digital instruments that sound "real," an interface—the musical-instrument digital interface—that's now an industry mainstay, and composition software that helps generate ideas, assemble phrases, and analyze existing works.

But now machines are actually learning to compose music of their own. Eduardo Miranda at England's University of Plymouth has developed software that generates music from scratch. Other composition software tools rely on high-level mathematical rules, but Miranda's approach is "bottom-up," he says. His software, which grew out of his research at the Sony Com-

puter Science Lab in Paris, France, adapts ideas from the field of artificial intelligence to create a sort of virtual orchestra. Ten "players" get together and generate simple sequences of musical notes. Each player is programmed to listen, evaluate, imitate,



and generate variations. After running for a few days, the artificial society produces haunting melodic streams.

These melodies are still ploddingly crude. "This is a beginning to getting a computer to create something new," Miranda says. The next step, he adds, is to evolve rhythms and dynamics.

It's too soon to say whether creative machines will supplant their flesh-and-blood counterparts, but "the technology is here," says Rodney Waschka II, a North Carolina State University researcher. Initially, such technology will help human composers by speeding the process and providing new ideas. In the long run, boy bands beware.—*Gregory T. Huang*

JAMES YANG (ILLUSTRATION); COURTESY OF THALES (FIXING THE LOCATION)