The Solar Eclipse QSO Party

Put a big red circle on August 21!

Ward Silver, NØAX

You have probably heard the news about the upcoming total solar eclipse on August 21. Dubbed the "Great American Eclipse," the entire United States and much of Canada and Mexico will be able to see some portion of the Sun eclipsed by the Moon. The path of totality in which the Sun is completely behind the Moon covers from Portland, Oregon to Charleston, South Carolina, as shown in Figure 1. This may be the most-watched solar eclipse in history, and ham radio definitely has a role to play!

Why the Eclipse is Important

As HF operators well know, solar radiation plays a major role in signal propagation. Daily, seasonal, and longer-term cycles of solar activity have profound effects. Imagine then, a whole day's worth of changes taking place over the course of a few hours. That's exactly what happens as the Moon's shadow temporarily blocks the Sun's rays from hitting the Earth during the eclipse. A propagation model's output in Figure 2 shows what is expected to happen to the maximum usable frequency (MUF) along several paths as the eclipse occurs.

Another unique aspect of the eclipse is the abruptness with which the changes take place. During a normal day, the *terminator* (the line between dark and light areas) moves pretty fast — about 1,100 miles per hour — to make it all the way around the Earth. The eclipse's deepest shadow, or *umbra* — where the Sun's disc is completely covered by the Moon — moves even faster, crossing the North American continent in 1 hour and 33 minutes at a ground speed of 2,240 miles per hour. The time during which the Sun is completely covered — *totality* — is a maximum of about 2½ minutes if the viewer is positioned exactly in the middle of the Moon's shadow.

We're not doing all this work to observe the bands just during the short period of totality, though. The partial shadow, or *penumbra*, also has a dramatic effect that lasts for 3 hours or more, as shown by Figure 2. This creates a perfect opportunity to measure how the ionosphere responds during the eclipse, as well as the hours before and after, but only if there are a lot of signals and receivers to do it. That's where hams come in.

Solar QSO Party Goals

As described in *QST* articles about the HamSCI group (**hamsci.org**) in the August and October 2016 issues, over the past few years, professional researchers have noticed the amateur's ability to generate quality data about signals. At the same time, a combination of software-defined radio (SDR) technology and the Internet have enabled amateurs to build a sophisticated network of automated signal decoders that listen to the bands 24 hours a day, such as the Reverse Beacon Network (RBN), PSKreporter, and WSPRnet. The map in Figure 3 shows a typical set of RBN data, illustrating the effect of night and day on the ham bands.

The upcoming eclipse presents a perfect opportunity to demonstrate the

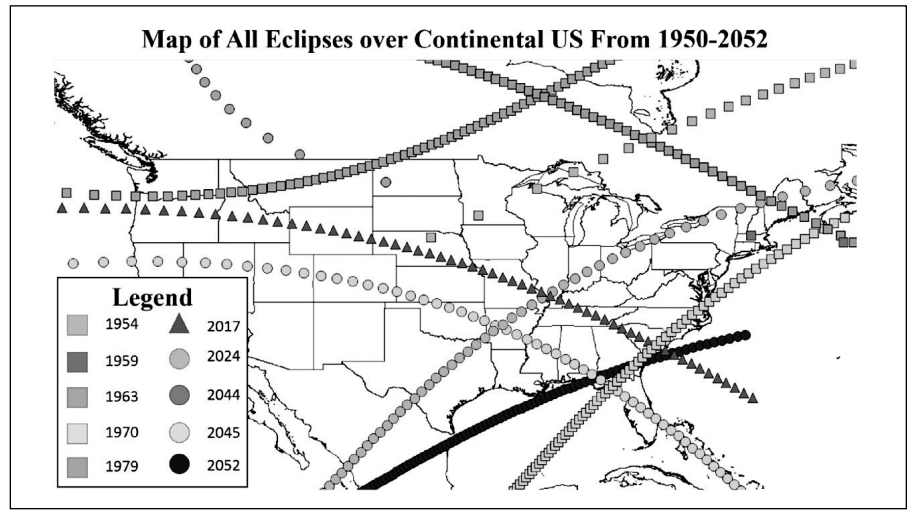

Figure 1 — Map showing total solar eclipses visible in the continental US from 1954 to 2052. The August 2017 path of totality (red triangles) first hits land near Portland, Oregon, at 1715 UTC. The end of the land-based path occurs 90 minutes later near McClellanville, South Carolina. [Graphic courtesy of Magda Moses, KM4EGE]

scientific value of Amateur Radio, and the HamSCI team came up with the idea of a Solar Eclipse QSO Party, or SEQP. (There are other on-the-air events during the eclipse, too.) The object is to get amateurs on the bands from 160 through 6 meters during the eclipse (which occurs on a Monday) and collect as much information about their signals as possible. The notes at the end of this article provide additional information on the eclipse, including how to determine when it will be visible at your location. The entire eclipse will take 1.5 – 2.5 hours from beginning to end, depending on your location.

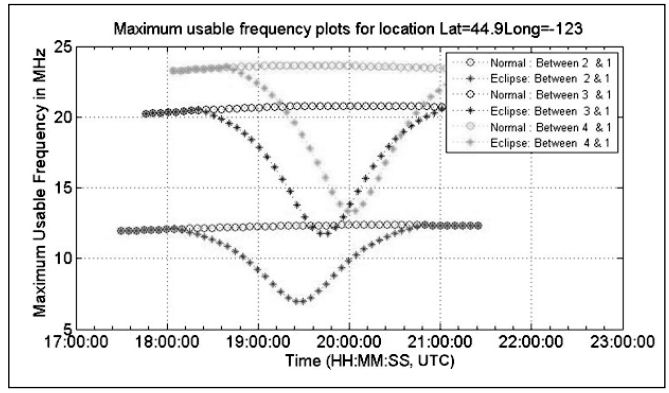

Figure 2 — MUF along three paths between stations across the US. The model shows the sharp drop in MUF as the eclipse occurs. Station 1 is in Oregon, Station 2 is in Wyoming, Station 3 is in Kansas, and Station 4 is in South Carolina. [Graphic courtesy of Magda Moses, KM4EGE, and Charudatta Chitale]

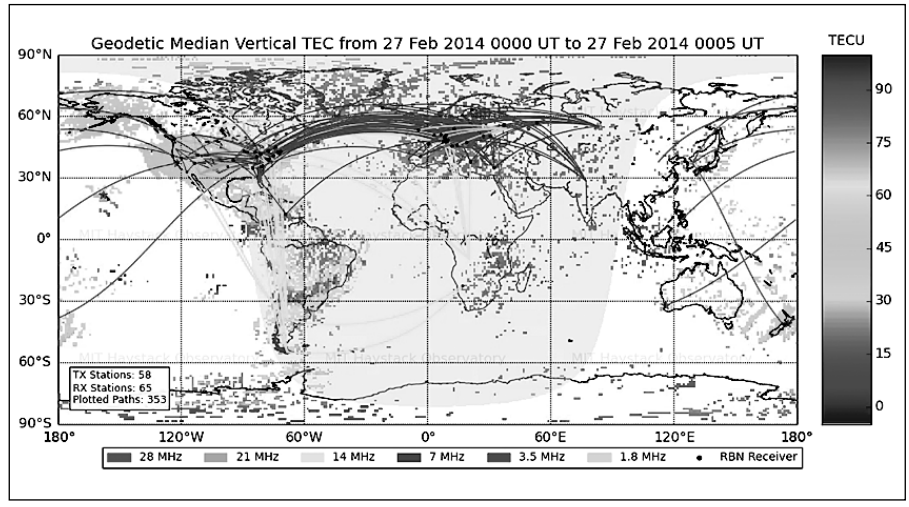

Figure 3 — Map of RBN signal reports on several bands with the day/night terminator shown (TEC is Total Electron Content). The effect of solar radiation on the ionosphere and on received signals is clear. An animation showing the 24-hour period following this graphic is available in the digital *QST* version of this article. [Graphic and video courtesy of Magda Moses, KM4EGE, and Anthea Coster]

How to Participate

There are two basic ways for you to participate in the SEQP. The listen-only option is to set up an RBN receiver, or *node*, to make signal-to-noise ratio (SNR) measurements during the SEQP. The listen-and-transmit option is to get on the air during the eclipse and contact other stations so the RBN will receive and measure your signal's SNR. If your station has the capability, you can do both. This can be a great project for your club or a student project, as well.

The rules for participating as an active station are summarized in the sidebar, "Solar Eclipse QSO Party Rules Summary." (See the HamSCI website for detailed rules and updates.) While scores will be calculated and published based on total QSOs and bonus points from submitted logs, this isn't a contest, per se — it will be a true "let's all get on the air and make a lot of contacts" QSO party. There will be plenty of contest-style fun with rapid-fire contacts made over wide areas, which aligns well with the goal of making a large number of measurements before, during, and after the eclipse. (It is perfectly understandable if you turn off the rig to go outside and watch the eclipse as it reaches your location!)

Preferred modes are CW or RTTY (those will be received and decoded by the *CW Skimmer* and *RTTY Skimmer*), along with PSK (captured by *PSKreporter*). Include "CQ" or "TEST" in your transmissions to be sure the automated decoders recognize and measure your signal. Phone QSOs, signal strength reports, and observations are welcome, too. WSPR fans are certainly encouraged to be active, and their signal reports will be captured by the WSPRnet system separately from the SEQP. If you use CW, make it easy for the RBN nodes to capture your signal by using a consistent format and sending speed.

For active stations there are two traditional categories — Single Operator (SO) and Multioperator (MO) — and one special category, the Sounder Team. SO and MO participation is pretty much the same as in other contests — get on the air and make contacts. The Sounder Team, however, is a coordinated effort between two stations who will repeatedly attempt a sequence of contacts on all of the SEQP bands from 160 through 6 meters. This type of operation allows repeated measurements of conditions along a fixed path, so the effect of the eclipse can be assessed without having to also take into account continually changing station locations.

Other special rules include allowing duplicate contacts after the start of each clock hour. In other words, you can work all stations again as soon as the clock minutes "roll over" to 00. This helps ensure sufficient activity during all 8 hours of the event. Another guideline applies to stations using rotatable antennas — leave them pointed toward or along the path of totality during the whole event, so the only thing affecting your signal strength is propagation. Note that the exchange requires your six-character grid locator, such as EM48cd. You can look up your grid locator via online tools, such as the one provided by AMSAT at **www.amsat.org/amsat-new/tools/grids.php** or by using a map-based service, such as **no.nonsense.ee/qth/map.html**. Watch the SEQP page on the HamSCI website for updates, changes, and additional discussions.

You can use any logging software that supports the SEQP, and software authors have been provided with the necessary details to modify their programs. What is important is for your log to comply with the Cabrillo 3.0 format standard. (Sample logs are provided on the HamSCI website's SEQP page.) Logs will be uploadable online, or you can e-mail them. Paper logs will not be accepted, although you can use WA7BNM's Cabrillo converter web page to manually enter your QSOs and create a Cabrillo-formatted entry.

Following the eclipse, all of the collected logs and the data from RBN and other networks will be collected and combined into a database by professional researchers at Virginia Technical Institute. The data will then be made available to the geophysics research community for study and further research.

SEQP Summary

The upcoming total solar eclipse is literally a once-in-a-lifetime event across the United States, both visually and on the air. By putting your station on the HF bands during the eclipse, you can be a part of Amateur Radio's long-standing role of contributing to scientific research and personal interaction with the Earth in a way completely unknown to most people. Be sure to keep August 21 clear on your schedule so you can be a part of the grandest show in the sky!

Solar Eclipse QSO Party Rules Summary

See the HamSCI SEQP web page for complete rules and an FAQ.

Time and Date: Monday, August 21, 2017 from 1400 – 2200 UTC

Bands: 160, 80, 40, 20, 15, 10, and 6 meters (60, 30, 17, and 12 meters will not be used)

Modes: CW, PSK31, and RTTY (Phone contacts may also be submitted)

Categories: Single Operator, Multioperator, Sounder Team (see website), and RBN Node

Scoring: Number of QSOs completed plus bonus points (see website)

Exchange: Send the call sign of receiving station, signal report in RST format, six-character grid locator (e.g. EM48ss), and call sign of sending station.

Log the date, time, band or frequency, mode (CW, PH, or RY — for RTTY or PSK), both call signs, signal report sent and received, and grid locator sent and received.

Logs should follow the Cabrillo 3.0 format standard and may be submitted via web log upload at **contest-log-submission.arrl.org** or e-mailed to **seqp-logs@hamsci.org**.

Notes

[1]An eclipse overview with state and county maps showing eclipse path and times can be found at **www.eclipse2017.org/**.
[2]HamSCI website: **hamsci.org**
[3]NASA Solar Eclipse website: **eclipse.gsfc.nasa.gov**

Ward Silver, NØAX, is a Contributing Editor to ARRL, working with *The ARRL Handbook*, *The ARRL Antenna Book*, license manuals, and *QST*. He is an Amateur Extra class licensee and active on HT. He has a personal interest in scientific research by amateurs, and is working with the HamSCI team as an ARRL liaison. You can reach Ward at **n0ax@arrl.org**.