



WRC Overview

WRC Snapshot

www.wrc-nc.org

Nonprofit research center advancing innovation globally with applied research, engineering and testing for wireless technologies – from implanted medical devices to satellites and space exploration.

The WRC fosters collaboration globally among companies, industry groups, academic institutions and other research organizations.

Unique approach to intellectual property does not require a share of jointly developed inventions. This operating principle fosters novel collaboration among world-renowned engineering experts and clients.

WRC Community Initiatives

RIoT - building communities for Internet of Things across the nation. More than 9,000 members and 90 company sponsors.

Advanced Mobility Collective - global community for new mobility services including autonomous air and ground vehicles.

AERPAW 5G Innovation - testbeds for drones and unmanned aerial systems supported by an industry consortium and \$24 million NSF grant.

Government R&D - applied research and development for government agencies including the U.S. Department of Defense and public safety initiatives.

R&D Engineering Services

Applied research and development for design, simulation, prototyping, fabrication and certified testing. *See Services Overview document for more details.*

Founder, CEO Gerard James Hayes, PhD
- Founded 2010 in Wake Forest, N.C.
- Team of wireless experts with more than 125 issued patents

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Flying cars are nearly visible on the horizon. Drones are delivering medical supplies. Autonomous vehicles are at work on farms. Wireless connectivity undergirds new products and services, many shaped by the Wireless Research Center, a novel nonprofit unifying and empowering connected communities for collaboration and innovation.

The WRC is a catalyst for collaborative innovation around the world. The WRC is a partner with clients and gathers communities of businesses, governments and researchers to bring new services to life including 5G, advanced mobility with autonomous air and ground vehicles, and Internet-of-Things connected devices.

At the core is a team of visionary, passionate and highly-accomplished engineers in a unique nonprofit organization. Communications expertise spans from implanted medical device sensors to satellites and space exploration. The WRC is a trusted partner for applied research, engineering and certified wireless testing using the best equipment in the world typically found only in the R&D labs at the largest companies. Customers span all industry sectors seeking expertise from the design of new concepts to certification and commercialization.

Founded on Visionary Innovation

The vision that birthed the WRC in 2010 began with founder Gerard “Gerry” Hayes, who holds more than 75 patents. After working at Lockheed developing satellite communications, Hayes led global advanced technology and “new concept” initiatives in research and development for Sony Ericsson for more than 15 years.

Innovation was rooted in the R&D culture at Sony Ericsson, thinking three to five years ahead about complex problems and connectivity innovation needed to develop solutions. Collaborating worldwide with academic researchers, industry standards groups and certification organizations, Hayes and his team worked to develop concept prototypes focused on commercialization and high-volume production.

Hayes and the R&D team were working on the connectivity challenges of smartphones years before the iPhone, streaming music years before iTunes, and Internet-of-Things possibilities when the world was using dial-up modems. Being a visionary futurist was the most important part of the job which shaped a unique view of the world. Driven by an inherent and zealous curiosity, Hayes and his team were focused on applied research and commercial development to address challenges on the horizon. In 2009, Sony Ericsson began closing the Research Triangle Park building where new mobile devices were researched and developed

for decades. Hayes joined a company making antennas for the military, GreenWave Scientific, but he had a vision to start something extraordinary. He knew other talented and visionary engineers valued living in the Research Triangle Park region after other technology and telecommunications titans were downsizing or closing RTP R&D operations including Nortel Networks, Alcatel Lucent, Cisco and smartphone manufacturers HTC and Research in Motion.

He saw GreenWave Scientific shipping new devices and technologies to be tested and certified with equipment that Ericsson had on site in the RTP. His vision for the WRC was a place where devices and new technologies could be developed and tested using the best equipment in the world. But not simply a “pass or fail” lab. Instead the WRC would offer collaboration from a team of exceptional engineers and mentors to help companies and entrepreneurs invent new products and services, create new jobs and form new companies.

Unique Approach to Intellectual Property

The WRC was born with a culture for collaboration and visionary innovation that Hayes enjoyed at Sony Ericsson with *two important exceptions* – a nonprofit and founding principle of not requiring a share of intellectual property. All jointly developed inventions for new and better products and services are owned by the customer.

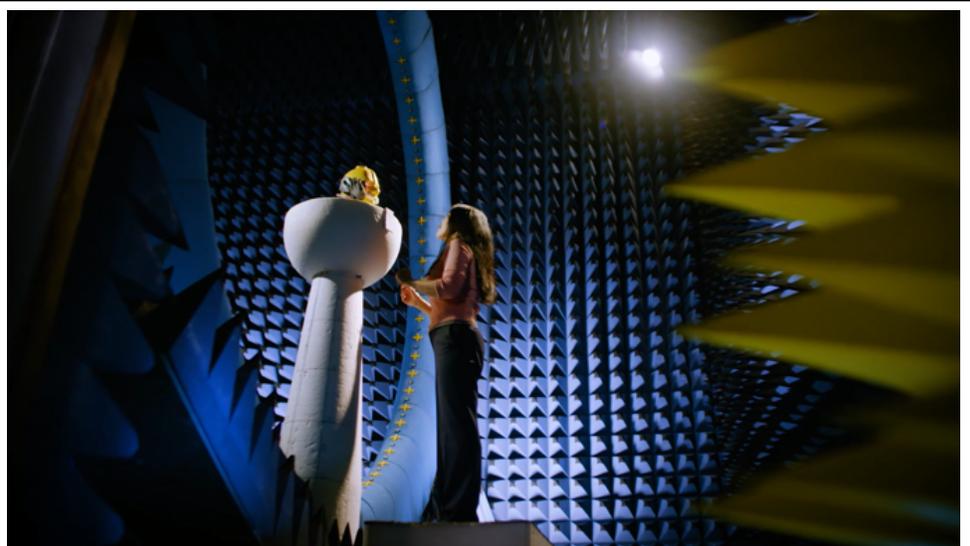
The WRC is a genuinely neutral community of experts collaborating with customers and partners for innovation. Unlike all other research institutions and universities around the world that rely on royalties from intellectual property for financial support, Hayes said his unique approach with the WRC fosters a novel paradigm of trust and collaboration. Though Hayes is not aware of any other organization with this operating principle, it works well for the WRC. The culture has inspired many experts to join his team who share a passion for their work and collaboration with other experts to shape the vision of communications and connectivity.

The culture of innovative collaboration and trust fosters the free exchange of ideas, unbridling the knowhow of an engineering team with more than 125 issued patents before joining the WRC at companies including Ericsson, Sony Ericsson, HTC, RFMD, Ixia Communications, Mohu, Lockheed Martin, GreenWave Scientific, U.S. Department of Defense, Booz Allen Hamilton, SDI Corporation, RTI International, Orbital Sciences, and Harris Corporation.

WRC R&D Engineering Services

The WRC experts become an extension of a company’s or partner’s team. This is why the WRC typically keeps the identity of customers confidential to maintain trust. Customers and partners range from Fortune 100 companies, the world’s leading research institutions and universities, government agencies, the world’s leading standard development organizations including the IEEE to startup entrepreneurs with dreams to launch a company.

The WRC bridges the gap between research and commercialization to bring products and services to market. The WRC uses applied research to develop intellectual property and assists with developing business plans and building relationships that lead to business and investment partners, customers and product launches.



Satimo SG-64 chamber for antenna testing was one of only three in the world when installed at the WRC and today is one of five in the world.

Hayes and WRC continued the Sony Ericsson culture of innovation, including many members of the Sony Ericsson team, supported by world-class design and testing equipment.

The WRC's Satimo SG-64 chamber for antenna testing, the type of equipment Sony Ericsson once hosted in the RTP, was one of only three in the world when it was installed and today is one of five in the world. Costing millions of dollars, other organizations with this equipment do not make it available to the public.

WRC engineers support design, simulation, prototyping, fabrication and certified testing for many clients in many sectors. One aspect is to help clients pass certifications for Verizon and the Cellular Telecommunications Industry Association (CTIA), which represents the U.S. wireless industry including carriers and equipment manufacturers. The WRC test and certification lab is accredited by the International Organization for Standardization (ISO), the most important global standard for accurate test and measurement data. The WRC is also certified by AT&T for consulting, designing and testing of IoT devices.

Wireless and Communications Market Landscape

Bridging the gap between academic research and commercialization, the WRC helps clients around the world develop products and services. Success is fostered by building communities of collaboration in public and private sectors, accelerating development of ideas from initial concept through commercial production. Innovation is engineered to solve complex scientific challenges for specific, practical solutions across virtually all industries – from wireless network infrastructure to connected devices.

Most typical wireless devices use radio waves that require antennas. Transmitters turn electrical signals into radio waves that can travel short distances, such as implanted medical devices and home Wi-Fi networks. Other devices communicate over millions of miles into deep space. The market for wireless voice and data applications include mobile phones for wireless voice and data, Wi-Fi and Bluetooth for local area networks, mesh networks, satellite communications and wireless sensor networks. Wireless energy transfer networks power devices ranging from electric cars and drones to mobile phones and biomedical devices such as pacemakers. Wireless body sensor networks monitor blood pressure, heart rate, oxygen level and body temperature – the genesis for the latest generation of fitness trackers, smartwatches and smart clothing. Military applications range from satellite communications to wireless mesh networks and sensor networks to support mission critical communications in open terrain and complex, obstructed urban environments. The WRC engineers have expertise recognized globally across the entire spectrum of communication technologies.

For many applications, the next generation in wireless will be driven by innovation in the way wireless networks operate, including the radio frequencies and how antennas handle radio signals and exchange data. The next evolution to 5G wireless networks will advance connected devices with Internet of Things (IoT) initiatives. 5G will be a catalyst for the continued evolution of wireless communications to support applications across many industries and markets, from drones, autonomous cars and smart cities to connected homes, improved healthcare and medical devices. Industrial applications include industrial robots, connected vehicle fleets, predictive maintenance, factory automation, and workforce training. Mobile Internet speeds will enable mobile phones to download entire movies in seconds.

5G networks will enable Internet-connected devices and sensors, including autonomous air and ground vehicles, to exchange information more than 100 times more rapidly than today's networks. New capabilities, called network slicing, will enable better management of data. Combining the next generation wireless infrastructure with smart phones, artificial intelligence, virtual reality, robotics and cloud computing will unleash new possibilities in what many observers are calling the Fourth Industrial Revolution.

Building Communities - Economic Development Collaborative Initiatives

The vision from 2010 is continuing to unfold with targeted, strategic initiatives to create connected communities for collaboration to solve challenging issues. Technology advancements are a part of the solutions, but real progress is fostered through innovative collaboration sharing expertise within the communities. 5G alone will not solve rural broadband challenges. Better drones and autonomous vehicles alone will not lead to advanced mobility transportation that improves how people live and work. Areas of collaboration include mentorship and

job training, urban planning, policy and regulation development, community education and alignment with businesses and government agencies. The WRC was created to foster this type of innovative collaboration. The WRC's economic development initiatives include:



The WRC is leading the deployment and operation of advanced wireless 5G testbeds in Raleigh and Cary as part of the Aerial Experimentation and Research Platform for Advanced Wireless ([AERPAW](#)). The testbed platform focused on drones and unmanned aerial systems, was announced last fall and scheduled to be operational this year. It is the nation's third advanced wireless research platform. AERPAW is supported by an industry consortium and a \$24 million grant from the National Science Foundation awarded to N.C. State University and the WRC to collaborate with other universities and communities. Hayes serves as the AERPAW business development manager and leads engagement with commercial companies. WRC Senior Staff Engineer Mike Barts serves as the AERPAW deployment and operations manager. WRC Senior Architect Asokan Ram serves as the AERPAW senior deployment engineer.



Known as “the Collective,” the [Advanced Mobility Collective](#) is a growing global community for collaboration to bring new mobility services to life including autonomous air and ground vehicles. Launched earlier this year, the Collective is led by Executive Director Todd Spain, a Cisco Systems veteran who also serves as the WRC's leader of strategic initiatives. Members of The Collective include WakeMed Health and Hospitals, the first U.S. health system to integrate drone technology for medical sample delivery, and a 35-year NASA veteran on the Collective's expert staff who led NASA aviation research. New advanced mobility services will transform every aspect of the economy in ways similar to the unleashing of the Internet in the 1990s. Advanced mobility will transform the way people live and work, and how people and cargo travel.



Part of the revolutionary advancements supported by 5G connectivity is the Internet-of-Things connecting devices that interact and exchange data. Started as a MeetUp group in Raleigh, the group was formalized by the WRC with full-time staff in 2015 led by Executive Director Tom Snyder, a technology veteran who also has roots in the Ericsson and Sony Ericsson R&D culture. [RIoT](#) has expanded to build communities and host events across the nation, including more than 9,000 members and 90 company sponsors. Since the launch of the first RIoT Accelerator Program in 2018, entrepreneurs have created companies with more than 100 jobs, produced more than \$47 million in revenue and raised more than \$8 million in investments. Startup companies that have worked in the WRC commercialization center at its Wake Forest headquarters and RIoT locations, including an office and lab at Raleigh Founded, have collectively raised more than \$400 million in investment capital and created more than 800 jobs.

Government and Public Safety R&D Engineering

Wireless Research Center engineers assist clients with applied research, engineering, testing and certification, including the U.S. government and Department of Defense, and local and state governments and public safety agencies. The WRC also partners with customers to apply for federal grants, including Small Business Innovation Research (SBIR) through the Small Business Administration and Small Business Technology Transfer (STTR). From early concept to mass production, the WRC assists clients with development throughout the entire design cycle. The government initiative is led by WRC Senior Engineer John Swartz. He joined the WRC with more than 30 years of experience in electrical engineering performing research and development for defense, medical, industrial and university labs, including Booz Allen Hamilton and RTI International. The WRC is working with UNC-TV Public Media North Carolina and the N.C. Department of Information Technology to develop a public safety research center. The center is tasked with developing and testing new products and services for first responders, beginning with innovative applications for ATSC 3.0/Next Gen TV to improve public safety response.