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**I W**

THE MANAGEMENT RESOURCE



# Opening Windows To The Future

How Technology Leader Of The Year Bill Gates  
keeps reinventing Microsoft

TECHNOLOGY & INNOVATION ISSUE • 25 Technologies Of The Year

IW'S 4TH ANNUAL TECHNOLOGY & INNOVATION AWARDS

# 25 WINNING TECHNOLOGIES

■ BY JOHN TERESKO, JOHN SHERIDAN, TIM STEVENS, & GEORGE TANINECZ

**N**EVER BEFORE IN INDUSTRIAL HISTORY HAS BUSINESS CHANGE BEEN so driven by technology. To help our readers adapt, anticipate, and profit from that rapidly growing potential, this year the editors felt compelled to expand to 25 the winners list for Technologies of the Year. Yet even as we honor these 25 world-changing innovations, we realize that this issue is really dedicated to the entrepreneurs behind these technologies—those whom Peter Drucker describes as being responsible for moving resources to areas of higher productivity and yield. In that spirit IW congratulates not just the 25 winning technologies and our Technology Leader of the Year, but all those reader-entrepreneurs who apply what they learn on the following pages in the coming year. The 1996 winners will receive their awards during IW's Managing for Innovation Conference at the Westin Hotel in Charlotte Apr. 7-8. Congratulations are also offered by AT&T, sponsor of the Technology Awards Program & Conference. The selection process for IW's 1997 Technology Awards Program will begin with a call for nominations in June. To reserve an entry form, call the Customer Service Center at 800-326-4146.

**Technology Leader of the Year**

Bill Gates  
Chairman and CEO  
Microsoft Corp.

**Technologies of the Year**

- American Honda Motor Company Inc.
- ANSYS Inc.
- Applied Sciences Inc.
- Battelle Memorial Institute
- Bell Laboratories
- Bentley Systems Inc.
- BHR Software
- Boothroyd Dewhurst Inc.
- Cadis Inc.
- Calico Technology
- Caliper Technologies Corp.
- Computer Associates International Inc.
- Connect Inc.
- Engineering Animation Inc.
- General Motors Corp.
- Innovative Knowledge Products Inc.
- Lam Research Corp.
- Lawrence Livermore National Laboratory
- Lockheed Martin Corp.
- Neural Applications Corp.
- Oracle Corp. and subsidiary  
Network Computer Inc.
- SAP America Inc.
- Shell Chemical Co.
- 3-D Technology Laboratories Inc.
- Trilogy Development Group

**Neural Applications Corp.**  
Coralville, Iowa  
**Intelligent process-optimization system**

If you want to talk about real-time process control, try the folks at Neural Applications Corp. Or perhaps the process engineers at the St. Paul plant of North Star Steel Corp., which partnered with Neural in prototyping advanced "intelligent systems" technology to optimize total energy input in electric-arc-furnace steelmaking.

The Intelligent Total Energy Controller, based on neural-network modeling techniques, simultaneously analyzes and reacts to data from four separate energy-related subsystems—which control the electric arc, gas burners, carbon, and oxygen input—to achieve the most advantageous mix of energy inputs.

A look at the numbers suggests the magnitude of the task: Process data collected by more than 200 sensors are analyzed by the computer system at a rate of up to 3,600 samples per second. And process-control feedback to the subsystems is

updated three times every second—making constant adjustments to the steelmaking process, notes Bill Staib, vice president for technology at Neural Applications.

Unlike conventional engineering approaches to complex systems—which control each subsystem separately—the Neural Applications technology takes advantage of the adaptive and data-mining capabilities of a neural network to optimally coordinate the once-separate process loops.

The value of neural-net technology, Staib explains, is that "the process-control model is based on data, rather than assumptions. It gives you a more exact model to begin with, and, as the process changes over time, you are able to track those changes."

The Intelligent Total Energy Controller can play a role in reducing air emissions and also affords managers increased flexibility in responding to variations in the cost and availability of different energy sources. But the primary benefit is a reduction in energy-related costs. Neural estimates that aggregate savings could total \$50 million a year for the U.S. steel industry if the technology were to be deployed across the electric-arc steelmaking sector. That's a conservative estimate, based on a 5% increase in overall energy efficiency. An earlier product, the Intelligent Arc Furnace controller, developed in 1991 and now in use at more than 30 sites, achieved energy savings of 8% by optimizing electrical input alone.

The latest configuration extends the scope of the system to include chemical components of energy, such as oxygen input, as well. Still under development is a product that addresses the "pure chemistry" of the furnace, including the mix of scrap, Staib points out.

The long-term impact could extend well beyond the steel industry. Intelligent systems technology—which is a hybrid combining elements of neural

networks, fuzzy logic, genetic algorithms, and expert systems—also has potential in other industries, including chemicals and food processing.

"Most process-control applications have some room for improvement," Staib points out. "The value of neural networks and intelligent systems technology comes into play in those processes where, say, a 5% improvement in efficiency is worth a lot of money, because it takes a lot of engineering power to solve it."

Neural Applications will continue prototype development of its system through 1997. The technology is based on development work led by Edward Wilson, an intelligent-systems scientist who is a visiting scholar and lecturer at Stanford University. Dane Meredith, melt-shop superintendent at North Star Steel, played a key role in the prototyping stage. A commercial product is expected to be available sometime next year.

**Oracle Corp. and subsidiary Network Computer Inc.**

Redwood Shores, Calif.  
**Network computing**

In October 1995 Oracle Corp. CEO Larry Ellison stood before a Paris crowd and told them about an upcoming \$500 device that would replace PCs around the globe and open entirely untapped markets to computing. He was branded a heretic.

Little more than a year later, the technology he trumpeted is a legitimate market phenomenon. Network computing—an open-standards platform in which an appliance for network communication and computing supports Web browsing, e-mail, data and word processing, and graphics—is for real.

Unlike the PC paradigm in which software is at the desktop, the network computer downloads software as needed from the Internet or corporate network and moves the complexity of the appliance to the network and network server. Oracle and allies say NC advan-

*Prototype development of Neural Applications' Intelligent Total Energy Controller was conducted at North Star Steel's St. Paul plant.*



## PROFILES



★ IW SELECTS 50 INDIVIDUALS  
 WHOSE ACHIEVEMENTS ★ ARE  
 SHAPING THE FUTURE ★ OF OUR  
 INDUSTRIAL CULTURE AND ★  
 AMERICA'S TECHNOLOGY POLICY.

■ BY VIVIAN POSPISIL AND JOHN TERESKO

**Russell Daggatt**,  
*president,*  
*Teledesic*  
*Corp., Kirk-*  
*land, Wash.*  
 ★ A spinoff  
 of McCaw

Cellular Communications Inc., Teledesic is developing a high-bandwidth network that will require the launching of 840 satellites beginning in 2000. In charge of working with regulatory agencies to allow for the launch and operation of the network is Daggatt, who sees the technology offering communications worldwide to the remotest locations, as well as in maritime and aviation applications.

**Howard C. Birndorf**, *chair-*  
*man and CEO, Nanogen Inc.,*  
*San Diego* ★ The former lab technician at Stanford University has been involved in the founding of seven biotechnology companies, two of which have been acquired by larger firms and four of which have gone public. Three-year-old Nanogen, still privately held, is involved in the computerization of disease diagnosis.

**Susan Kare**, *graphic de-*  
*signer, San Francisco* ★ An innovator in graphical-user-interface designs, Kare created the trash-can icon that allows Macintosh computer users to clean up their screens, as well as the widely recognized miniature smiling computer and wristwatch. In addition to the Macintosh images, she also designed most of the icons for Microsoft's Windows 3.0 software.

**Eva Sevick-Muraca**, *associate*  
*professor of chemical engineer-*  
*ing, Purdue University, West*  
*Lafayette, Ind.* ★ The researcher led a team that developed an imaging method called fluorescence lifetime imag-

## PROFILES



**David A. Thompson,** director, Advanced Magnetic Recording Laboratory, IBM Corp. Almaden Research Center

fram's Mathematica software, launched in 1988 as the first technical program to have an integrated symbolic language, is today used by millions of students, scientists, and engineers worldwide. Mathematica is also the focus of books, Internet discussion groups, and the 230-member institute.

**Kenneth R. Baker,** vice president, General Motors Research & Development Center, Warren, Mich. ★ Leader of GM's Electric Vehicle Program, Baker is responsible for numerous other technical advances, including ACuZinc, a new zinc alloy that can be used to make "net" shapes; and Magnasteer, a variable-assist power-steering system. Baker also created GM's Future Council, a project that includes customers on a long-term basis in evaluating future technologies.

**Malcolm J. Thompson,** president and CEO, dpiX, a Xerox company, Palo Alto, Calif. ★ A

founder of dpiX, the first-ever spinoff of the Xerox Palo Alto Research Center, Thompson has directed the company's development of new flat-panel display (FPD) and image-capture technology. Thompson is also chairman of the governing board of the United States Display Consortium, a government/industry partnership formed to develop an infrastructure to support FPD manufacturing in the U.S.

**David A. Thompson,** director, Advanced Magnetic Recording Laboratory, IBM Corp. Almaden Research Center, San Jose ★ Recently named to the Silicon Valley Engineering Hall of Fame, Thompson is a pioneer in the field of magnetic data recording and is credited with leading an effort that resulted in the magnetoresistive head, a device that enables huge increases in data storage capacity.

**Edward Wilson,** scientist, intelligent systems, Neural Applications Corp., Coralville, Iowa ★ A team led by Wilson has developed new intelligent-systems technology that optimizes energy input for electric arc furnaces in the steel industry. The neural-network-based system continuously adapts to ongoing changes in process conditions, without need for human intervention or system upgrades. Wilson is also a visiting scholar and lecturer at Stanford University.

**Vincent Rotello,** assistant professor of chemistry, and **Bing Mo,** doctoral candidate, University of Massachusetts, Amherst ★ The two chemists have developed an inexpensive process for making buckminsterfullerenes, or "buckyballs," the soccer ball-shaped carbon molecules that promise to become one of the super-materials of the 21st century. The discovery will make the molecules—previously too expensive for use outside the laboratory—more likely to be used in applications from high-strength, ultrafine wires to non-stick cookware.

**Andrew Csipkes,** member of the technical staff, Lucent Technologies, Norcross, Ga. ★ Csip-

kes' contributions in the manufacturing and testing of fiber-optic interconnection devices earned him a 1996 Philip R. Marsilius Outstanding Young Manufacturing Engineer award from the Society of Manufacturing Engineers. He led efforts in the development of three novel systems (vision applications) for non-contract measurement of critical parameters monitored during the finishing of fiber-optic connectors.

**Peter L. Andresen,** materials engineer, General Electric Co. Research & Development Center, Schenectady, N.Y. ★ A leader in the study of environmental effects on the mechanical properties and integrity of iron and nickel-based alloys used in the energy and plastics industry, Andresen was recognized this year by NACE International, a professional society dedicated to corrosion control. He has developed methods for predicting and extending the life of structures subject to environmentally assisted cracking, especially those in light-water power reactors.

**Don Eigler,** researcher, IBM Corp. Almaden Research Center, San Jose ★ The first to position individual atoms, Eigler pioneered the use of the scanning tunneling microscope (STM) to move atoms and study atomic surfaces at their most basic level. He also used the STM to place atoms in rings, creating "quantum corrals" that enable scientists to study the nature of electron waves on metal surfaces.

**Stephen Malkin,** professor of mechanical and industrial engineering, University of Massachusetts, Amherst ★ Malkin was this year's recipient of the Society of Manufacturing Engineers' Gold Medal, awarded for his internationally recognized research on machining and grinding processes and for technical contributions enhancing productivity and part quality.

**Hsuan (Shane) Chang,** computer scientist, General Electric Co. Research & Development Center, Schenectady, N.Y. ★ In October Chang was honored by the