NIWC Atlantic Develops 5G Technology for Use Across the Fleet

12 July 2024

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The U.S. Navy fleet could soon start reaping the benefits of 5G technology. For the past several years, in collaboration with Office of the Under Secretary of Defense, Research and Engineering (OUSD R&E) FutureG office, Naval Information Warfare Center (NIWC) Atlantic has developed and tested 5G capabilities in naval ship environments and is primed and ready to deploy those capabilities on board U.S. Navy ships. This same technology used by just about every civilian with a cell phone is now ready and waiting to start making an impact on improving shipboard quality of life and quality of work, that combined is known as Quality of Service (QoS) for Sailors.

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This new shipboard 5G technology got its start about five

years ago in NIWC Atlantic's Assured Real-Time Communications (ARC) Laboratory in Norfolk, which focuses on joint interoperability and cybersecurity.

While Wi-Fi technology has recently been piloted and used in limited but successful capacities in the Navy, such as with "Sailor Edge Afloat and Ashore" on board USS Abraham Lincoln (CVN 72), NIWC Atlantic engineers are working to implement 5G technology both afloat and ashore to make Wi-Fi and other technologies more effective, efficient and secure. Ultimately, NIWC Atlantic's efforts of 5G implementation will help ensure better overall QoS in part due to its more advanced security and performance.

"What our NIWC Atlantic (5G) engineers did with industry partners has laid a solid engineering foundation for 5G technology to potentially take off across the Navy," said Peter Reddy, NIWC Atlantic Executive Director. "The use cases we worked on here were shipboard and pier side, and there are a lot of other use cases that 5G will satisfy in the Department of the Navy."

The work that NIWC Atlantic does with 5G technology relates back to advancing QoS. "We try to use that [QoS] mindset in our development of engineering processes so that we're looking at solutions that meet [common communication capabilities such as] gaming or FaceTime, where Sailors are able to witness the birth of their children. It also allowed us to address security challenges with command and control-type communications," said Kevin Thompson, a senior engineer at NIWC Atlantic and test director for the Assured Real-Time Communications (ARC) Laboratory.

In the early stages however, NIWC Atlantic wasn't able to test this technology in a true shipboard environment without disrupting active Navy operations and activities. Fortunately, in 2021, USS Wisconsin (BB 64), an Iowa-class battleship that

is now a functioning museum ship ported in Norfolk, Virginia, reached out to NIWC Atlantic's Norfolk 5G team asking if they had a replacement part for one of their messaging systems. Over time, the museum ship crew and NIWC Atlantic 5G teams formed a meaningful relationship that continued to develop, and eventually provided the 5G team an opportunity to request, and subsequently start the testing of 5G aboard USS Wisconsin.

Testing on board USS Wisconsin by the NIWC Atlantic Norfolk 5G team has been vital to the success of 5G technology. NIWC Atlantic engineers deployed a private 5G core and tested 5G coverage and performance in the ship's interior spaces. They ultimately found that 5G propagation within those confined interior spaces proves to be excellent and consistent with results from prior testing.

However, working with 5G data hasn't always been smooth sailing. Since ships face unique radio frequency (RF) spectrum and security challenges, and because 5G technology is a common technological area used for many different purposes, the 5G team found it difficult to predict whether commercial 5G solutions would work as expected in Navy operational environments.

Also, 5G technology has different levels of maturity. "What that means is when we start looking at how we implement solutions leveraging 5G for quality of work and quality of life, we're taking two different systems and trying to figure out how we make them agree on a common infrastructure that can support both things," said Thompson.

Nevertheless, NIWC Atlantic has been hard at work overcoming the various challenges associated with 5G data. According to Thompson, NIWC Atlantic continues to come up with collaborative solutions so 5G successfully works across all devices and systems. Currently, they are trying to improve and

maintain the relationships they have with different program offices so NIWC Atlantic can implement 5G technology into their existing systems.

Arnel Castillo, senior engineer working as Program Manager (PM) for NIWC Atlantic's 5G prototyping efforts, explained that these relationships are vital. "You have to be able to respect the processes that are in place today, that way when you insert this technology, there is some grain of familiarity and some confidence that you're not totally changing the paradigm," said Castillo.

Thus far, the NIWC Atlantic 5G team has achieved numerous advancements with 5G technology including developing a reference architecture for ship-wide, littoral, blue-water, pier-side, and ashore operational domains.

The team also designed and implemented the Department of Defense's (DoD) maritime 5G multi-vendor (shipboard and pier-side networks) testbed, which enables the experimentation of 5G networks and user equipment (UE) in a wide range of 5G frequencies.

Additionally, they implemented the DoD's first Voice over New Radio (VoNR) and Video over New Radio (ViNR) private 5G network, which is especially favored by Sailors since it provides them with a better QoS.

According to both Castillo and Thompson, 5G technology holds a promising future for all Sailors. Not only will this technology, common to cell phones, soon transform communications and connectivity on all naval ships both afloat and ashore, the Get Real Get Better initiative helps arm leaders and problem-solvers with a near-limitless warfighting advantage.

"The great work this team has done has really positioned the

Navy very well to be ready to move out quickly to rapidly expand 5G capabilities across the fleet," said Reddy.