

MAY 23, 2005

## VOICES OF INNOVATION

### Nick Holonyak: He Saw The Lights

The electrical engineering professor's LEDs may soon make incandescent and fluorescent bulbs obsolete

Creative people who dream of leaving their mark on the world can't help but envy Nick Holonyak Jr. Already his handiwork in light-emitting devices shines brightly almost anywhere you look. Soon it'll be even more evident because one of Holonyak's ideas -- the light-emitting diode, or LED -- is poised to turn Thomas Edison's light bulbs into museum pieces.

Holonyak built his first LED in 1962, when he was a researcher at General Electric Co. ([GE](#)). It emitted only red light. But today its descendants glow in a rainbow of colors. You can't miss them in New York's Times Square, where huge billboards, such as the eight-story-tall NASDAQ display, gleam brightly even during the day. More LEDs are in the traffic lights and buses. Cars jamming the streets have LED turn signals, brake lights, and dashboard displays. Headlights are next.

Meanwhile, white-LED systems are starting to replace incandescent bulbs and even fluorescent tubes because LEDs draw less electricity -- and last for up to 10 years. Holonyak foresaw it all. "I knew incandescent light was doomed a long time ago," he says, and he predicted as much in the February, 1963, issue of *Reader's Digest*.

The same year, Holonyak left GE to become an electrical engineering professor at the University of Illinois, where he had earned his PhD a decade earlier. He's still there. Many of the 60-odd PhD students he has mentored are entrepreneurs, execs, and researchers at Silicon Valley companies such as Infinera, JDS Uniphase ([JDSU](#)), and Lumileds Lighting, helping to expand the LED universe.

In addition to the red LED, Holonyak developed the world's first red-light semiconductor lasers in 1962. Also known as laser diodes, these are key components in CD and DVD players, laser printers, copiers, and other high-tech gadgets. "I wanted visible light," says Holonyak, "because I knew that if I could get red light, other colors would be possible."

Starting in the 1970s, Holonyak also unleashed a spate of laser discoveries geared to invisible light, or infrared energy. This led to the diodes that transmit pulses of infrared light over the world's fiber-optic telecommunications networks. And his latest big idea is an infrared light-emitting transistor. LETs might transform not only telecom systems but also computers by

enabling optical and electronic functions to be integrated on one chip. Excited by that prospect, the Defense Advanced Research Projects Agency (DARPA) set up a research center last summer, headed by Holonyak and protégé Milton Feng, a professor of electrical and computer engineering also at the University of Illinois and co-inventor of the LET.

Computer scientists have long imagined optical computers 1,000 times faster than any electronic computer. Yet packing chips with thousands of tiny optical switches has been a snag. Could LETs be the solution? "It's way too early to know. This work is still in its infancy," says Holonyak. "I'm not going to be around to see the outcome."

But Holonyak, 76, is already getting to see LETs take root. Early this year physicists at California Institute of Technology reported developing one, and DARPA is funding research at Columbia University, Georgia Institute of Technology, and Harvard University. So Holonyak may well be around long enough to add another award to his long list of honors, including the 1995 Japan Prize and the 2004 Lemelson-MIT Prize, each worth \$500,000. It would be a nice acknowledgement for producing one bright idea after another...after another.

By Otis Port

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