Scouts Snare Spacecraft

Mix some barbed wire with a little Scouting ingenuity for a high-flying contact.

Doug Cook, KD5PDN

Jamboree on the Air (JOTA) is Boy Scouting's annual Amateur Radio event, which enables Scouts around the world to communicate with each other. For more than 50 years, this event has allowed Scouts to participate in a fellowship so large that it outnumbers attendance even at some of the world Jamborees. It is the most efficient way to provide an international Scouting event from one's local ham shack, campout or Field Day event.

I have been a Scout leader for 18 years — 5 as a Scoutmaster. In the early 1990s I got my Technician license after my fellow Scout leader, John Dronberger, N5YZA, showed me how radios could improve our communications during Scout activities. Amateur Radio has enabled our troop to connect with others and has been integrated as part of our emergency preparedness plan for the troop.

Figure 3 — Scouters with WB5BSA included Doug Cook, KD5PDN; Larry Holden, W5MPA; Mark Hamblin, AE5MH; Matt Ford, KF5JRP; Mike Campbell, W5KSU, and John Dronberger, N5YZA.

Because our troop gained a greater number of hams than the average troop, JOTA became a natural fit and we have continued to use it in our program. John (see Figure 1) and Mark Hamblin, AE5MH (see Figure 2), helped JOTA to become an annual council event at the John Nichols Scout Ranch, one of our Scout camps in Oklahoma. As volunteer campmasters, they reserve the third weekend of October each year for JOTA (see Figure 3).

For the 2011 event, in addition to the traditional Amateur Radio station setup, we enhanced the Jamboree with a few new programs related to the Radio merit badge.

The Fox and the Pickle

One of the new activities was an electronic foxhunt. A small transmitter was hidden in a nearby grove of woods. Scouts used radio direction finding gear to narrow in on the hidden "fox." Larry Holden, W5MPA, built a low-powered transmitter to repeat our troop's club call sign (WB5BSA) as the Scouts zeroed in on its location. They got a sample of how naturalists in the wild use similar gear to locate animals with radio-tracking collars.

Another popular activity was radiosurgery. I brought a radiosurgical unit used to remove skin lesions such as skin tags and warts. As an optometric physician, I use this instrument for minor procedures on the delicate skin adjacent to the eyelid. For the activity, I had Scouts remove the "warts" from a pickle (see Figure 4).

Another successful new activity was contacting other JOTA stations via Amateur Radio satellites. We successfully communicated with station K2BSA, the call sign of the Boy Scouts of America's national headquarters, via the AO-51 satellite during an afternoon pass. [AO-51 ceased operating in November 2011. — *Ed.*]

Figure 1 — John Dronberger, N5YZA, demonstrates ham radio to a group of Scouts.

Figure 2 — Mark Hamblin, AE5MH, brings the world to the John Nichols Scout Ranch for members of Troop 117.

Figure 4 — Doug Cook, KD5PDN, supervises Cub Scouts removing the "warts" from a pickle using the Ellman Surgitron, a radiosurgery device that operates on 3.8 MHz. [Bill Wilburn, N5NUK, photo]

Figure 5 — The completed barbed wire beam on an Adirondack-style display stand.

The Barbed Wire Beam

Prior to the event, the world Scout organization's JOTA website (**www.scouting.org/jota.aspx**) announced that astronaut Mike Fossum, KF5AQG, would be working the event from orbit, using the International Space Station's Amateur Radio station. Mike is an Eagle Scout and Scout leader who was on Expedition 29, which completed the final build of the station. Mike had gained a reputation as an astronaut who would work the ISS ham station, NA1SS, in his off-duty time. Amateurs around the world get excited to hear a voice instead of the usual APRS (Automatic Packet Reporting System) beacon coming from the station during a pass.

In order to contact Mike, we could have used any standard equipment. However, this was an opportunity for us to create equipment that would instead be symbolic. I brainstormed a design for a "barbed wire beam" satellite communications antenna, which would both fulfill our goal of contacting Mike and would be unique to us as Scouts and Radio Amateurs. In considering what to use for the antenna elements, I decided on barbed wire since it is a well-known symbol of the western plains, which includes Oklahoma.

I sketched out the design, which is based on Joe Leggio's, WB2HOL, tape measure antenna design. The elements were joined together with proper pioneering lashings including the shear, diagonal and square lashings. (Tips on tying these lashings can be found in the Scout Handbook or at **www.pioneeringprojects.org/resources/ebooks/sceng.pdf**.) It was a zero budget project — the parts were debris from a tornado that struck our community just months earlier. I found plenty of good cedar branches and 10 feet of usable barbed wire amidst the debris, which was plenty for my design.

While the tape measure beam design has a soldered hairpin, I decided to make the driven element one piece and cut it longer to incorporate the hairpin bends. I used zip ties to temporarily secure the elements while tuning them, and then I secured the elements with lashings after tuning was complete. I cut ¼ inch nibs from each end of the driven element to tune it down to the intended 145.800-145.825 MHz frequency range used for satellite communications. Traditional radio component technology begins with a soldered coax connection; I used an RG-174A cable to connect the driven element to my radio via an SMA connector. Using a shear lashing, I lashed the finished beam to a tripod to use it as a display when not operating (see Figure 5).

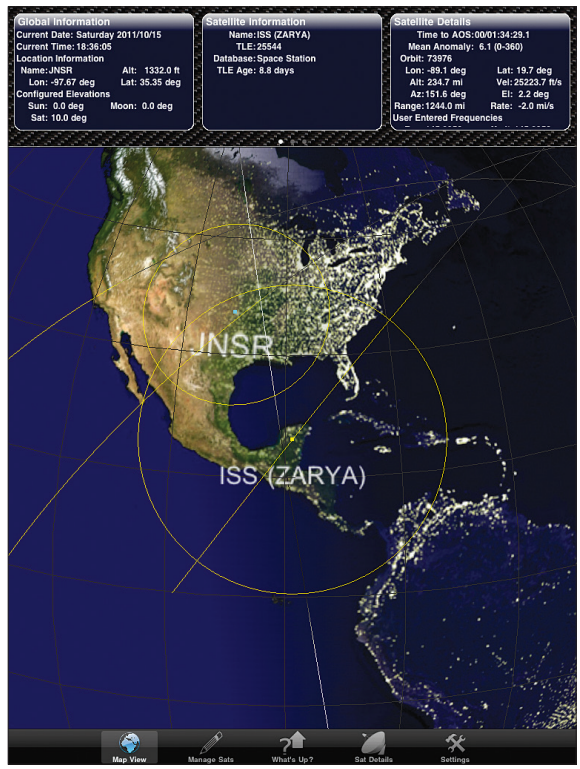

Figure 6 — This screenshot taken from *ProSatHD* shows the ISS and the JNSR Scout camp. The surrounding yellow circles indicate their respective communications ranges.

I used an antenna analyzer to tune the beam to 145.825 MHz. This is the frequency the ISS's digipeater uses when in APRS mode. The SWR was excellent at the design frequency and acceptable for use over much of the 2 meter band.

As shown in the antenna analyzer display view, the SWR at 1.12 was very efficient for the intended frequency. The ISS North American voice frequency of 145.800 is close enough to enjoy optimized voice use with the antenna as well.

I used a Yaesu VX-8R handheld transceiver to test the arrangement for the upcoming contact. The VX-8R has a maximum output of 5 W. NA1SS is usually set in an APRS digipeater mode when not in use for voice contacts. I was able to send and receive my APRS beacons from more than 1000 miles away.

Contact on the Fly

I used **www.heavens-above.com** to get pre-

Figure 7 — A little radio, a little Scout ingenuity and you have handheld space communications system.

Figure 8 — Eagle Scout Carey McCachern, N5RM, demonstrates ham radio to another Scout.

dictions of the overpasses of the ISS during our JOTA weekend. During a satellite overpass in the field I like to use *ProSatHD* for the iPad or iPhone [available in the iTunes store — *Ed.*] to get up-to-the-second predictions.

On Saturday evening the ISS was due for a very peripheral pass at 6:30 PM local time. For our main attempt, I planned to contact Mike, KF5AQG, at 8:00 PM. For the 6:30 attempt the software predicted an elevation of less than 10° off the horizon. Most satellites would not be worth the bother for such a peripheral and narrow window of opportunity.

Figure 6 is a screen capture from *ProSatHD* used to predict satellite passes. The blue dot labeled JNSR (John Nichols Scout Ranch) mapped our location. The illustration showed an ISS test might work, so I decided to test my radio gear to be ready for the 8:00 pass.

At 6:30 in the evening, I pointed my antenna to the southwest and quickly heard a booming signal. Mike was talking to Mexican Scouts from Baja California. He was approaching the Yucatan Peninsula.

He spoke quickly in order to make as many contacts with as many JOTA stations as he could. The ISS travels 17,000 miles per hour and the window for making a contact is short. As we were on the peripheral edge of the window, our opportunity would last only a few seconds.

We heard Mike call "CQ JOTA." I gave my call sign the first time and Mike didn't reply, instead responding to another station. On my second attempt, he replied with our call sign. I held up the microphone and, on cue, the Scouts around me on cue said "Hello Mike!" Mike acknowledged and quickly went on to CQ the next station. The whole contact lasted about 7 seconds.

"I've used walkie talkies in Scouts but the handheld radios shown to me are able to reach much farther. This would be great for backpacking and makes me want to get my license now." —Scout Glenn Herrick

The ISS at the moment of our contact was over the Yucatan Peninsula 1200 miles away. The station was just 2.2° above my horizon. While contacts may be futile at this distance and angle, in many cases our barbed wire antenna showed surprising performance with a VX-8R running 5 W (see Figure 7).

We scored what felt like the equivalent of an Amateur Radio hole in one by contacting Mike aboard the ISS. For me, it felt like a mountaintop experience. I am not an antenna engineer, just an optometrist. It was with immense satisfaction that I was able to design and build an antenna that symbolized Scouting, ham radio in space and Oklahoma in one pioneering project that was a successful satellite communications system.

Extra! Extra! Read All About It!

The success of the ISS contact was picked up by the media. The *Oklahoman* published a good article. The staff photographer wired me for sound as he video recorded our contact. An enhanced multimedia presentation is available online. Go to **newsok.com** and search for 3616398 to see news, pictures and a video of our contact.

Our ISS contact was also the subject of an Amateur Radio podcast for Twit TV (**twit.tv/show/ham-nation/22**). In it, recently licensed Eagle Scout Carey McCachern, N5RM, and I were interviewed about our contact with the ISS. Carey worked the event and loved having access to our great collection of gear. I wanted him to appear to show that some Scouts really get into the hobby (see Figure 8).

All photos by the author except as noted.

Doug Cook, KD5PDN, an ARRL® member, works as an optometric physician in Guthrie, Oklahoma. He's been licensed since 2001 and is active in Scouting as well as Amateur Radio. Doug can be reached at 1217 Mockingbird Rd, Guthrie, OK 73044, **twoeyedox@gmail.com**.