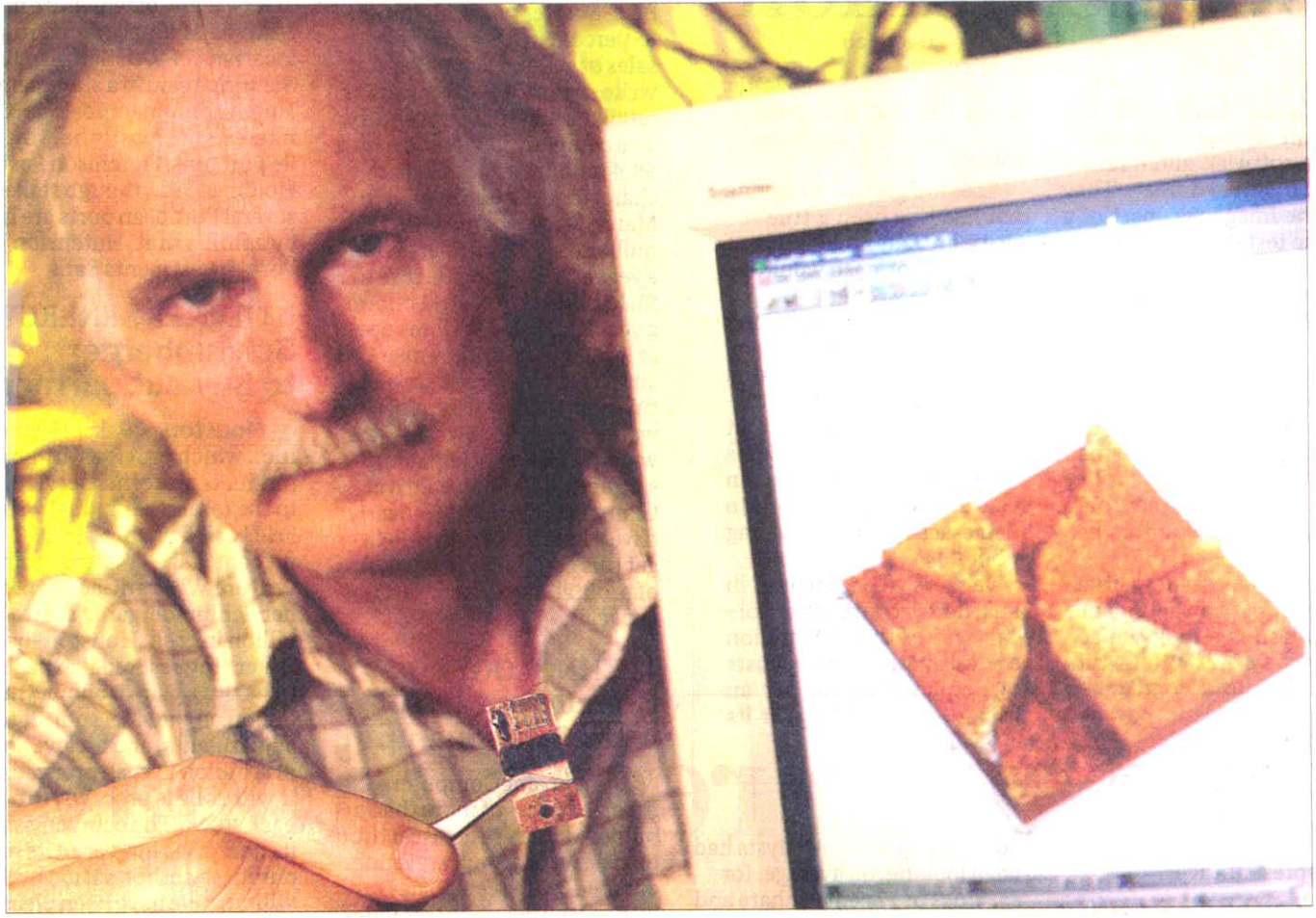

GARY MEEK / Georgia Tech

Georgia Tech professor **Walt de Heer** holds a proof-of-principle device made of graphene. Researchers believe that graphene — ultra-thin layers of graphite — can be used to build transistors superior to silicon-based semiconductors.

THE NEW SILICON?

Georgia Tech scientists experiment with using ultra-thin layers of graphite in semiconductors.

By BOB KEEFE
bkeefe@ajc.com

There's a reason why the center of the technology world is called Silicon Valley. Semiconductors made from the element are found in virtually every electronic device today.

But with tomorrow's gadgets expected to need more computing muscle and less power consumption from smaller processor chips than silicon can deliver, researchers are seeking new substances that can keep the high-tech innovations coming.

Scientists at Georgia Tech may have found an answer at the point of a pencil.

The researchers have discovered a way to use ultra-thin layers of graphite to build transistors that by some measures can be 25 times more effective than traditional silicon-based semiconductors.

Walt de Heer, a professor in Georgia Tech's School of Physics, cautioned that real products based on the layered graphite — called graphene — may be a decade or more away.

But de Heer's research is beginning to attract some attention in the semiconductor industry, as well as some substantial financial backers, among them semiconductor giant Intel Corp. and the National Science Foundation. The government alone has pumped about $1.8 million into the research.

"This is a new material ... that has a lot of potential," de Heer said. Apparently graphene not only transfers electrons better than silicon, he said, it also has displayed other advantages not seen in other materials.

Nobody, de Heer included, is predicting that silicon will go away anytime soon as the primary building block for semiconductors, or that graphene will become its ultimate replacement.

Still, industry officials and analysts generally agree that with the ever-increasing number of transistors required by today's ever-shrinking electronics, technology companies will start bumping up against the constraints of silicon sometime in the next 10 to 15 years.

"The people who are in charge of the technology road maps for the semiconductor industry ... have basically said: 'We're getting nervous. We're reaching the physical limits of what we can do with silicon,' " said Nathan Brookwood, senior analyst at Insight 64, a semiconductor industry research firm.

"There just isn't another silicon technology that's on the horizon," he said.

That's where research like de Heer's comes in.

Until now, among the most promising potential replacements for silicon have been so-called carbon nanotubes that, at least in laboratories, have proved more efficient.

The technology being de-

➤ See **GRAPHENE, F5**