

# Willis J. Whitfield: Father of the Modern Cleanroom

Technicians who work in the field of contamination control may not realize they owe a huge debt of gratitude to Willis J. Whitfield, who died last November at age 92. Whitfield worked as a physicist at Sandia National Laboratories from 1954 to 1984 and was project leader for advanced development studies of microwave propagation measurements, contamination control, and cleanroom development. In the early 1960s Whitfield invented the laminar flow cleanroom by developing his idea to supply air to a cleanroom in a unidirectional flow rather than moving the air randomly about the room. The idea was patented in 1964, and the introduction of contamination-free laboratories enabled the miniaturization of electronic and mechanical components, leading to our modern-day cell phones, laptop computers, and the emerging field of nanotechnology.

The laminar flow cleanroom also quickly changed the way laboratories, hospitals, and the National Aeronautics and Space Administration (NASA) operated. “I was amazed at the high level of interest [generated], chiefly from hospitals,” Whitfield said during a 2005 visit to Sandia. “They were very nervous about infections, and rightfully so.”

*Time* magazine dubbed Whitfield “Mr. Clean” in April 1962, noting it was his idea that led to the Whitfield Ultra-Clean Room, the predecessor of today’s cleanroom. The original 8 × 10 ft model of the Whitfield cleanroom was built in 1961. Air entered the room through the ceiling and exited through the floor, a design that allowed for more than 600 air changes per hour compared with 20 air changes per hour of previous cleanrooms. Whitfield’s group tested the new cleanroom design using a particle counter to check for dust contamination, and the prototype turned out to be 1000 times cleaner than any cleanroom ever tested up to that time.



*Whitfield in his cleanroom at Sandia in 1962.*



*Whitfield with his IEST Fellow plaque in 2011.*

“We turned on the particle counter and it just stopped counting,” Whitfield told a group of Sandia management during his 2005 visit to the facility. “We thought there was something wrong with it.”

During his remarkable career, Whitfield was granted patents for the laminar cleanroom, laminar flow bench, and a sludge irradiation device. He published nearly 50 papers on contamination control and other topics, including the operation of a gamma irradiation facility.

Whitfield was always very humble about his invention. “I just thought about dust particles,” Whitfield said. “Where are the rascals generated? Where do they go?” He also could not believe he was the first person to think of a laminar flow cleanroom. In a 1995 interview with *CleanRooms Magazine*,

Whitfield said, “The idea was so simple that some place, some time, somebody must have had this idea before.”

Whitfield’s two sons, Joe and Jim, are both engineers. Jim told the *Sandia Lab News* about his father’s disbelief. “He built it, found out no one had done it that way before, and said, ‘I don’t understand why [no one had invented it]. It’s so simple,’ ” said Jim, who was a young boy at the time. “I heard someone ask him how long did it take him to think of that idea and he said, ‘Five minutes; I just did the obvious thing.’ ”

In addition to his work at Sandia, Whitfield worked with NASA to provide spacecraft sterilization techniques and planetary quarantine efforts during missions to the moon and Mars. Among his many honors, Whitfield was recognized by the American Society of Mechanical Engineers with the Holley Medal for the unique concept of the laminar flow cleanroom principle, and *CleanRooms Magazine* honored him as its first Hall of Fame inductee.

In 2011, IEST named Whitfield a Fellow of IEST “For his pioneering breakthrough of the laminar flow cleanroom, which led to orders-of-magnitude improvements in manufacturing capabilities, cleanliness, and the protection of life from airborne hazards.” IEST also honors Whitfield each year by presenting the annual Willis J. Whitfield Award to worthy recipients for substantial contributions to the field of contamination control through published papers, studies, and reports.