Rowland Wells Redington

1924-1995

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Rowland W. "Red" Redington, who died on June 22, 1995, was a physicist and manager of technology who led enormously successful innovation projects that set the world standard in CAT scanning and magnetic resonance imaging. His greatest strength was captured by a journalist who labeled him "medical imaging's player coach." Red had a remarkable ability to bring out the best in each member of the large teams needed to create world leadership in medical imaging systems.

Red's colleagues most vividly recall his laugh. Sharp, explosive, and infectious, it expressed the zest that marked his efforts whether it was skippering a sailboat, learning woodworking, or leading a research and development team on a technical leap that would carry General Electric beyond the competition in a pioneering field.

Red was born in Otega, New York, in 1924. His mother was a schoolteacher, and his father ran a feed store and tinkered with farm machinery. He earned his bachelor's degree in mechanical engineering from Stevens Institute of Technology in 1945 and went to work as an aerodynamicist for Curtiss Wright in Buffalo, New York. But the view from his window of war surplus airplanes being scrapped contrasted sharply with the excitement being generated not far away in Ithaca, where Cornell University was assembling one of the world's best physics departments, under the leadership of Hans Bethe, Richard

Feynman, and Robert R. Wilson. Red earned a Ph.D. degree in physics from Cornell, writing his dissertation on the diffusion of barium in barium oxide. On graduation in 1951, he joined General Electric's (GE) Corporate-level Research and Development Center in Schenectady, New York.

At the bench, he worked on new concepts for electron multiplier tubes for infrared-light imaging, helped develop improved video cameras, published papers on subjects ranging from electrostatic optics to infrared absorption, and earned patents in such areas as camera tubes and electrophotographic processes. He would ultimately publish ninety-nine technical papers and earn twenty-six U.S. patents.

By the early 1970s Red had become a manager of a small group developing imaging technology. Its efforts ranged from a concept for three-dimensional television that never made it out of the lab to a program on electronic fluoroscopy for GE's x-ray business that achieved some technical success.

Then, in 1973, an innovation burst on the scene. Godfrey Hounsfield, an engineer at EMI in Great Britain, introduced the first practical computerized axial tomography x-ray system, soon popularly known as the CAT scanner.

GE x-ray marketers were not initially impressed. X-rays had achieved a resolution of one millimeter or less while the CAT scanner could at best achieve one centimeter. X-ray imaging was instantaneous, while the first CAT scanner required minutes to acquire data. Surely CAT was at best a research device with a market measured in tens of units, not hundreds or thousands.

Red, however, appreciated the advantages that had inspired Hounsfield. Here was a way to distinguish density differences of as little as one-half of one percent, a feat impossible with conventional x-ray systems. That meant, for example, that brain tumors could now be found without painful and sometimes dangerous injection of air or other contrast materials, or exploratory surgery. Hospitals began ordering CAT scanners instead of conventional x-ray systems. This got the attention of GE business leaders, and they came to the Research and Development Center and to Red.

Hounsfield's initial machine had used a principle called "translate-rotate" to send and detect the hundreds of pencil-shaped x-ray beams that provided data for making an image. One might get into the business by simply imitating this approach. However, Red and his colleagues at the Research and Development Center thought they could do better.

In 1974 Red sold a more daring approach to GE Medical Systems business leadership. GE would leapfrog the EMI approach with an advanced scanner employing a fan beam instead of a pencil beam, and continuous rotation of the x-ray tube and detectors in place of the translate-rotate approach. It offered a faster scan, one that might image the head or body in just five seconds. But it also offered daunting challenges. Neither the required detectors, nor the complicated mathematical algorithms needed to reconstruct the image, then existed. Housfield himself had looked at the continuous rotation approach and declared it impractical.

Red and his team initially developed the concept for a prototype capable of imaging a five-inch diameter object, and targeted mammography as an application. In 1974 the GE Research and Development Center launched a joint project with the Mayo Clinic to build a fan-beam CAT scanner for breast cancer screening. Putting together a multidisciplinary team of dozens of people, Red led the effort that built, on schedule, this pioneering fan-beam scanner. Even before its delivery to the Mayo Clinic in 1975, however, GE committed to a next step, a "whole body" fan-beam scanner aimed at the commercial market. It was built on the foundation created by Red and his team. For example, the algorithms for fan-beam CAT scan reconstruction were developed for GE by Gabor Herman and colleagues at the University of Buffalo, and the xenon x-ray detector was developed by GE's John Houston and N. Rey Whetten.

As the fan-beam scanner quickly moved from lab project to commercial product, Red remained deeply involved. He spent one week a month at the University of California, San Francisco, in 1976, helping to coax top performance out of GE's first prototype scanner. He helped solve a crucial problem that had led to images that made skulls look thicker than they actually were.

The "third generation" CAT technology that Red championed has since become the world standard. As it did, and as GE built a highly profitable business, Red began looking for another frontier. It proved to be magnetic resonance (MR).

MR had entered physics in the late 1940s with the pioneering work of Bloch and Purcell and was applied to medicine in the early 1970s by Lauterbur and Damadian. It offered a way to use the combination of a strong, uniform magnetic field and radio signals that make images of the inside of the body without x-rays. Again, here was an area that initially looked dubious as an improvement on x-rays. Resolution was poor, and though you could make a two-dimensional "slice" image, it looked initially like a bad CAT scan.

Red, however, saw opportunity. Asked to put together a team on MR, Red went out and looked for the very best people in the field. Two of the university researchers he found were recognized as world class, but he was warned that they were prima donnas who could never work together. He hired them both anyway, and under his coaching, they complemented each other as technical leaders. Red was similarly able to bring out the best in people already available at the GE lab and blend them into what became a world-class team.

Red urged that MR's advantage was the ability to do spectroscopy as well as imaging: that is, to measure the levels of chemicals inside the brain or body without surgery or use of needles. When GE Medical Systems suggested that Red lead a research program on imaging, Red replied: "that's not research, that's development." The outcome was an agreement by GE Medical Systems in 1981 to purchase for Red's research team a 1.5 Tesla magnet, about three times the field strength of the magnet other MR researchers were using, for research on both spectroscopy and imaging.

Competitors said that good images could never be made on high-field systems. Red's team proved them wrong by producing, in 1982, better-quality images than those seen anywhere else in the world. As MR established its ability to provide images of "soft" tissues of the brain that were much better than even CAT scanning, this capacity gave GE a competitive edge. (Spectroscopy, the other target of the program, was accomplished with technical success, but has not so far proven of major clinical value.) Again, close teamwork with GE Medical Systems rapidly turned the lab prototype into a product. GE's Signa® magnetic resonance imager, introduced in 1983, put GE into a commercial leadership position that it has never relinquished.

Red subsequently returned to the bench to do research on magnetic resonance microscopy, and retired from GE in 1989. Among his numerous awards were the prize for Industrial Applications of Physics sponsored by the American Institute of Physics, and the "Engineer of the Year" award from 1989, presented by *Design News Magazine.* He remained a great coach and mentor to many scientists and engineers.

Throughout his career, Red pursued a wide variety of interests. He was an avid sailboat racer on Lake George. His crews never left the boat without a good day. Winning was less important than trying out new gadgets. He enjoyed practical jokes. He collected old mantelpieces and parts for MG automobiles and was a long-standing volunteer fireman.

Red's marriage to the former Shirley Bennett in 1947 resulted in a devoted lifelong partnership. Their shared interest in gardening led to an outstanding garden of dwarf conifers, and leadership in many local and national horticultural societies. Their deaths were only a few months apart.

Red's success resulted from his rare combination of skills. He could do first-rate technical work himself, head a team to come up with a new idea, sell the idea to a skeptical management, and defend the idea when the world said it couldn't be done. Through it all, he earned not only the respect but also the affection of all involved. Themes he pioneered in the 1970s and 1980s are staples of the research and development of the 1990s: teamwork between businesses and laboratories, multidisciplinary effort, speed, and quality. As he put it: "build it the very best way you know how, grab the top of the market, then work at reducing costs. But whatever you do, don't compromise quality at the start, because you can never recover."