Ham Radio in Virtual Reality

A group of radio amateurs and virtual reality enthusiasts joined forces in an effort to merge their two worlds by developing a ham radio interface for operating within the metaverse.

Oryx "Rucio" Gazella, KØRYX

During the COVID-19 pandemic, many clubs used virtual conferencing tools to remain active when meeting in person wasn't possible. While these tools are great alternatives to in-person interactions, they flatten our three-dimensional (3D) world into two dimensions. In an effort to stay in a 3D world, some hams turned to *virtual reality* (VR) as a means to connect.

Rise of the Metaverse

VR is a computer simulation of a 3D environment that's typically experienced by wearing a headset containing *stereoscopic displays* (display devices capable of conveying depth), and handheld controllers tracked in the 3D space. Although VR equipment is not required, the immersive experience it offers can be well worth the investment. Manufacturers like Meta, Valve, and HTC offer various models of VR equipment ranging from $300 to more than $1,000, depending on equipment features.

VR equipment is connected to a PC that runs the simulation software. The PC and software are responsible for rendering the environment and performing other tasks, such as connecting people (also known as *players*) together over the internet. The simulation software is colloquially referred to as the *metaverse*. Metaverse players choose a unique username, similar to a call sign, to log in to the platform. This username is how you're identified. My metaverse username is Rucio.

In the metaverse, you pilot a virtual character known as an *avatar* — a digital representation of how you appear to others within the metaverse. Avatars are highly customizable and often are an important part of someone's virtual identity. A variety of human and

Above: NARA members FoxBox, Rucio, Hikari Akimori, and Stiefel Jackal operated 20-meter voice at NARA's first Field Day event in 2022. VR allowed them to be together for the event, even though they were miles apart.

HyoCheetiBurd learned about NARA's 2023 Field Day event from social media and joined our VR world on Neos to check it out. This was his first exposure to amateur radio. Access the digital edition of *QST* (**www.arrl.org/qst**) to experience the metaverse.

non-human avatars, such as robots, dragons, and birds, are available.

VR is different from virtual conferencing, in that it simulates reality and provides shared environments (often referred to as *worlds*) where you can interact with objects and directly collaborate on projects.

A New Kind of Radio Club

In November 2021, a small group of VR and amateur radio enthusiasts met on the Neos Metaverse platform (**https://neos.com**) and formed the Neos Amateur Radio Association (NARA, **https://n1ara.org**) in an effort to promote amateur radio through the use of VR. It's an international club, open to all who have an interest in amateur radio and the metaverse.

We chose the Neos Metaverse platform because it's free to use, provides powerful development tools that are accessible from within the platform, and works well with and without VR equipment; as long as players have an internet connection and a computer, they can operate with us in VR. One of the development tools we use heavily is called Logix, a node-based visual language programmed directly in the platform. Programming is done by connecting Logix nodes together with virtual wires to form complex systems.

Neos has thousands of social worlds, games, and educational content, all built by its players. It can be downloaded for free at **https://store.steampowered. com/app/740250/Neos_VR**. Before installing it, re-

view the system requirements to ensure that your PC is able to run it.

Creating a Gateway between Worlds

News of our club spread rapidly in the metaverse. Within 6 months, we had grown to 45 members! While this was exciting, we felt somewhat disconnected from the hobby, as we lacked the capability to operate ham radio from within the metaverse. It was clear that in order to thrive as a club, we had to bridge the gap between the virtual and real worlds.

In order for our club to operate amateur radio collaboratively in VR, we had to build three interfaces: one to provide radio control and voice operation, one for the ability to log contacts, and one to allow us to operate *WSJT-X* from within VR.

Development kicked off in March 2022, with Marco "FoxBox" Pursell, KF7MYJ, and me leading the effort on the voice interface. FoxBox built the front-end user interface, while I developed the back-end ham radio interfacing and audio streaming.

Within the first month of development, we were able to remotely control an Icom IC-7300 HF transceiver. By the next month, we had a working variable frequency oscillator knob and live indicators for power, SWR, and signal strength. In the final month, we had a fully functioning ham radio interface capable of simultaneously operating all voice modes from multiple transceivers within VR!

One of our talented members from Germany, Sven "Rixx" Steffens, DL7SVT, developed the panel on our logging interface that allows us to log contacts from our stations and store the results in a database. This interface even checks for duplications.

And for the final interface, Rixx; Robert "Stiefel Jackal" Smith, KN4MFF, and I developed a *WSJT-X* panel that allows us to operate *WSJT-X* from within VR. This panel displays decoded messages and the active contact. An operator can use the panel to respond to calling stations or initiate a CQ. Once a contact has been logged, the panel plays a cheer sound effect and fires confetti into the air.

Virtual Field Day Location

Not only did we succeed in creating what might be the first ham radio interfaces in VR, but we also created a world to operate out of. Modeled by FoxBox, our forest park world was designed to mimic a typical Field Day

This group photo, which includes NARA members and visitors, was taken after the 2023 Field Day in NARA's forest park world had ended. The *WSJT-X* panels to the left were simultaneously operating radios on the east and west coasts of the US throughout the event. A wide variety of unique and colorful avatars represented the players.

location. It's complete with pavilions, picnic tables, BBQ grills, numerous towers and antennas, and a fire watchtower that doubles as a photo gallery documenting our build progress. This world is available for all to enjoy and can be found by searching "NARA" in the Neos world browser.

Our ARRL Field Day events in 2022 and 2023 were a huge success. We had a combined total of more than 150 VR visitors who participated and were able to learn more about Field Day. Any VR players who were on Neos looking for worlds to visit could see our Field Day event and join. Others saw our social media posts and joined via a link that took them directly into the world. This is similar to a real-world Field Day event, which would be frequented by curious members of the public.

For many, our events were their first introduction to amateur radio. Tomas "Frooxius" Mariancik, creator of the Neos Metaverse platform, said,

> The virtual ham radio Field Day event was my first introduction into this hobby. Being able to see and hear the operators communicate in real time helped me understand and appreciate the activity as if I was there in person, if not better.

Looking Ahead

This was the most involved amateur radio project any of us had ever worked on, and we're very proud of what we've accomplished! Node-RED modules developed to support this project have been made available on GitHub, at **https://github.com/bontebok**.

We truly believe that amateur radio's presence in the metaverse will help to strengthen interest in the hobby and provide an effective space for clubs to meet, collaborate, experiment, and operate together. We look forward to building even more interfaces in the future, which may include slow-scan television, digital modes like PSK31 and RTTY, and live software-defined radio receivers. See you in the metaverse!

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.