Reading Works

The Reading Works is a high technology plant dedicated to the production of electronic components for telecommunications equipment. We are one of 22 manufacturing locations within Western Electric, a wholly owned subsidiary of the American Telephone and Telegraph Co., Inc.

Products manufactured by Western Electric range from the behind the scenes components such as the integrated circuits made at Reading to the telephones we use everyday. Western exercises careful control of the involved processes that bring products from the basic research stage in Bell Laboratories, through production in our factories, and finally to our ultimate customers.

Through AT&T International and our Government Sales Group, WE also provides telecommunications equipment and services to other nations and the Federal Government.

Locally, the Western Electric Reading Works depends on Berks County for its dedicated employees as well as essential goods and services. One of the area's largest employers, WE is a major contributor to the health of Berks County's economy. Through our employees purchases, as well as those of the company, millions of dollars in business are poured into the community each year.

In our own business, diversity, leading edge technology, and increased product demand have been the driving forces behind Reading's continued growth. Most recently, our office building has helped meet the need for additional manufacturing space since it now accommodates offices previously located in the manufacturing building. This 210,000 square-foot building, completed in 1982, houses engineers, other professionals and clerical and administrative personnel and brings our total floor space to more than one million square feet. Our 133 acres of rolling hills is an ideal site for this new building and the many manufacturing and support facilities surrounding it.

Berks County provides a good home for Western Electric's Reading Works and the people who work here.
The history of the Reading Works closely parallels the history of modern electronics. We began our operations in Berks County in 1952, just five years after the invention of the transistor by Bell Laboratories. The Reading location, conceived as a leading-edge technology facility, has maintained that position and earned the reputation as a pioneer in the field.

Our first mission was to manufacture semiconductor devices for the United States Government. The Government needed a reliable source of high quality devices for use by the Military and the space effort. Berks County, known for the strong work ethic of its people, proved to be a perfect location and our original site in Laurel-dale was selected. During its first ten years in Berks County, the Laureldale plant, housed in six converted old knitting mills, was dedicated to this Government business.

With increased demand for semiconductor devices within the Bell System, we were afforded our first opportunity to supply devices to the System in 1962. Our Laureldale location no longer met the demand for increased production and a new Reading plant was constructed in Muhlenherg Township. Since then, we have been supplying devices of the highest reliability and technical sophistication for use in the Bell System's network. In fact, almost every new communications system being introduced by the Bell System utilizes electronic components manufactured here at Reading.

Like the electronics industry itself, the Reading Works has had a dynamic history. Today, as in the past, Reading works closely with Bell Laboratories to bring new devices through the development stage into full manufacturing. Very often product lines are moved to another location so that Reading can tackle new challenges. Therefore, Reading's history has been an evolutionary one. In the 1960's we continued making transistors and diodes and added traveling wave tubes. By the 1970's diodes were still highest in volume; but linear integrated circuits had been introduced and were becoming an increasingly important product line. Adding to Reading's diversity, we began the manufacture of optoelectronics, microwave devices, until magnetic bubble memories; and to accommodate newer technologies, older products were transferred to other locations.

In the early 1980's, with the transfer of our diode lines to Kansas City, linear integrated circuits became our largest product line. New products such as gated diode crosspoint (GDX) integrated circuits and lightwave devices, have been introduced and continue to gain prominence. Optoelectronics, microwave devices, and bubble memory devices are expected to remain in production at Reading throughout the 80's.

All of these products will be used in advanced telecommunications services such as transmission, lightwave, electronic switching, and telephone systems. Modern cleanrooms (far left) provide an environment as clean as a hospital operating room, quite a contrast from the manufacturing facilities first used in Laureldale (left).

A Changing World
Engineering

Few industries have changed as radically and as rapidly as the electronics industry. In fact, the technology practiced today draws upon specialties that simply did not exist when manufacturing began at Reading. Diffusion technology, ion implantation, thermocompression bonding, thick film technology, epitaxial layering, beam lead interconnection, and laser etching are just some of the processes that have challenged the ability of our engineering staff in this new age of electronics.

To meet this challenge, our engineers must be drawn from many different disciplines including electrical, chemical, mechanical, and industrial engineering; materials science and metallurgy; and computer engineering and science.

This variety of engineering expertise is the crucial element in the ever-changing environment of electronic components. It has been the force behind the constant improvement and miniaturization of our products. The functions of the traveling wave tubes, diodes, and transistors that are Reading's history are still important today, but now these functions are performed on the surface of integrated circuit chips—sometimes smaller than the head of a pin.

Thanks to sophisticated manufacturing, just a few chips are able to handle the workings of an entire telephone. And, we are rapidly approaching the day when all these functions will be handled by only one chip.

The major role that Western Electric engineers have played in the advancement of the industry is clearly illustrated in the high degree of patent activity within the Company. WE has been issued more than 14,000 patents in its more than 100 years history. Reading Works employees have been granted almost 200 patents and continually have a number of patents pending approval.

Advancing technology and engineering expertise support our Product Planning and Management (PLPM) Organization. Engineers and managers working in PLPM are responsible for developing business and marketing strategies that consider the impact each Product Family has in satisfying Bell System needs and achieving product line objectives. These strategies help to formulate a plan to better utilize product line strengths and resources. They also form a basis for establishing an inter-relationship with manufacturing, sales management, services, and development. PLPM's support aids Western Electric management in better meeting customer needs and ensuring the financial health of the product line.

In order to help our customers provide the finest communications service at a reasonable price, it is imperative that we continue to find ways to reduce our manufacturing costs.

Very often in engineering, innovation and improvement are the main job functions. Such innovation and improvement is recognized by our Cost Reduction Program. The most significant contribution to the Cost Reduction Program is the engineering effort to eliminate process steps, reduce the labor effort required, and increase yields in established products as well as reduce new product costs.

Another important segment of the program is Administrative Cost Reduction. This effort, which can reduce paperwork, labor, and duplication, affects the cost of our product through the dollars saved in exactly the same way as in Engineering Cost Reduction cases.

This program has and continues to save the Company millions of dollars each year. With ever-increasing competition in the communications industry, Cost Reduction continues to be
Engineers continually work to improve product reliability through the development of sophisticated test equipment. An important part of all of our jobs,

Our advancing, technological environment offers a continual challenge to the engineer to keep abreast of the state-of-the-art in the industry. So, a Western Electric engineer's training doesn't stop when he graduates from college; in fact, it's just beginning. Our Corporate Education Center, located near Princeton, New Jersey, and our Summer on Campus Mas-ter's Program are only two ways that education continues. More importantly, it occurs on the job, where engineers interact daily with their peers, technicians, and other professionals from a wide variety of backgrounds, as well as the technical/professional employees in Bell Laboratories, Together, WE manufacturing engineers and Bell Labs research engineers and scientists strive to improve the new and existing products upon which a reliable communications network depends.

Engineers are involved in all aspects of our business from planning process and product development, to facilities engineering. Their diverse backgrounds and interests come together to meet the challenge of our ever-changing world.
Manufacturing

Our water treatment facility provides purified water, both for our use and for release back into the environment. Tests are conducted to verify the required levels of purity.

Through a layman's eyes the first look at the Reading Works is both fascinating and surprising. While the term 'factory conjures up a picture of steam, dirt, and noise, our factory is more like a laboratory or hospital. The air is pure and dry, everything is clean and fresh, and the noise is simply the pleasant sound of people working.

Through our employees' eyes, it may be fascinating, but it's not surprising. They know that the quality and reliability of our products demands this unique atmosphere.

If our manufacturing areas seem clean and orderly—then our specially designed "clean rooms" are immaculate. They produce the atmosphere required to manufacture highly complex devices with extremely intricate designs. Designs so complex and devices so small that one speck of dust can turn the sophisticated device into junk.

With this in mind, our clean rooms are designed to reduce the number of particles in the air from more than a million to less than 100 per cubic foot. And the particles that do get through the clean room filters are smaller than common bacteria.

Working in an environment similar to that of a hospital operating room, our clean room employees wear gowns, gloves, and head gear to maintain the purity of the atmosphere and could easily be mistaken as members of a surgical team.

Reading Works employees are dedicated to upholding our long-standing reputation for producing reliable, high-quality products. Our philosophy is that quality must be built in.

The primary responsibility for quality lies with the trained shop operator who, following engineering instructions, builds quality into the product.

In process inspection and testing provides verification of

Operators are trained in-house to use sophisticated manufacturing equipment.
quality and reliability. Quality control is twofold: throughout the manufacturing cycle, individual devices are inspected at critical points and the processes and machinery used to produce them are also inspected. This in-process checking is designed to discover, correct, and prevent product defects at their points of origin.

To ensure that quality is built in, everything that touches our products, even the one million gallons of water we use daily, must be free of impurities. Just as we constructed clean rooms to provide clean air, we also constructed a water treatment plant at our location to provide clean water. Many of the operations performed at the Works require that chemicals be rinsed off products. A spot of residue from regular drinking water would block out critical portions and functions of an integrated circuit chip. In fact, our products need even cleaner water than the human body does. If one million pounds (120,000 gallons) of good drinking water were evaporated, it would leave behind about four hundred pounds of residue. Yet, if the same amount of water we use were evaporated the same way, less than one pound of residue would remain.

Not only is the water treatment plant’s input to the Works clean, its output is even cleaner than the water it joins from local streams and springs. The plant treats about a million gallons of water per day, helping our local community keep our waterways free of pollution. Our employees are proud of the water treatment plant, which was cited by the Environmental Protection Agency (EPA) as a model plant for the electronics industry.

In addition to providing a quality product to our customers, the Reading Works is committed to providing a quality work environment for our employees. As the record shows, the Reading Works is a clean, safe place to work.
The source of all of Reading's products is an ultra-pure crystal, the most common one being silicon, as shown above. The crystal is sliced into wafers to be processed into chips.

The wafers are mounted and lowered into wells where epitaxial layers are deposited.

Patterns are produced on the wafer which define the outline of the chip as well as the components on it.
Although Reading makes many types of devices, the manufacturing processes for most semiconductor products we make are very similar. The source or starting point for these products is an ultra-pure crystal. We use several different kinds of crystals, the most common one being silicon.

The crystals or ingots we use are two to four inches in diameter and anywhere from three to twenty inches in length. The ingots are sliced into wafers 20 thousandths of an inch thick and polished to the appropriate dimensions and surface perfections.

The wafers then go through a series of processes where additional layers are grown on the starting wafer. These layers contain elements, or impurities of the desired type and number to provide the desired electrical characteristics.

The next step is to produce patterns on the wafer which will define the components on the chip as well as the outline of the chip. This is done by applying a light sensitive coating on the wafer and then exposing it by shining ultraviolet light through a mask. The areas that have been exposed to the light can be removed by chemical etching, leaving a pattern of bare areas where more impurities will be introduced into the wafer.

These impurities are driven into the wafer by diffusion at very high temperatures, typically 1000 degrees Centigrade.

This optical lithographic and diffusion sequence is repeated as many times as necessary to achieve the necessary electrical characteristics in each device.

Once completed, devices are contacted electrically and interconnected using metals appropriate for the device.

The wafers are then ready to be separated into chips, either by sawing or chemical etching.

Once in chip form, the devices are tested and mounted for shipping or put into packages.

It is the wide range of semiconductor materials, impurity elements, and contacting metals that enable us to produce the variety of devices manufactured at Reading.
Service Organizations

Though service organizations do not play a direct role in production, they do have a significant impact since they help keep the Works running smoothly and its people happy, safe, and healthy. Their functions touch almost every aspect of our working lives, from employment to retirement.

In fact, practically no task can be completed without interacting with a service organization. On a typical day, an employee may visit the Benefits Department for an explanation of insurance coverage, have an appointment with the Medical Department, receive a paycheck prepared by our Payroll Department, pick up a telecopied message from the Mail Room, request a data run from our Computer Center, and end the day with a farewell to the Security Guard.

Our numerous service organizations can be divided into six major areas: Human Resources, Administration and Accounting, Safety and Medical, Security, Manufacturing Support, and Information Systems Support. They employ professionals from such diverse academic backgrounds as accounting, computer science, psychology, education, and medicine. They also provide career development opportunities to administrative and clerical employees who, through years of dedicated service become specialists in their fields.

Nurses and doctors see employees every day for routine appointments as well as individual medical concerns.

Security guards monitor all shipments to and from the Works.
On an average day, employees in the Central Files area handle thousands of sheets of paper.

Accounting professionals keep track of all the Works' statistics—from how much money we spend to how many products we make.

All new employees meet with members of the Personnel organization for an orientation to WE's policies, procedures, and benefits.
To maintain our leadership position in the telecommunications industry, Western Electric and Bell Laboratories have made a commitment to be on the leading edge of software technology especially in relation to manufacturing.

When a typical manufacturer computerizes his processes, selecting the right hardware and software is much like going to the grocery store—the computer, or hardware, is selected from a number of models and the program, or software package, is taken right off the shelf. At Western Electric things aren't that simple.

With the sophistication of our technology, the supplier's hardware must be modified or our own hardware must be developed in-house. The software packages must be written and programmed by our information systems professionals.

Whether it's a small, stand-alone computer in a testing machine, or a software package tying many mini-computers into a central system, computers are used in almost all phases of our manufacturing processes.

While computerization makes manufacturing easier and more efficient, it's more than just a convenience. With the increasing complexity of our new products and the continuing drive for miniaturization, the use of computers is a necessity.

In the past, modernization, new features, or improvements required changes in wiring, relays, or countless other discrete components. Today, computer software provides greater flexibility through programmed instruction-information directed to the equipment controlling the process. Software applications provide versatility in processes that formerly were achievable only through costly, manual changes in hardware.

At the Reading Works, computer capability means many things. It means that production employees can go to a terminal to find out which product groups to work on and to obtain instructions as to which process steps should be followed. For engineers it means keeping track of product information from the design stage through manufacture. And accountants use computers to develop forecasts and results and in the many day-to-day financial operations, inherent in a business enterprise of the Reading Works' size.

Additionally, our computer serves as an interface with the Company's consolidated data center in Greensboro, North Carolina. This corporate data center processes information for many functional areas of our operations including personnel, payroll, accounting, purchasing, receiving, customer service, and facilities management—to name a few. Using terminals located at their desks, employees at Reading feed data into and extract necessary information from the database at Greensboro.

Here too, while the computer makes our employees' jobs easier, the sheer volume of information we process has made it a necessity.

Software has become increasingly important in Western Electric's business as a management and engineering tool, an aid in manufacturing and service support, and, most recently, as a product that is being sold to the company's customers.

The Reading Works of today is not only at the forefront of semiconductor technology in its manufacturing operations; it is at the forefront of information's systems support technology as well.
Telecommunications needs are growing rapidly. Helping to meet increasing demands for new and better communications services is the mission of Bell Laboratories, one of the world's largest and foremost industrial research and development organizations.

There are 19 Bell Labs locations with branch laboratories at major Western Electric manufacturing sites, such as the one in Reading. Bell Labs is jointly owned by AT&T and Western Electric.

More than 20,000 technical and administrative employees work for Bell Labs nationwide. Over two-thirds are engineers, scientists and technical support personnel. Most Bell Labs engineers and scientists have graduate degrees and many hold doctoral degrees. Disciplines represented include electrical engineering, computer science, physics, mathematics, operations research, economics, mechanical engineering, metallurgical engineering, materials science, ceramic science, chemical engineering, chemistry, communications, and psychology.

Bell Labs employees have been granted a total of about 19,000 patents and have received many major awards. Seven have won Nobel Prizes including, most recently, Arno Penzias and Robert Wilson. They discovered the faint cosmic background radiation remaining from the "big bang" explosion which many believe gave birth to the universe about 18 billion years ago.

Bell Labs has proved the value of long-term investment in research and development – not only for telecommunications, but for society as well.

For example, the transistor, invented at Bell Labs in 1947, revolutionized communications and brought into being entire new industries based on solid-state electronics.

Other dramatic Bell Labs advances have included high-fidelity recording systems, sound motion pictures, long-distance television transmission, coaxial cable, the origination of radio astronomy, the electrical digital computer, information theory, microwave radio relay systems, electronic switching, the silicon solar cell, the laser, charge-coupled devices, magnetic bubble devices, pioneering work in satellite communications, microwave communications systems, new computer languages and systems, and many, many others.

The Reading Laboratory, which was established in 1958 with 17 scientists and engineers, today totals over 200 technical staff members. Education is an important criterion for being chosen as a Bell Labs staff member. In fact, 37 percent of that population have doctoral degrees, 33 percent hold master's degrees and almost everyone has a bachelor's degree. They actively work on the development and design for manufacture of semiconductor devices which include analog integrated circuits, lasers, detectors, power transistors, and diodes. Unique to Reading is the design and manufacture of high-voltage integrated circuits for the No. 5 ESS (a new digital electronic switching system), high-performance and high-reliability semiconductor components for the undersea optical communications system, and other lightwave communications systems.

Bell Labs and WE employees work closely together to develop or improve manufacturing processes and products. Above, a Bell Labs and WE team pool their resources on a development effort.
Employees at the Reading Works come from a wide variety of backgrounds and reflect a broad range of interests. During their free time, Reading people are involved in a number of diverse activities ranging from hobbies and community service to competing in world class running and championship chess.

Their jobs here are just as varied as their personal interests and all play an important role in maintaining the Reading Works' leading-edge position in the telecommunications Industry.
Working, taking care of a family, and participating in religious and social activities is enough to more than fill the average person's life. But Telephone Pioneers aren't "average" people. They are people with energy, purpose, and a dedication to helping others.

The Telephone Pioneers of America is an association of telephone industry employees and retirees with more than half a million members worldwide. Thanks to their large membership and high degree of activity, local Reading Works and BTL Pioneers became the Laureldale Chapter in 1982, after serving more than twenty years as a Council.

Pioneers are continually involved in new and on-going community service projects. One recent innovation, designed by a BTL Pioneer, is a playback recorder which tapes sounds and automatically plays them back. This device helps children with speech handicaps learn to talk; but, it is only one of many aids for the handicapped the Laureldale Chapter developed. The Elcode, an electronic communications device used in teaching severely handicapped children by word and picture association, and the minicomunicator, a small portable device which augments the Elcode and is ideally suited for the victim of cerebral palsy, were also invented by Pioneer volunteers. Besides being used to educate, these machines enable the handicapped to communicate via the machine, which lights up words or messages at the touch of a switch specifically designed for the individual.

A device that combines both play and therapy is the Laura Dale doll, the first in a series of talking toys used to communicate with children who will converse with dolls or stuffed animals, but not with other people. Therapists are able to talk with a child through the doll's mouth while observing the child's reactions through a one-way mirror. The Pioneers also offer a "Climbing Squirrel," which is voice-operated, for use with autistic, deaf, and speech-handicapped children. Vocalizing is reinforced, since the only way a child can get the squirrel to climb the pole is through voice tones. A toy with the same purpose is the Pioneer-invented car racing set which is also voice-controlled.

Drawing on their experience in electronics and communications, the Pioneers have also developed aids for the blind. One invention, which affects all the employees at the Reading Works since it is a part of our telephone switchboard, and a big help to our blind operator, is the light probe. This feature can be used for any task where light detection is a factor. The light probe, which is almost like a magic wand to the visually handicapped, turns light into sound. This same technology is also used to allow the blind to enjoy some of the every day pleasures sighted people often take for granted. For example, a
game of baseball, once impossible for the blind child, is now a reality, thanks to the Pioneers beeping baseball. And now all children can enjoy the experience of their first Easter Egg Hunt using the Pioneers' beeping eggs.

The Pioneers have also developed or provided practical aids for the deaf and hearing impaired. Audio aids convert a pocket radio for use by the hearing impaired, for example. The Porta Tel is a communication device which allows a deaf person to use the standard telephone or specially designated public telephones. The Porta Tel is light enough to take on trips and can be used both to send and receive messages, since it features a display screen. Just as the Pioneers turned light into sound for the blind, they have turned sound into light for the hearing-impaired through the use of the sound probe. The Pioneers work closely with the Barks County Hearing Impaired Association to provide these devices to the Association's clients.

"Be a clown! Be a clown! All the world loves a clown!" and the handicapped, elderly, and needy are no exceptions. Just ask the Pioneer "Klowns." Yes, the Pioneers do more than bring happiness to those in need through their innovations in technology; they do it through the universal language of the clown. The "Klowns." the brainstorm of a WE Engineer, are some of the most sought-after people in Barks County. They bring the gift of laughter to senior citizens, the handicapped, children, and spectators at fund-raising affairs and special events. And they take their clowning seriously. Their makeup, which takes two hours to apply, is professional and unique to each clown, following the universal law of clowns everywhere. They are a unique group of Pioneers who spread the joy of Pioneering to everyone they meet.

Have you ever heard of a club with thousands of members, who don't even pay dues, and can take advantage of educational and recreational programs and participate in social and charitable events? Just such an organization exists at the Reading Works and every WE and Bell Labs employee is automatically a member.

Taking its name from our original location in Laureldale, the WELaurel Club was formed in 1960. Its aim is to "secure wholesome and healthful recreation, encourage good fellowship, and provide employees with educational opportunities and facilities." It's still going strong today serving the same good purposes.

The WELaurel Club offers activities to meet the interests of just about everyone. The 'Trading Poster,' the advertising arm of the Club, is published monthly. It includes items for sale or trade by employees and retirees and notices of upcoming Club events and activities. If you're the athletic type, you can participate in co-ed activities such as our Golf League or our Volleyball League. Whatever your game, there's a league or a club for you. In addition to athletic groups, the WELaurel Club supports other employee organizations for those interested in travel, photography, flying, and cooking.

While many WELaurel members share an interest in athletics or hobbies, they also like to have fun and learn together. The WELaurel Evening School offers a variety of courses ranging from investments to small engine repair to cooking. Health-oriented courses include first aid and CPR training. Social activities range from the annual Family Picnic to a Hoedown every fall.

But it's not all fun and games around the WELaurel Club. One special activity helps spread holiday cheer to needy children in Berks County. Acting as Santa's Helpers, Reading Works employees donate a beautifully wrapped gift to that special child whose name they have chosen. Thanks to hundreds of our employees who participate each year, local boys and girls may well receive that special gift they asked Santa to bring.

During the holiday season, many employees become Santa's helpers through the WELaurel Club program that provides gifts for hundreds of under-privileged children.
Community Involvement

Take a look into any organization of people helping their community, school or church, or their neighbors, and you'll surely find a Reading Works employee representing WE or volunteering his own time to help get the job done.

Western Electric demonstrates its commitment to the youth of the community by sponsoring Junior Achievement, an organization designed to help young people better understand the free enterprise system and an Explorer Scout Post, which encourages young people with interests in electronics. In both these groups, employees serve as advisors. Taking volunteerism one step further, the Explorers often choose a project which makes a meaningful contribution to the handicapped.

The Reading Works also responds to the needs of youth by offering a "Careers" program to local schools through its Speakers Bureau. WE employees, who volunteer to serve on the Bureau, also present talks ranging in topics from the history of Pennsylvania to the telecommunications industry. The Bureau offers its presentations free-of-charge to schools, civic organizations, and any other interested groups. This is just one way WE and its people serve the community.

Another way we join together is in support of the United Way. In addition to its financial contribution, Western Electric provides administrative and managerial expertise to the United Way and its agencies. Reading Works' employees serve on various boards and committees with the encouragement and support of the Company. They bring to bear their backgrounds in such broad fields as accounting, construction, and labor relations. One special contribution the Reading Works makes during the annual campaign is not in dollars, it's in people. Each year, WE management employees serve as Loaned Executives, working with companies and employee groups in the community throughout the campaign.

Closer to home, WE has its own United Way Steering Committee. Made up of a broad cross section of employees, the Committee works year-round to keep employees abreast of United Way activities and policies. Its biggest job is planning and running the in-house campaign which takes place in conjunction with the annual community-wide drive. Thanks to the Committee, and the generosity of Reading Works people, it's always a success!

Many employees are involved with United Way and its member agencies. Whether it's being a scout leader, a counselor for a crisis program, or a handyman at a sheltered workshop - WE people are there.

There, and many other places, too. Our employees are members of school, college, and hospital boards; city and municipal councils and township commissions; neighborhood crime watches and fire companies; and civic organizations and service clubs. They coach children in sports activities ranging from swimming to soccer to the Special Olympics. Western Electric people and their Company are there when they are needed. It's a natural extension of the spirit of service exemplified by the Bell System.