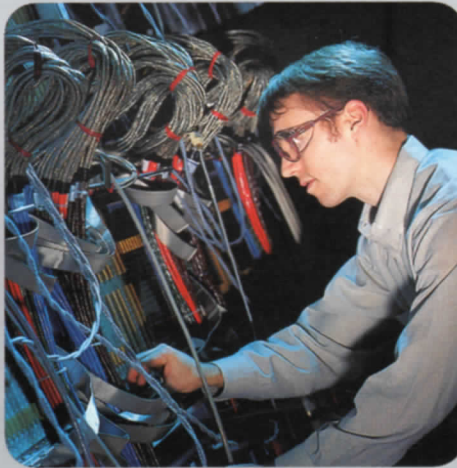
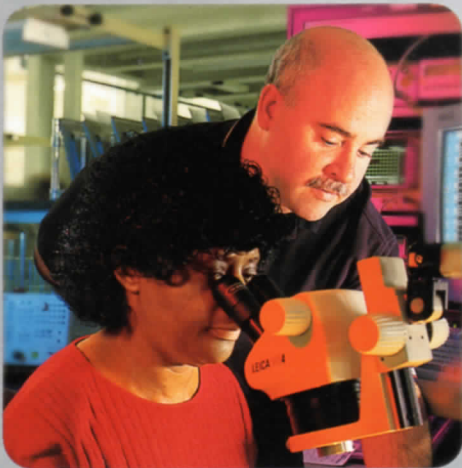
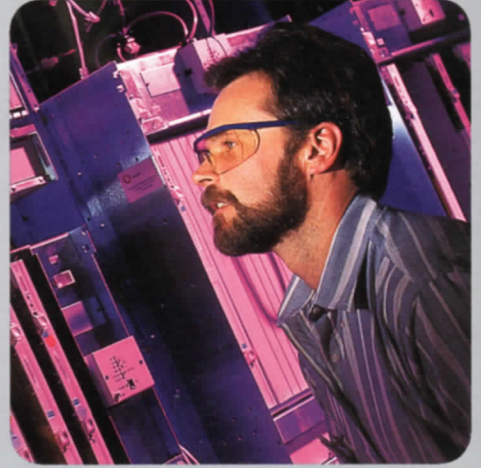


March 1999

# Lucent

m a g a z i n e



## Manufacturing for the New Millennium

I N S I D E

Speed = Customer Satisfaction • Countdown to Y2K





DAVID CORNWELL

**Renate Goetschi** of Austria races to the finish line in time to claim victory in the women's downhill event at the World Alpine Skiing Championships in Vail, Colo. U S WEST used Lucent's SLC 2000 equipment to provide audio to the broadcasters covering the event, held Jan. 30 to Feb. 14, 1999.

## READERS' LETTERS

### A Sense of Belonging

Lucent Magazine is outstanding. It keeps us informed and is positive, entertaining and enthusiastic. I am a retiree with 42 years of service, and it's nice knowing I still belong. The pension plan increase made me feel that way as well. Lucent's future looks great.

Tom McLaughlin,  
Savannah, Ga.

### Free Feedback

I suggest that we include market research pre-paid reply slips in every Lucent Magazine to collect information from employees about our customers. Employees who are in direct contact with customers around the world could give important feedback on all topics related to customer satisfaction.

Ahmed Saeed Qureshi  
Riyadh, Saudi Arabia

### Willing Volunteers

The November Lucent Magazine would have been even more inspiring if it had included the volunteer activities of the people on the back cover.

Elka Grisham  
Whippany, N.J.

### Lucent's Greatest Hits

I enjoyed hearing the GROWS song when it came out last year (see "Downloads" at <http://grows.web.lucent.com>), and have since heard about other songs composed and sung by Lucent employees. Lucent Technologies Nuremberg, Germany, has a song playing on telephone hold, and I understand that the R&D group in Switching and Access Solutions and a group in BCS also have songs. I think a compilation CD of Lucent songs would be a fun addition to the Lucent gift/rewards catalog.

James Blackmore  
Swindon, United Kingdom

## Take Our Quiz on Page 8

**Answers to How Much Do You Know About Lucent's Factories?** 1. 58 factories are located around the world to serve Lucent customers. 2. Asia/Pacific: 11; China: 7; CALA: 3; EMEA: 11; U.S.: 26. 3. Omaha: 2,200,000 sq. ft.; Merrimack Valley: 4,280. 4. Brisbane, Australia: 5,000 sq. ft.; Millipitas, Calif.: 10. 5. St. Petersburg, Russia; Brisbane, Australia. 6. Atlanta; Columbus, Ohio; Dallas; Kansas City, Kan.; Merrimack Valley; Oklahoma City; Omaha, Neb.; Bydgoszcz, Poland; Campinas, Brazil; Chernigov, Ukraine; Nuremberg, Germany; Qingdao, China; Rouen, France; St. Petersburg, Russia; Shanghai, China; Hsin Chu, Taiwan; and Tres Cantos, Spain.

**Answers to Do You Remember WE7?** 1. 1881. That year, Theodore Vail paid \$150,000 cash to Western Union for 1,000 shares of Western Electric Manufacturing Co. stock. Incorporated on Nov. 26, 1881, the new company merged Western Electric with Gilliland Electric and Charles Williams Jr. 2. Global almost from the start, in 1882 WE had factories in Chicago, New York, Boston, Indianapolis, and Antwerp, Belgium. 3. Washing machines, cameras, curling irons, fans, irons, light bulbs, vacuum cleaners, electric stoves, electric drills, radios, wrought-iron tile-top tables—in three sizes.

## Instant Info On today@lucent

**W**hen you think about the best place to get quick, concise and up-to-the-minute information about Lucent, one thought should come to mind—today. **today@lucent**, that is.

**today@lucent** features the colorful Web version of Lucent Technologies Today, links to more than 400 Lucent intranet sites and the popular Ballot Box voting mechanism. In addition, since Lucent Technologies



Today comes out around noon, Eastern time, Lucent news that breaks early in the morning or late in the afternoon can be found on the **today@lucent** "Watch This Space" scrolling marquee. Employees can reach the site at <http://today.lucent.com>. The site is not available to retirees because it resides behind Lucent's firewall. Retirees can access Lucent's Internet site at <http://www.lucent.com>.

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## Lucent Magazine on Tape

Lucent Magazine is available to visually impaired employees on a two-track cassette tape. To order, call 908 582-5075. Leave your name, address and telephone number.



**Lucent Technologies**  
Bell Labs Innovations



**Lucent Magazine**  
March 1999  
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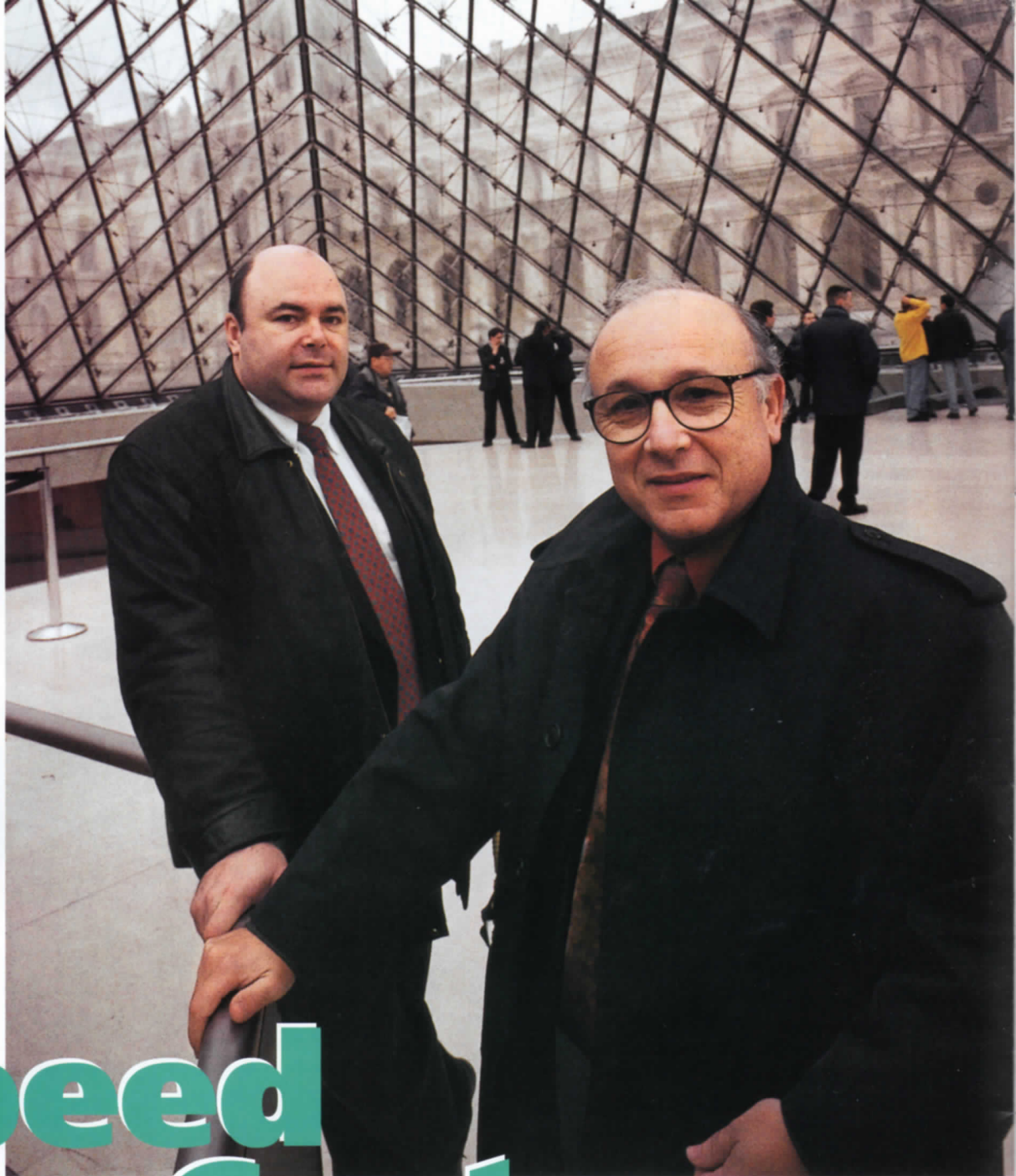
## 14 | Countdown to Y2K Lucent Resets the Clock



**ON THE COVER** The "unsung heroes" of Lucent's global manufacturing and provisioning community include: top row (left to right) Detlev Planer, Nuremberg, Germany; Susanne Reimer, Nuremberg; and Robert Lahey, North Andover, Mass. Middle row (left to right): Alveda Bates (left) and Sheila Menges, Columbus, Ohio; Robert Hudson (left) and Lana Hagy, Orlando, Fla.; and Marco DeMartino, Nuremberg. Bottom row (left to right): Mary Jelks (left) and Pat McKinney, Columbus; Spencer Newman, North Andover; and Alan Chen, Coke Kung, Gaylord Huang and Wayne Chung, Hsin Chu, Taiwan. **Photography by Adrian Bradshaw, Ben Fink, Stephen Sherman, Wolfgang Steche and Roger Tully.**



In the Louvre's glass pyramid in Paris, Eric Ropital (left), EMEA GSP, credits teamwork for the optical masterpiece Lucent created in record time for new European operator NETs, co-founded by Serge Petroff (right).



# Speed = Customer Satisfaction

Lucent employees are taking to heart the call for speed. Whether racking up a revolutionary seven days to add switching capacity, or a record-breaking five weeks to build a DWDM network, we're learning how to break through barriers and dodge obstacles to get the job done. Read on to see how two teams working on separate projects learned some of the same lessons about speedy execution . . .



## Photons Connect City of Light to London

In Europe, nimble new telecommunications operators are crisscrossing political and geographical borders with networks that run at the speed of light. And Lucent is there to serve them all—in record time.

In France, for example, the new European operator NETs got a brand-new DWDM network connecting Paris and London in just five weeks—half the normal time required.

The network follows two physical routes along highways, railways and through the English Channel tunnels. The high-capacity network enables NETs to offer European telecommunications carriers 16 wavelengths, or channels, on one fiber pair—each with 2.5 gigabit-per-second capacity. With a total capacity of 40 gigabits in both directions on one fiber pair, carriers can transmit the equivalent of half a million simultaneous phone calls.

### All About Teamwork

How did the Lucent team get the network up and running so quickly? "Teamwork," said Eric Ropital of GSP's EMEA sales office. "We put together a special services team that first installed and tested the equipment all at once in a platform in our offices in LePlessis-Robinson," he said.

Then the \$6 million worth of equipment was shipped out for permanent installation at the 21 sites along the network's route. "Without the professionalism of our people, and the support of the management of Lucent Technologies in France, we never could have met such a challenge," he said.

The contract was signed at the beginning of September 1998, the network was up and running in October, and NETs is currently serving four customers on the London-Paris network.

### Record-Setting Pace

"It's something of a 'world record,'" Ropital said. "We were asked several times to confirm the deployment schedule."

Even better, the Lucent team made sure the network it built would be expandable in case NETs decided to tap into the deregulated markets of other European countries.

"We installed the backbone of the NETs network," Ropital said. "And put everything in place for connecting other branches to extend it to Germany, Spain, Italy, Belgium and the Netherlands, or to transatlantic cable heads for links to the United States."

It wasn't long before the company asked for bids for extending the network. "NETs is currently planning a pan-European network," Ropital said, "that will be extended first via Amsterdam, Frankfurt, Milan, Barcelona and Madrid." Lucent will learn soon if its bid for the work was accepted.

What NETs can offer—the idea of shared optical fibers—interests more and more telecom operators.

"Lucent knows how to approach these new accounts, and its organization is flexible enough to diversify its activities to gain new market share. And that will be decisive for the future," Ropital said.

—Evelyn Monnier, Suzanne Sidhu

## Explosive Growth Sparks Seven-Day Revolution

There's a global communications revolution going on and Lucent is at the center of it. But another kind of revolution is taking place inside Lucent: speed and an obsession for serving customers have cut the time needed to deliver increased switching capacity to a record-breaking seven days.

Sound impossible? Just ask BellSouth. "We were anxious to meet explosive second-line and Internet usage growth," said Bill Smith, vice president, Network Strategic Planning, BellSouth. "When Lucent told us we could meet that demand in seven days, we almost didn't believe them. But it worked. Working together, we overcame several problems we knew would occur in any new process like this."

"Everyone felt accountable to get the project done, even though it was a new process and a couple of days before Christmas," said Jim Tison, installation representative, GSP Services and Systems. "It shows that when we and our customer shoot for the same basket, we all score big."

### Making Quantum Leaps

How did Lucent make the play? The breakthrough team, under the leadership of Karen Stone, project director, Switching and Access Solutions (SAS)/Customer Delivery Improvement (CDI), formed in August. Obsessed with making quantum leaps in customer delivery, the team won support from Lucent's leadership to work the issue full time.

The team attributes the breakthrough to intense focus on customer needs, no preconceived solution, and building on the fixed product applications and whole-order delivery initiatives of the Cheetah project, forerunner of CDI. "We revolutionized our approach by bringing into the process early the people who need to make change happen," Stone said. "People in the factory, product developers, engineers and installers, for instance, are an integral part of the team and of the solution."

The team recommended a new process and system in early November. It included:

- ▶ Creating a core team responsible for the order, from end-to-end. Dubbed the 007 Team (Order Owners for Seven Days), it's made up of four critical functions in the order realization process: customer service, engineering, providers (factories) and installation.
- ▶ A Web-based order realization system the team created with Bell Labs Research and the Chief Information Officer Organization. Stone said the system "gives everyone on the 007 Team access to the same critical information, in real time."



# "Having Web-based access to all the information is a tremendous speed advantage."

**David Reese**, installer

► Using standardized, fixed application 5ESS Switch models; conditioning customers' central offices in advance with *Service ADDvantage*, the service offer that shortens 5ESS Switch intervals for standardized models; and using the ST 2000 tool developed for quick switch testing—all previous Cheetah/CDI successes.

## Web Access Works

"The engineering specs for each of the standardized models are on Web-based templates," said Chris Camacho, the breakthrough team's engineering representative. "It allows us to support factory and installation processes fast. When the 007 team puts in a specific model order, they populate the data field with the appropriate engineering template."

To David Reese, Lucent installer on the team, "having Web-based access to all the information is a tremendous speed advantage. It eliminates

time-consuming phone calls to track down paperwork, such as engineering specs. That's good for customers."

Not every customer will need seven-day growth, but the breakthrough team plans to roll out this process throughout North America and improve it with every cycle. That means creating 007 Teams in the regions to handle the need—complete with people to back them up.

"This breakthrough team and its achievements are hallmarks of high-performance and examples of innovative thinking. The team took a completely fresh approach to how we deliver for customers. It's an example of how essential teamwork is to innovation, and to our customers' and Lucent's success," said Frank D'Amelio, vice president, SAS Product Marketing and Management.

Mark Chellberg, SAS product marketing representative on the breakthrough team, put it in perspective: "We're excited about the process. It's not without challenge or flaw or risk, but all revolutions start small." ○

—Marie Panzera

A customer's need for speed was satisfied by the 17-member cross-functional Breakthrough Core Team, represented here by team leader Karen Stone (bottom) and (clockwise) Cecilia Copeland, Mark Chellberg, Mike Lawson, Tom Marinelli and Jerry Hughes.





# The Glass Revolution

## OPTICAL NETWORKING TEAMS BUILD CORE FOR NETWORK OF NETWORKS

It's happening as you read these words. Lucent teams around the world are building more and more of the glass backbone for the network of networks—the optical core that will provide seamless interconnection between all networks everywhere, from wireless to broadband to the tried-and-true voice network envisioned by Alexander Graham Bell.

Last year alone, Lucent's Optical Networking Group (ONG) won billions of dollars in contracts for its breakthrough optical technologies in dense wavelength division multiplexing (DWDM). The new connections resulting from these wins will be added to the nearly 2,000 DWDM systems Lucent has already deployed globally, in five of seven continents—more than any other optical networking vendor.

"We want to be known as the vendor of choice to leading-edge carriers around the world," said Gerry Butters, ONG group president. "We set aggressive goals for ourselves and are committed to being the global market leader—by a wide margin."

ONG is meeting its goals through some of its new projects, listed below.

### Europe

Along with the NETs contract linking Paris and London through the English Channel tunnels (see story, page 3), Lucent is hard at work in other countries throughout Europe. In Spain, a December contract with Telefonica is providing a sixteenfold increase in capacity between Madrid and Seville. Telefonica's new advanced data and voice network will be its first optical networking technology applications. Lucent also has started building a state-of-the-art optical network for KPN Telecom BV, the Netherlands' national telecommunications company, interconnecting 14 cities—including Amsterdam, Rotterdam, The Hague and Utrecht. The new network will provide a basis for expansion across Europe.

### Mexico

MCM Telecom, a new service provider in Mexico, chose Lucent to install a complete optical network—including voice, data and private lines—for local communications services. Beginning in December 1998, the new network offers customers in Mexico City advanced telecommunications services, including high-speed data, Internet access, ATM, frame relay and Internet protocol services. Lucent is building out similar networks in Monterrey and Guadalajara, enabling

MCM to provide services to business customers in all three cities of Mexico's "golden triangle" during the third quarter of 1999. "Lucent's industry-leading optical networking and switching technology and unrivaled network experience will further enhance MCM Telecom's ability to offer world-class telecommunications services to its customers in Mexico," said Rogelio Velasco, Lucent Technologies de Mexico managing director.

### China

In the past three years Lucent has won more than 300 SONET, SDH and optical networking equipment contracts in China, representing almost three-quarters of a billion dollars of business. The most recent wins name Lucent as an optical networking supplier for customers that include the Posts and Telecommunications Administrations in several China provinces. "Despite its financial crisis, Asia is experiencing an explosive demand for telecommunications services," said Mike Chan, China senior vice president, operations, Global Service Provider Business. "Carriers in Asia are upgrading their networks to handle additional bandwidth so they can meet the needs of new and existing customers. Lucent's optical networking portfolio enables service providers to streamline and improve the efficiency of their networks while keeping pace with the growing volume of traffic."

**Mike Chan, China senior vice president, operations, Global Service Provider Business, sees communications demand increasing in the region.**

### The World

Audacious *Project OXYGEN*, an initiative of CTR Group Ltd., aims to bring advanced communications services to people around the world. Targeting

telcos, Internet service providers, PTTs and start-ups, CTR Group plans to lay new cable around and between six of the earth's seven continents, to reach 74 countries with 101 landing points. Lucent will be the exclusive provider of the land-based optical networking equipment, as well as service and network management software, power systems, interconnect equipment and professional services—a package worth more than \$1 billion. "Existing cable is at capacity," explained Ken Wirth, ONG's director of market development. "Internet traffic is driving the need for more capacity, and CTR understood the value proposition Lucent offers—one vendor for technology, products and services." Lucent will begin to build the landing stations in the fourth quarter of 1999.





Our World-Class Factories Work to Fuel Lucent's Growth

# Manufacturing for the New

**Who in Lucent really "makes the things that make communications work?" The answer must include the 40,000 men and women in our company's global manufacturing and provisioning community. These often "unsung heroes" possess the skills and dedication**

needed to produce Lucent's innovative portfolio of products—from hair-thin strands of glass powerful enough to carry hundreds of thousands of phone calls per second, to highly intelligent microchips that are the "brains" of communications systems.

They work in locations around the globe, from St. Petersburg, Russia, to Brisbane, Australia. A critical component in Lucent's success, manufacturing employees are committed to keeping Lucent lightning-fast in delivering products to customers whose own success depends on being first and fast to market as well.

"Our manufacturing and provisioning capability is part of Lucent's great heritage and one of our great strengths," noted Chairman and CEO Rich McGinn. "No company can match the depth and breadth of this capability, and that clearly sets us apart in the marketplace."

## **Innovating for Efficiency**

Just consider that since Lucent became an independent company, our 58 factories worldwide have

increased overall production by 31 percent. Lucent's plants have slashed cycle times and reduced distribution intervals to quickly deliver products to increasingly demanding customers. And our factories have found innovative ways to increase overall efficiency and reduce the cost of goods.

For example, Microelectronics' Orlando facility has built a super-fast cleanroom that has halved order-to-delivery time for silicon



wafers. Our Wireless factory in Columbus, Ohio, and Global Provisioning Center in Nuremberg, Germany, are setting records in delivering one of the largest and most complex projects in the world to Saudi Arabia. And Switching

and Access Solutions' Hsin Chu factory in Taiwan has tripled capacity and improved delivery time through a grassroots, floor-to-ceiling re-engineering plan.

At the same time, Lucent's manufacturing capability means that customers can count on our products to meet the highest standards of reliability and quality. Because of the close ties between Bell Labs and our factories, Lucent is able to bring products to market faster than ever before. For instance, at the Merrimack Valley Works in North Andover, Mass., R&D and manufacturing worked side-by-side to ensure that the *WaveStar* BandWidth Manager—a revolutionary optical networking product—would make it to market in a matter of months.

And in an effort to become a truly multilocal company—that is, at home in many markets—and to gain access to new technology, Lucent has entered into a number of joint ventures to use manufacturing facilities in locations such as Chernigov, Ukraine, and Tianjin, China.

"The telecommunications industry has experienced unprecedented growth in the last few years," said Rock Pennella, Lucent's chief manufacturing officer. "Our manufacturing capabilities enable us to take advantage of that tremendous opportunity and ensure that Lucent continues its healthy growth. Manufacturing fully supports Lucent's strategy



C O V E R  
S T O R Y

# ng Millennium

At Lucent's Columbus (Ohio) Works, product engineer Joe Nguyen (left) tester Alveda Bates and layout operator Pat McKinney inspect a switch interface that processes calls for the *Airloop* Wireless Local Loop System. Columbus produced the components for a new wireless network being installed by Lucent in Saudi Arabia.



## How Much Do You Know About Lucent Factories?

1. What is our total factory count (including joint ventures)?
2. How many factories do we have in each region?
3. What's our biggest factory in square footage? In number of employees?
4. What's our smallest factory in square footage? In number of employees?
5. Which factory is farthest north? Which factory is farthest south?
6. Eighteen manufacturing sites are also Global Provisioning Centers (GPCs)—warehouses and central distribution locations. Can you name them?

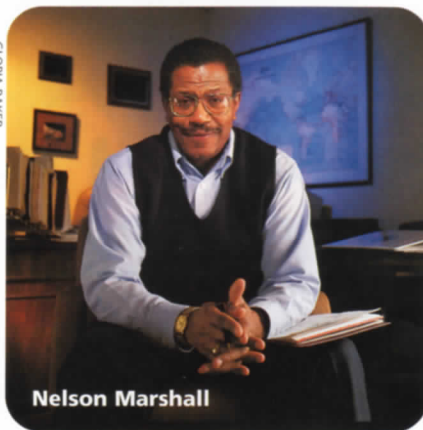
(See answers opposite the contents page.)

If you didn't score as well as you might have, learn more about Lucent's global manufacturing community at <http://mfg.web.lucent.com/>

to be a take-share company that can achieve a double-digit annual growth rate."

### Building a Community

To create a strong, unified global manufacturing community much like Lucent's tightly linked



R&D organization, the company has established the Global Manufacturing/Provisioning Council (GMC), a cross-business unit organization headed by Pennella. The GMC enables all of Lucent's manufacturing facilities to share ideas and best practices.

"Our industry is becoming more competitive every day," McGinn said. "To take advantage of the opportunities in the marketplace and to defend against aggressive competitors, we must become more productive and cost-efficient in all we do. That also means being faster to market with high-quality, highly reliable products and superb support, and being constantly innovative in the way we work."

Added Pennella, "The manufacturing community is committed to helping Lucent grow by finding ways to work smarter, by developing greater manufacturing flexibility and by making sure that innovation is as commonplace on our factory floors as it is in our research labs. Customers look to Lucent for product innovations, not product commodities. We must focus our world-class manufacturing capabilities on high-value technologies that set us apart in the market and support Lucent's growth."

A key differentiator for Lucent is our highly skilled manufacturing

and provisioning work force.

Our intent is to continue to staff our factories with the best people by looking at the type of positions that will open up in the next few years and the skill sets needed by the people in those jobs. Lucent, in partnership with the Communications Workers of America and the International Brotherhood of Electrical Workers, is working to ensure that current employees have the opportunities to get the education and work experience they need to handle changing job requirements.

"Almost all of our large factory locations have classrooms set up so that we can bring training directly to our employees," said Nelson Marshall, Lucent's manufacturing and planning vice president. "Through The Alliance and the Enhanced Training Opportunities Program, we offer a variety of skill-building programs, including opportunities to earn high school and college degrees, in addition to helping increase employees' confidence and job competitiveness."

Lucent is also forging relationships with several universities worldwide to develop programs that will enable the next generation of Lucent employees to step into highly skilled manufacturing positions. "With technology advancing so rapidly, Lucent has to keep raising the bar on the skills our people need," Marshall said. "We're not leaving that to chance."

### Keeping Customers in Mind

Manufacturing also plays a key role in Lucent's commitment to customer satisfaction. Manufacturing locations worldwide have launched a number of initiatives aimed at uncovering, correcting and anticipating any problems that stand in the way of Lucent's ability to completely delight its customers. In October, the Global Manufacturing/Provisioning Council, for example, invited managers from Bell Atlantic to give what Marshall calls a "heart-to-heart" assessment of Lucent's ability to manufacture and deliver zero-defect products on time.

LUCCENT ARCHIVES

**Western Electric Company**

An Advertisement of Western Electric Company—Continued from the November 27th issue of the Saturday Evening Post, the January 1929, 1930, and 1931, and in the December Issues of McCall's, Success, and Good Housekeeping.

## Do You Remember WE?

1. When did Western Electric become part of the Bell System?
2. Where were its factories located at that time?
3. Over the years, WE manufactured more than telephone equipment. Name some of those products.



In addition, sales teams continually offer feedback to factory personnel about overall performance, and are only too happy to bring customers through a factory as their orders are being filled. "Satisfying customers is our key driver," Marshall said.

"Without a doubt, manufacturing and provisioning will continue to be vital functions for Lucent," Pennella said. "And the company will continue to invest in new technology and training to keep our manufacturing capability on the cutting edge. Lucent could not have achieved the level of success we're all so proud of if it weren't for this community. The challenge now is to make sure we continuously improve our performance."

And Lucent's manufacturing community is doing just that. The stories on the following pages illustrate just a few examples of the extraordinary things happening in our factories to increase production, streamline practices, satisfy customers—and fuel Lucent's growth. ○

—Maureen Dvorak

## Fast and Flexible in Merrimack

**T**he WaveStar BandWidth Manager was a critical product for the future of the Optical Networking Group—the first step in a business plan designed to turn the competition on its head by inventing a whole new generation of global transport products.

While ramping-up for production, the group's Merrimack Valley factory, with 1.2 million square feet and nearly 4,000 employees, proved that a huge facility can bend and stretch to manufacture a sophisticated system as flexibly as a small start-up.

"It's a very complex product," said Mike Kahl, in charge of product development through first customer delivery. "It's a newly defined network element that replaces several products with one." With its four refrigerator-sized equipment bays, 1.5 million lines of software code and a dozen chips with as many as 1 million gates each, the product required a flexible factory staff to make sure it would be ready in time.

"The first thing we had to get accustomed to was working with six Bell Labs locations instead of one," said Arnie Ziemian, test engineering manager. Producing the BandWidth Manager required adding staff and expertise from Nuremberg, Germany; Raleigh, N. C.; Indian Hill, Ill.; and Huizen, the Netherlands. Conference calls at odd hours became the norm. In fact, the cross-functional group grew to include about 1,000 people who never met face-to-face all at once.

Then, in a bold move, the team changed the normal procedure for making the prototypes and early product models used for development testing. "We wanted to make the models

for the product right here at the factory to get the experience" said Ziemian.

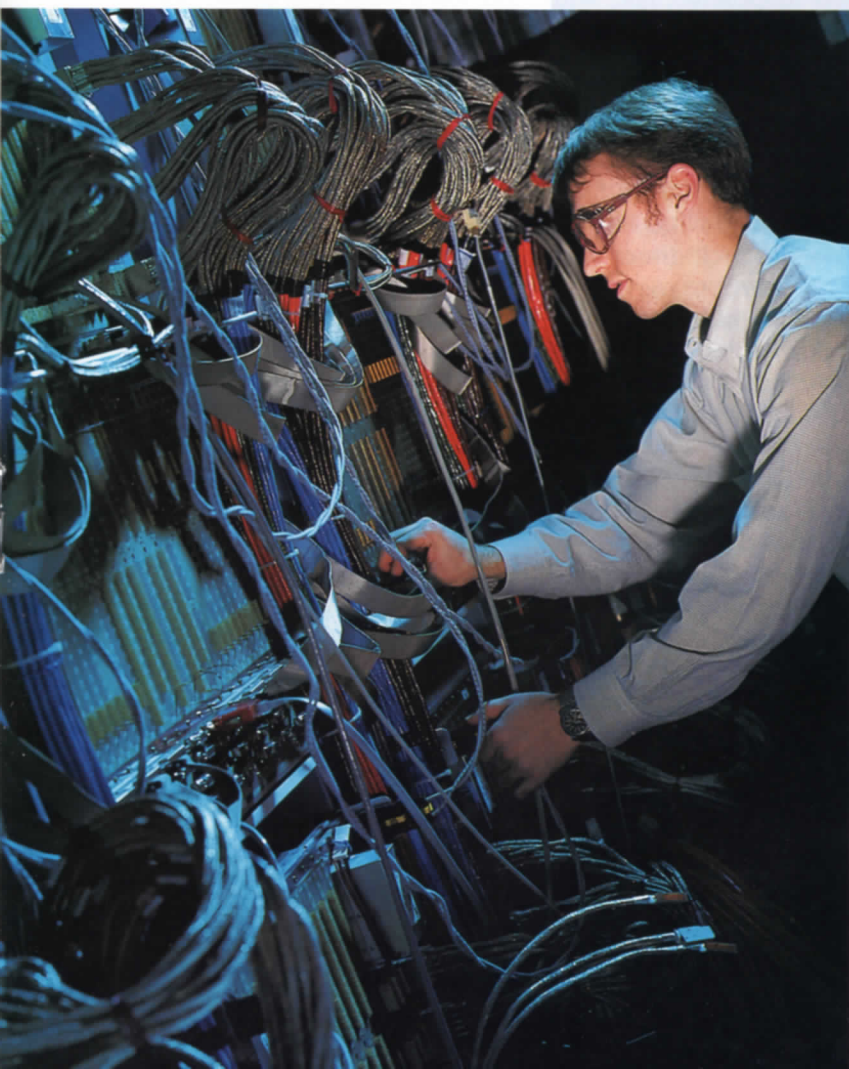
Normally, prototypes were contracted with outside vendors so production and model development wouldn't interfere with each other. "We worked with the New Product Introduction Center and the manufacturing shop, and did it on the fly," Ziemian said.

End result? Tyco Submarine Systems Ltd., the first in a long line of customers, got its system just seven months after the first model was built. Benchmarking data indicate that the product's time to general availability is among best-in-class. And the competition is still trying to copy the BandWidth Manager.

"It was a best-in-class effort all the way around," Kahl said. "It proved that Merrimack Valley is fast, flexible, first to market and growing the business."

—Suzanne Sidhu

Spencer Newman, systems test engineer in Merrimack Valley, inspects cables during testing of the BandWidth Manager.





## Pulling for Speed in Hsin Chu

**W**hen Lucent's Switching and Access Solutions (SAS) factory in Hsin Chu, Taiwan, swapped its slower "push" manufacturing for speedier "pull" processes, the results were amazing.

Hsin Chu supplies 5ESS switches to the growing Asia/Pacific market, and sends material to our Qingdao, China, facility. The change from "push" to "pull" has tripled the factory's capacity, slashed order-to-delivery time from six weeks to one, improved 5ESS Switch delivery performance in the region, cut manufacturing inventory by a third and boosted margins by 10 percent.

"Push manufacturing is the traditional style that builds to a forecast, which can never be exact," explained George Foo, Asia/Pacific and China manufacturing vice president. "Pull manufacturing, on the other hand, builds to customers' orders. But for it to work, processes must be re-engineered for speed."

That's what a team at Hsin Chu has spent the last year doing, led by factory head Gaylord Huang and supported by Benjamin Nan of the SAS global manufacturing organization.

The team began by benchmarking best-in-class companies, customizing what they learned to fit Hsin Chu's needs. When new processes had been tested and accepted by the line organization, they were documented as standard operating procedures.



ADRIAN BRADSHAW

The Hsin Chu team that swapped "push" manufacturing for "pull" and produced amazing results includes (from left) Alan Chen, Coke Kung, Gaylord Huang and Wayne Chung.

"I'm proud of what our factory accomplished," Huang said. "We now have the confidence to design new systems to meet new challenges."

"Almost all of Lucent's factories have implemented some elements of pull manufacturing," Foo said. "But Hsin Chu is one of the few that has overhauled every operation to focus on building to customer orders."

—Suzanne Sidhu

## Fabulous Fabs In Orlando

**A**s the leading supplier of communications integrated circuits (ICs or chips) and optoelectronic components worldwide, Lucent turned in a winning performance last year—reporting 10 percent growth, while the overall semiconductor industry declined.

What's Lucent's "trump card?" It's Microelectronics' global factories, including the company's most advanced semiconductor manufacturing facility in Orlando, Fla., with 1 million square feet, 1,700 Lucent employees, a 150-member Bell Labs process development team, and two cleanrooms.

Speed rules at the Orlando facility, where automated materials-handling and information systems ensure manufacturing accuracy and fast cycle-time. The particle-free cleanrooms produce more than 12 million chips a month. As a result, Orlando is the world's fastest chip fabrication facility, as reported in recent benchmarking studies comparing the cycle-times of strategic manufacturing partners and competitors.

"As chip designs become more complex, Orlando plans to play a critical role in putting more functionality on a microchip and increasing overall chip performance," said David Williams, vice president, manufacturing, who oversees manufacturing, engineering and production control for Orlando's newest cleanroom.

The Orlando facility's list of customers is impressive: 3Com, Compaq, Lucent, Motorola, Apple Computer and Sun Microsystems. And Orlando can serve those customers quickly. Twice last year, employees rallied to meet critical requests from 3Com, cutting order-to-delivery time in half and delivering chips in just over a week.

"Keeping pace with the semiconductor industry means competitive manufacturing that will require major investment, a technology focus and near flawless execution," said Williams. "The manufacturing organizations that implement these successfully will prosper, and we intend to prosper."

—Linda Crockett



In the Orlando 2 (OR2) cleanroom, equipment operator Robert Hudson (left) and operational supervisor Lana Hagy check silicon wafers for dust and other tiny defects. OR2 is the world's fastest chip fabrication facility.





## DENPORT Factories Count on COGS

**B**usiness Communications Systems has taken major steps to bring cost of goods sold (COGS) to best-in-class levels—with customer-pleasing results.

The *DEFINITY* ProLogix Solutions, a telecommunications solution for small and mid-sized businesses, is a good example of a new product designed with best-in-class costs in mind. Based on competitive benchmarking and customer research, BCS redesigned the audio display terminals for the telephone sets and introduced a smaller, lightweight cabinet.

Using a manufacturing platform already developed, the DENPORT South factory in Shreveport, La., cut the costs of manufacturing ProLogix's telephone sets by 20 percent and eliminated 11 steps from the production process, said Brad Siepmann, engineering manager.

At the same time, the DENPORT West factory in Denver, redesigned the *DEFINITY* analog circuit boards to handle additional ports and developed a compact cabinet with plastic casing to house the switch. DENPORT West has been turning in record-setting performances—dropping COGS by 10 percent for the past two years—and many of the factory's cost-saving ideas were used in designing and manufacturing the *DEFINITY* switch, according to Technical Manager Moe Tabrizi.

"For four years, we've reduced costs in all BCS factories. We're proud to have improved our productivity and directly helped Lucent's bottom line," said Terry Daniels, general manager, BCS Global Manufacturing Operations.

The BCS Repair and Distribution Center in Little Rock, Ark., also has produced remarkable results. The center—which employs 430 people—refurbishes, repairs and ships the majority of product returns. Thanks to upgraded computer systems, on-time shipping performance exceeds 98 percent.

All of this is good news for BCS. "The next step is to improve our 'full-stream costs'—which include installation and transportation costs—and further drive down our costs," said Sid Heath, BCS technology director. "We won't stop until Lucent takes the lead in driving down costs."

—Linda Crockett

DENPORT West's innovation processes helped cut manufacturing costs by 10 percent. Product engineers Willard McFarland (left), Richard Ferguson, Dieter Knollman and Chris Gurnett revamped analog circuit packs, integrated circuits and equipment cabinets to produce the *DEFINITY* ProLogix switch.



ROGER TULLEY

ERIC BAKKE

Susanne Reimer of the Global Provisioning Center in Nuremberg, Germany, tests frequency boards for GSM base stations. The center provides wireless equipment to a broad spectrum of Lucent customers.



WOLFGANG STECHER

## Columbus, Nuremberg Speed Up for Saudi

**I**t's considered the biggest Global System for Mobile Communications (GSM) contract win outside the United States—a \$699 million agreement for Lucent to build an advanced wireless communications network to serve Saudi Arabia. Additionally, Lucent has been awarded 100,000 lines of wireless local loop business.

One of the largest, most complex communications projects in the world, it will take less than two years to complete and will require Lucent to "fire on all cylinders" to meet major milestones along the way. Thanks to the efforts of Columbus Works, the Wireless Network Group's factory in Ohio, and the Global Provisioning Center (GPC) in Nuremberg, Germany, the job is well on its way. One deadline required the factories to meet an early delivery date that would not conflict with the Islamic holy month of Ramadan.

At the Columbus Works, engineering and manufacturing teams worked together on every phase of production for the *AirLoop* Wireless Local Loop System. In less than four months, 70,000 customer transceivers and other wireless components were shipped to Saudi Arabia ahead of the deadline. "We had to turn on a dime to meet the deadline," said Pat McKinney, layout operator in Columbus.

The GPC, which is producing the GSM base stations for the Saudi network, faced a similar challenge. The GPC shifted into high gear and reduced the GSM base station assembly and production time from 15 days to four and met the deadline.

As the *AirLoop* business in Saudi Arabia has increased, Wireless Advanced Mobile Phone Service/personal communications services also has grown. Global demand jumped approximately 63 percent from the fourth fiscal quarter of 1998 to the first fiscal quarter of 1999. The increase was driven largely by international demand for Series II and Compact Minicells.

—Linda Crockett



# Tuning in to HDTV



**Back in the late 1970s, high definition television (HDTV) was touted as "21st century TV." Now, as we approach the millennium, HDTV is becoming a commercial reality.**

It's often said a picture is worth a thousand words. High definition television's (HDTV) sharper and clearer images will change the word count on that adage.

"HDTV pictures are strikingly better than what we're accustomed to seeing on today's conventional television screens," said John Mailhot, Lucent Digital Video (LDV) engineering vice president.

While telephones, computers and most other electronic devices have

changed dramatically in the past 25 years, the television looks very similar. Except for the widespread introduction of color in the 1960s, TV is much the same.

That's changing with the gradual introduction worldwide of HDTV. And Lucent Technologies, backed by Bell Labs research and development, is playing a leading role in this evolution.

HDTV offers viewers sharper images with five times as many

Trade show members focus on the latest in HDTV technology and view a live HDTV demonstration at last year's National Association of Broadcasters Convention in Las Vegas. Thanks to Bell Labs technology, HDTV is beginning to take off in markets worldwide.

picture elements incorporated into the screen. The drawback: Sets now on the market with rear-view projection picture tubes cost between \$7,000 and \$12,000.

## Creating the Market

"Bell Labs was key in developing the Motion Picture Experts Group standard—the foundation for transmitting digital television signals, including HDTV," said Mailhot. "That, coupled with other Bell



Labs contributions, created the entire digital television industry."

Since digital broadcasting requires far less bandwidth than analog

transmission used with standard television, broadcasters can package more programs into a channel previously capable of handling only one program. Mailhot sees this extra space as creating more revenue-generating opportunities for broadcasters.

"Broadcasters can package more channels and add data services, such as sending financial or sports news or newspaper headlines directly to subscribers' sets," said Mailhot.

#### Prize-Winning Work

NHK, Japan's public broadcasting corporation, conducted much of the early HDTV research in the 1970s and began analog digital broadcasts in the mid-1980s. In the late 1980s, the video compression techniques, system architecture and encoder pioneered by Bell Labs helped to shape a North American HDTV standard.

In 1997, Japan conferred its prestigious

C&C Prize on Arun Netravali, Bell Labs vice president of Research, for his work in digital image and video compression technology. That same year, The Academy of Television Arts and Sciences awarded Lucent an Engineering Emmy Award for its technological contributions as part of an industry consortium responsible for developing an HDTV standard in the United States.

"LDV is a direct outgrowth of all the years of work in Bell Labs," noted Netravali. "We want to capitalize on our strong intellectual property position and believe our investment over the years in the entire digital video area has some real business value."

Soon after Lucent's spinoff in 1996, Lucent Digital Video was formed. The business unit develops, manufactures, integrates and markets a broad variety of digital video products.

These include LDV's flagship product, the Flexicoder. Created and marketed through an ongoing alliance with the Harris Corp., the Flexicoder is the only encoder on the market that can be upgraded from standard to high-definition broadcasting. Encoders compress video and audio signals so they can be transmitted using less network bandwidth. The U.S. Federal Communications Commission set a goal of making HDTV the standard by 2006.

#### Taking the Lead

The marketplace soon confirmed Netravali's confidence that the accumulation of expertise and product know-how would translate into a valuable commodity. Since shipping its first HDTV encoder only last August, LDV has sold more than any other manufacturer to the broadcast, cable and satellite markets.

LDV has made significant inroads in Asia, the birthplace of HDTV, and sold digital television equipment to China's Hubei Cable TV Network Co. Ltd. Hubei Cable will construct the world's largest digital video network by using a variety of fiber-optic technologies supplied by Lucent to connect 36 cities in the Hubei province. Indovision, the sole direct broadcast satellite provider in Indonesia, incorporates Lucent's digital video equipment in its 40-channel service. TVA, the French-language broadcast station based in Montreal, also uses Lucent's digital video encoder.

The Communications Industries Report says the U.S. HDTV market will rise to \$18.9 billion by 2004.

## Bell Labs Stars In TV's History

Bell Labs has a long history in the development of broadcast television. Notable events include:

### April 7, 1927

The first long-distance television transmission occurs between

the Bell Labs auditorium on State Street in New York City (at left) and Washington, D.C.

### 1962

The Bell System's Telstar communications satellite transmits the first live television pictures across the Atlantic.

### 1966

Bell Labs scientists develop a silicon

diode array camera tube, making reliable television transmission to Earth from the moon's surface possible.

### 1992

An HDTV system developed by AT&T and Zenith is tested by the U.S. Federal Communications Commission.

### 1997

Japan awards Arun Netravali, Bell Labs executive vice president, its C&C Prize for his work in digital image and video compression technology; Lucent creates Digital Video business unit; The Academy of Television Arts and Sciences awards Lucent an Engineering Emmy Award for its work in developing an HDTV standard for the United States.

### 1998

Lucent Digital Video ships first HDTV encoder.

A separate report sees regions other than North America and Europe accounting for 42 percent of all business by 2005.

"We're still in the early stages of video as a mode of communication," said Netravali. "We believe it will really take off and place an unprecedented bandwidth demand on communications networks. Anything that places a significant requirement on networks is our business." ○

— Stephen J. Hudik



April 7, 1927

AP PHOTO ARCHIVE/LENNIX MCLENDON, OPPOSITE: LUCENT ARCHIVES



# Countdown Y2K



Y2K problems? Not at Lucent's Omaha Works in Nebraska. Bill Schmidt (left) and Bill Meyers are part of an energetic team that has pushed factory "readiness" ahead of schedule. The team is now working on Y2K contingency plans.



**Year 2000? Y2K?** How about June 30, 1999? That's Lucent's 'stake in the ground'—a moving up of the 'millennium clock'—to ensure that our information systems, products, facilities and factories are Year 2000 ready. ➡ Ready for what? Ready for the Year 2000 date change without a significant disruption to Lucent and its customers. ➡ With more than 50 factories, a thousand-plus facilities and tens of millions of lines of computer code running in thousands of mainframes and business applications, it's no



## Lucent Resets the Clock

said John Pittman, vice president and chief quality, environment, health and safety officer who leads Lucent's Year 2000 program.

"We play in virtually every dimension of Year 2000. We have factories, facilities, customers, products, suppliers, information systems, networks, mainframes, personal computers and desktops—we have it all," said Pittman. "We're working with governmental agencies and trade associations, and with our customers and suppliers to get ourselves ready, and to support their readiness efforts as well. As a high-performance company, we've taken an active role in the industry to find and implement solutions."

Besides pursuing its own internal inventories, assessments and deployments, Lucent is completing programs to make its new products Year 2000 ready and has developed evolution strategies for customers

small task. It will cost Lucent an estimated \$535 million from calendar year 1997 through 2000.

For Lucent, "Y2K readiness" has required a near-Herculean effort, according to Walt Gibbons, Lucent's Year 2000 program management vice president. "We've accomplished a tremendous amount, but there's still a significant amount of work left."

With less than nine months to go until the new year arrives, Lucent is working to ensure that its computer systems will run without disruption after 01/01/00—that they'll be ready to handle data containing dates in the next century. "When 2000 arrives, we want to be viewed as one of the companies that was part of the solution, not part of the problem,"



## Networks That Work

**F**or Lucent, Y2K readiness involves more than just an internal focus on our systems and processes. The company is deeply involved in plans aimed at ensuring the reliability of the entire public switched network in the United States. It's an involvement with a keen focus on customers and their expectations.

When the Year 2000 finally arrives, "we want to make sure our support for customers matches their needs so that the public telecommunications network continues to operate," said Ronnie Lee Bennett, Y2K program management vice president for Lucent's Global Service Provider business.

Bennett and other Lucent people have been deeply involved with the Network Reliability and Interoperability Council IV (NRIC) since it was created in 1998 by the U.S. Federal Communications Commission to resolve Y2K issues that could affect the public telecommunications network. Bennett chairs the council's subgroup committee on contingency planning for the network.

"Our involvement with NRIC has provided us with a significant opportunity to work closely with all of our customers," said Bennett. "We sit down with them and listen to their expectations and needs. We're right there with our customers when they make decisions about the support they need to ensure the reliability of their networks. The understanding that has evolved from the council's work has helped us immensely in terms of structuring our customer support to match their needs."

The key deliverable of Bennett's subcommittee has been a detailed outline and training package on how to develop contingency plans related to Y2K readiness. The material is now available to all communications providers via the Internet. "Everyone has access to it," said Bennett. "Right now, we're developing workshops to further disseminate information on contingency planning."

The critical component that will enable Lucent to provide the support customers expect is ensuring that "we're ready for Year 2000," said Bennett. "So far, we've done an excellent job of testing our own equipment and working with customers to deploy software upgrades and solutions, as well as equipment, into their networks. Right now, they've got a good feeling about that."

who own non-Year 2000 ready products. The company has launched extensive programs to identify and alert customers who have non-Year 2000 ready products. Lucent continues to monitor customer reaction to improve company responsiveness and has started contingency planning to address potential Y2K support issues. Lucent's Global Procurement Organization is working with third-party suppliers of products and services to ensure their continued ability to support Lucent after the Year 2000 date change.

"Year 2000 is a key priority for Lucent up through our board of directors," said Pittman. "It's important to us, as a business and as employees, to be successful."

### Closing the Gaps

In fulfilling its charter, the Lucent Year 2000 Program Office continues to identify gaps, albeit increasingly smaller in scope, in Lucent's Year 2000 effort. For example, some workstations and PCs within Lucent are managed and maintained by individual

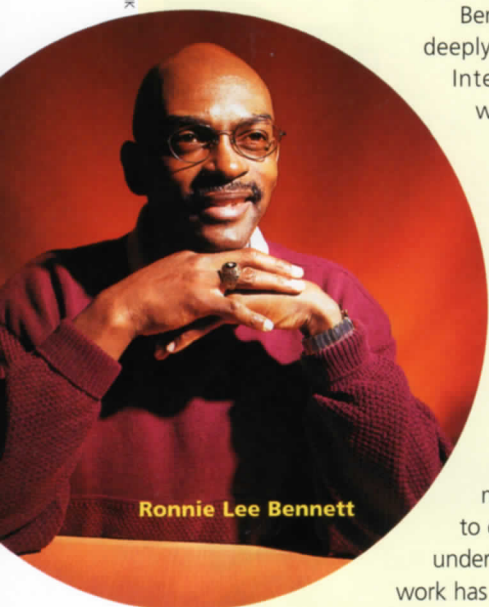
business groups and corporate centers—not by the Chief Information Officer (CIO) organization. If this equipment is not connected to Lucent's corporate network, it probably will be bypassed by Lucent's current CIO inventory processes that help detect and ensure Year 2000 readiness. As a result, people throughout the company need to identify these systems, resolve issues of responsibility and assign readiness accountability.

This need has put added focus on Lucent's June 30 readiness date. "The Year 2000 program office raises issues, finds the gaps, intervenes when necessary," said Gibbons. "We prod, push and put stakes in the ground. Issues surface everyday. But there is no magical 'them' doing the work for us. The competition for mind-share and resources has been one of our biggest challenges. The business units and corporate centers are stepping up to that challenge and assigning accountability. Yet, every person needs to ask themselves, 'Do I have a role to play in Y2K readiness?'"

### Do You Have a Role?

People have answered that question at Lucent's Omaha Works. Here a team of 20 highly motivated engineers has tackled the challenge of ensuring Y2K readiness of all systems that don't fall under CIO responsibility in the 2.4 million-square-foot manufacturing plant. With 54 acres of space "under roof," that still leaves a lot of equipment, machinery and systems—no small task. Yet, the team has continually delivered results ahead of the Y2K plan, according to Bill Meyers, non-CIO Y2K program manager in Omaha.

"While we've had our share of challenges, we've also been very fortunate here in Omaha," said Meyers. "About eight years ago we started a program to standardize electronic components in our equipment, including any new purchases. Our goal was to speed up maintenance and reduce equipment downtime and spare parts inventories. With standard-



Ronnie Lee Bennett

TOM SOBOLIK



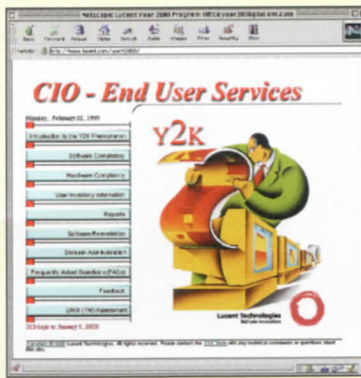
ization, our engineers are more familiar with the equipment we do use. This has saved us valuable time, especially during the assessment and testing portion of our Y2K readiness program."

Omaha has shared the benefits, too. With "sister" plants in Venezuela, Thailand, Australia, Ireland and China that use the same standardized equipment, Omaha's Y2K team has taken a lead role in sharing information to speed Y2K readiness globally.

#### Working the Priorities

"We expect to have everything but-toned up here in Omaha in terms of Y2K readiness within the next few months," added Meyers. "Right now we're focusing on contingency planning, all those different scenarios involving our suppliers, emergency services, communications—even whether we'll have power to run the plant. We're evaluating the potential likelihood and magnitude of multiple external impacts."

Y2K solutions that work in Omaha, Neb., work in Australia, too. Jaynah Stevens (left), Rhett Zeplin and Bob Antonijevic are spearheading efforts to ensure Y2K readiness at the Network Products Group's electronic wire and cable factory in Brisbane. The factory is a sister plant to the Omaha Works, which has shared its Y2K manufacturing solutions with other plants as well.



#### What About Me?

If you routinely log onto Lucent's network from your PC, chances are your PC has been scanned for Y2K readiness. Lucent's Chief Information Officer Organization (CIO) has inventoried and scanned more than 95,000 Windows-based computers in 60 countries. It's using the information to develop and manage Y2K readiness plans with the business units.

Typically, Lucent's CIO will ensure that core computer hardware and applications—like Windows 95/98 and Exchange—and major business unit applications, such as SAP and PeopleSoft, are Y2K ready. Each business unit will manage Y2K readiness for BU-specific software. End users will need to manage remediation of their own data files, most notably Microsoft Excel and Microsoft Access files, to ensure Y2K readiness.

The CIO has set up a Year 2000 End User Remediation Web site, <http://y2k.wcc.lucent.com> that provides additional help on Y2K readiness issues, including feedback on your specific situation. You can also learn more about Y2K issues by visiting Lucent's Corporate Year 2000 Web site at <http://www.lucent.com/y2k>.

Similar to the team in Omaha, other organizations are preparing for Year 2000. "People throughout Lucent are balancing a lot on their plates to get this work done," added Pittman. "We're working to ensure that we maintain a strong focus on advancing Y2K readiness while meeting

Lucent's revenue and profitability goals. Each organization has established its own roadmap and now they're executing against their plans."

The clock is ticking. "This is one deadline we can't renegotiate," said Pittman. ○

—John Brooks



# What's the most important quality of effective leaders?

TOM SAVER



**People skills.** This includes taking the time to listen to your employees and valuing their input, making everyone feel part of the team, setting an example by demanding of yourself what you demand of others, and recognizing, complimenting and rewarding your employees' hard work.

**Manuel Benitez**

switch engineer,  
Global Service Provider Business,  
Coral Gables, Fla.

MICHAEL FOLEY



**Communication skills.**

A leader could have a strong vision, but if that leader cannot communicate it, the vision is of little value. It is important to know what to say, how to say it and when to say it.

**Alisa Stoll**

member of technical staff,  
Bell Labs,  
Columbus, Ohio

PAUL VAN RIEL



**Openness and honesty.**

An open atmosphere and open discussions result in getting the best ideas from everyone on the team. Being honest about everything assures people that making a mistake is human. It may happen, but it's OK.

**John Niezen**

customer information developer,  
Switching and Access  
Solutions Group,  
Hilversum, the Netherlands

BRIAN PAYNE



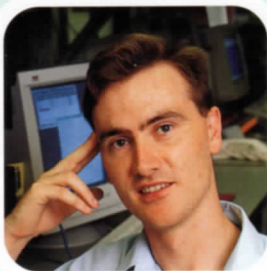
**The ability to inspire.**

I describe leadership to my soccer-playing daughter as being able to ignite your side by example. Play like your shorts are on fire. There is little need to say a word when you display 100 percent effort, determination and enthusiasm.

**Marty Bruno**

manager,  
Business Communications  
Systems Group,  
Englewood, Colo.

NANCY COHEN



**Being able to serve.**

Serving those who are under your care and putting their needs first. If you serve them, they will respect you and follow you, and you will have a true team. Leadership means putting yourself last.

**Steven Hampson**

software engineer,  
Switching and Access  
Solutions Group,  
Sydney, Australia

SAL DIMARCO



**Consistency.** Although a leader may not agree with the decisions made by all of his or her employees, it's important to treat all employees alike. There is nothing more discouraging to a worker than favoritism.

**Joan Phillips**

secretary,  
Microelectronics Group,  
Allentown, Pa.

RICK FRIEDMAN



**Understanding the business.**

Whether it be bits and bytes, finances or sales, the most important quality of a leader is a complete understanding of the business and the ability to make effective decisions based on that understanding.

**Larry Levine**

program manager,  
Data Networking Systems Group,  
Natick, Mass.

RICK TALCO



**Courage.** Courage to let go, courage to not have all the answers, courage to ask the tough questions, courage to take risks, courage to insist that the dignity and development of those being led be a priority, courage to make decisions and courage to say "I was wrong."

**Barbara Kopf**

global marketing director,  
Global Service Provider Business,  
Warren, N.J.

