

# Under Radio-Quiet Skies

While the world becomes increasingly connected, the National Radio Quiet Zone relies on the restriction of electronic transmissions in order to study the cosmos.

## Allison McLellan

Driving past the Allegheny Mountains of West Virginia, all connections to the outside world begin to fade. Cell signals and radio broadcast channels get weaker until, eventually, they're gone completely. That is what happens when entering the United States National Radio Quiet Zone (NRQZ).

The NRQZ is a 13,000-square-mile area between Virginia and West Virginia, including a small part of Maryland, where the Allegheny Mountains act as a natural barrier to radio and television broadcast. In this zone, radio service is heavily limited to avoid overwhelming the minute astronomical signals measured at the Sugar Grove Station, in Pendleton County, and the Green Bank Observatory (GBO), in Pocahontas County. This protection has lasted for decades despite an increasingly technology-driven world, preserving the NRQZ as a place to observe scientific phenomena that can't be seen anywhere else on the planet.

## The History

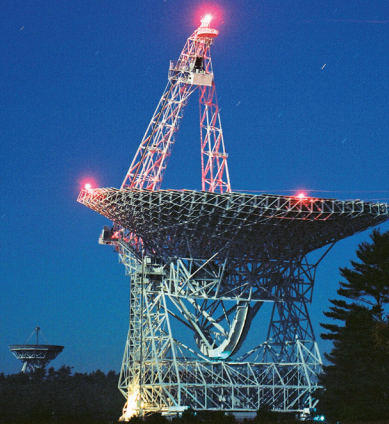
In 1956, the State of West Virginia created State Law 37A, forming the West Virginia Radio Astronomy Zone (WVRAZ) to protect any radio astronomy facility within the state

from electrical power levels above a certain threshold. It is divided into five zones, ranging in the severity of regulation on radiating devices based on proximity to an observatory. The FCC then established the National Radio Quiet Zone in 1958 to govern all fixed-based licensed transmitters throughout a 13,000 square-mile area.

Thus, a receiving station was activated as "Naval Radio Station Sugar Grove" in 1969 as part of the ECHELON surveillance program. Initially a secret program, ECHELON was spearheaded by the US government in the late 1960s with cooperation from Canada, the United Kingdom, Australia, and New Zealand to investigate communications between the Soviet Union and their allies during the Cold War. The site in Sugar Grove intercepted and processed all electronic telecommunications entering the eastern

side of the US. The station's involvement with the National Security Agency received recognition during the 2013 controversy over former CIA Technical Assistant and government whistleblower Edward Snowden through reports from *The New York Times* and *The Washington Post*. Shortly thereafter, the Chief of Naval Operations ordered the base closed by 2015, citing plans for relocation. In 2017, the former Navy base was bought by an investment group for \$4 million with plans to be converted into a health-care facility.

Thirty miles west of Sugar Grove is the Green Bank Observatory in Pocahontas County, established in 1956. The site houses the Robert C. Byrd Green Bank Telescope (GBT), the world's largest fully steerable radio telescope, towering at 485 feet and weighing 17 million pounds. Measuring the radio



[John Stoke, photo]

signature given off by all molecular matter in the universe across 0.1 – 116 GHz, it is one of the most sensitive radio telescopes in the world. It measures signals in micro-Jansky units — according to the GBO website,<sup>1</sup> that is less energy than what is generated by a single falling snowflake.

As the only telescope in the world that can provide the instant resolution and sky coverage necessary to understand how planets are formed, the GBT is used to study everything from comets to the origins of the universe. GBO Business Manager Mike Holstine described, “[The GBT] has found that the basic building blocks of life exist everywhere in our galaxy... This is extremely important for the formation of life.”

The only designated quiet zone in the United States, the NRQZ has been so successful that it has become a model for similar quiet zones across the world. The International Telecommunication Union has even suggested forming quiet zones in space.

### Life in the Quiet Zone

Those living in the NRQZ must adjust to very specific perimeters to comply with GBO operation. In areas closest to the observatory, only diesel-powered vehicles are allowed because of the interference caused by spark-ignited engines in gasoline-powered cars. Law requires that power lines be buried 4 feet underground, the use of any Bluetooth devices or microwaves are prohibited, and television is only accessible through satellite or cable through most of the area.

One technology that is not quite so impacted by Quiet Zone limitations is Amateur Radio, as operation is on completely different frequencies than those used by the telescopes. Still, a radio amateur must use low power and highly directional antennas.

ARRL member Pat Schaffner, KC8CSE, is president of the Eight



### Visitors from Far, Far Away

The uniqueness of the Quiet Zone has attracted a variety of visitors. As one of the most radio-quiet places on Earth, it is the perfect place for those who claim to have electromagnetic hypersensitivity (EHS). Surveys across California, the United Kingdom, Sweden, and Taiwan have found that about 1 to 5% of their population believe to be afflicted. While rare, those who claim to suffer from EHS experience a range of adverse symptoms, from headaches and nausea to rashes and prickling sensations on the skin, all from exposure to electromagnetic fields. Although EHS is not a medically accepted diagnosis, a few dozen wireless refugees have fled to Green Bank (population 143) since the eruption of the digital revolution through the 2000s.

The small town has also attracted international attention. Russian billionaire Yuri Milner gifted \$100 million to the Search for Extraterrestrial Intelligence Center at the University of California at Berkeley, which will use part of that donation to rent the Green Bank Telescope (GBT). Yuri founded the project Breakthrough Initiatives in 2015 with his wife Julia Milner “in order to explore the universe, seek scientific evidence of life beyond Earth, and encourage public debate from a planetary perspective,” according to the project website.<sup>2</sup> His donation will go toward taking 20% of the GBT’s time over the next decade, utilizing its acute sensitivity to explore the possibilities of extraterrestrial life.

Rivers Amateur Radio Club (N8RV) in Pocahontas County. Licensees are served by eight repeaters throughout the county, and the club provides communication for events in the area. In describing limitations on Amateur Radio, Pat said, “All repeaters must be approved by the observatory — their power, location, antenna gain, and so on — in order to deploy them. If they ask us to shut down the system, we must comply.”

ARRL member Rudy Marrujo, KD8WPG, is also a member of the Eight Rivers Club. When he moved to

the NRQZ 5 years ago, he saw Amateur Radio as a necessary tool. He said, “Amateur Radio gives us the opportunity to communicate with friends and neighbors, and therefore unite our community. It takes on a heightened and more significant purpose here in Pocahontas County.”

There are numerous instances in which Marrujo has used Amateur Radio to call for help for members of his community, as well as for complete strangers in need of assistance. He recounted a time when two women from out of the area had

## An Unlikely DXpedition

Walt Skavinsky, KB3SBC

Accompanied by fellow Amateur Radio operators Bill Stauffer, KA3RMM, and Edward Beneiser, WA3WSJ, ARRL member Walt Skavinsky, KB3SBC, received approval from the Green Bank Observatory Interference Protection Group to set up a DXpedition in the National Radio Quiet Zone.

Our crew planned to operate from Cass Scenic Railway Park atop Bald Knob Mountain, the third-highest point in West Virginia. This location falls within Zone 3 of the five smaller zones that make up the NRQZ. Zone 3 is restricted to frequencies below 30 MHz, with a power limit of 5 W.

We rode a train to the summit and spent 2 nights in a reserved caboose, built in 1949, which contained five beds, a small kitchen, and a coal stove for heat, with a lead-acid battery and solar charger providing power and lighting. Two solar panels, a charge controller, and a homebrew lead-acid battery box provided power. Setup included a homebrewed inverted L antenna fed with a 1:1 unun and a homebrewed G5RV. I used my Elecraft KX3 to contact stations across 80 – 10 meters, while Bill used an FT817 and a KX3. Ed utilized a pedestrian mobile pack with a modified Kulikov military antenna attached to a Buddistick coil to make CW contacts on 40 and 20 meters on his Elecraft KX2. After a 1-mile hike to the Bald Knob Fire Tower, we activated the local Summits on the Air (SOTA) summit W8V/PH-002. We also deployed a British military Clansman dipole kit, stretching 34 meters of wire per leg, to obtain our only contact on 160 meters.

Operating holiday style, our team made just over 100 contacts under somewhat challenging band conditions. This area is not a place you think of as the perfect place to operate Amateur Radio, but with a little preparation, it turned out to be a great event.



GBO Business Manager Mike Holstine under Green Bank's 140-foot telescope, with a view of the GBT. [AUI/GBO, photo]

their car break down on one of the county's rural roads, and Marrujo and his radio became their only means of assistance.

## The Quiet Keepers

In an age of almost ubiquitous technology, it is a wonder how such a large area has been able to maintain radio-quiet skies — that is where the Interference Protection Group comes in. The group is comprised of several Green Bank Observatory employees who balance their responsibilities at the facility with the additional duties of maintaining a database of known RFI for observational use, planning the testing of electronics to be installed within the facility, and discussing possible mitigation techniques for upcoming technologies.

Within the 10-mile radius of the WVRAZ, the team uses a truck outfitted with equipment to monitor licensed transmission sites and seek out offending signals. They inspect Amateur Radio stations near the observatory and ensure they are maintained up to code, but the source of an interference issue is often unexpected. This past year, the crew began an intense search for RFI indicated at 1,404 MHz within 2 miles of the GBO. After several fruitless drives

through the community, an RF technician finally located the offender — a Raspberry Pi accidentally left on in a scientists' office.

Mike Holstine is also co-head of the Interference Protection Group. He said, "With the advent of the digital revolution and the interconnectivity of everything manufactured and sold today, the pressure on the Quiet Zone has become tremendous. Simply keeping up with the volume of requests for licenses is onerous. Add that to the increase in wireless communications devices in every household, and it becomes almost impossible to manage."

Everyday tools such as the tire pressure monitoring system in vehicles, LED lights, the automatic door opener at the local grocery store — essentially, anything wireless — become problematic in the NRQZ. "That being said," Holstine continued, "the Quiet Zone is still extremely quiet in comparison to any other place on the planet."

### Notes

<sup>1</sup>[www.greenbankobservatory.org](http://www.greenbankobservatory.org)

<sup>2</sup>[www.breakthroughinitiatives.org](http://www.breakthroughinitiatives.org)

Allison McLellan is an Assistant Editor for *QST*. She can be reached at [amclellan@arrrl.org](mailto:amclellan@arrrl.org).