

One curious thing about Amateur Radio is the lack of interest shown by non-amateurs to our many marvelous achievements. For those who are not fascinated by the 'magic' of radio most of what we do for fun seems, well, boring. Worked Rodrigues Island on 75 meters? Ho-hum. Broke through the pile-up to contact Heard Island on 30 meters? Yawn. Set up a digital repeater with links around the world? Bor-ing. But there is one Amateur Radio activity which gets everyone's attention, and that is when you tell them you've talked with an astronaut. A non-ham friend approached me a few years back and asked me who I'd talked to recently. He was surprised and impressed when I told him that I'd talked with Doug Wheelock on the ISS the week before. The whole community notices when you are talking to people in outer space. And it's great fun!

So, when the opportunity came to help with the Chiddix ARISS contact, I couldn't say "No". Hari Rebba VU2SPZ from the CIRC had gotten the idea that Chiddix needed to have an ARISS contact while his son Dhruv KC9ZJX was still a student at Chiddix, and he refused to take "No" for an answer. After repeated applications and some Hamvention lobbying by Hari, Chiddix Jr. High School (CJHS) in Normal was added to the list of schools designated to get an ARISS contact. CJHS was the primary sponsoring group with the Challenger Learning Center (CLC) in Normal and the Children's Discovery Museum (CDM) also in Normal being supporting organizations. The news of CJHS's selection came through in December of 2016, and our big project started. Having a lot of experience tracking satellites and making contacts through the OSCAR satellites, I knew it should be relatively easy to make a two-way contact with the ISS. Easy that is, if the astronauts used their high powered Kenwood radio (not the antique Erickson hand held), and if there was a good antenna angle (with no obstructions) from the school site, and if we could find a teacher willing to take on the extra work to sponsor a contact, and if the administration would give us access to the facility long enough to set up our station, and if the weather wasn't too bad when our date came up, and if the antenna loaded up properly from the school roof, and if the rotators kept rotating, and if we got the correct frequencies programmed into the radios, and if we remembered to adjust for the Doppler when the big moment came.....etc. etc.

The problem with making an ISS School Contact is that you have no chance to try out your setup before the day of the Contact. And you only get one chance. And you have a lot of people watching and wondering if you're really going to be able to make this happen. So, it qualifies as a high-pressure event. But, it can be incredibly rewarding. When it all works, and the astronaut answers the call, and the kids get their chance to talk to the astronaut the moment is one to remember.

An ARISS School Contact is arranged by the Amateur Radio on the International Space Station (ARISS) organization. That organization is made up of representatives from ARRL, AMSAT, and of course NASA, along with many international partners. Twice each year applications are reviewed, and groups are selected to participate. Groups who are awarded a chance to talk with the ISS have the option of selecting either a Direct Contact or a Telebridge Contact. A Telebridge contact is routed from the classroom, where the students are, through an Internet VOIP link to a fixed Amateur Radio Station somewhere around the world, and on to the ISS. For a Direct Link, the students work directly with local amateur radio operators, and the radios are set up in the classroom. That gives the students a chance to see and operate the radios, which (in my opinion) makes the whole thing much more dramatic and educational. When we met with representatives from Chiddix, the CDM, and the CLC it was agreed that the Direct Contact was the best choice if we could make all the arrangements. We'd let the kids see what Amateur Radio was able to do! I enlisted Ralph Bellas K9ZO, Ed Deutsch KC9GF, and Dennis Mills KE9UA initially, and with the support of the CIRC the planning began.

Back in contact with the ARISS program, we submitted our equipment plan. ARISS specifies that the Amateur Radio team for a Direct Contact must provide a 2-meter FM primary station with tracking antennas and 50-150 watts of power and, in addition, a completely independent backup station with an omnidirectional antenna and emergency power so the contact can continue even if electrical service to the classroom is interrupted. The type of transmission line, frequency resolution of the transceiver, and number of memory channels in the radio are all specified. ARISS wants the contact to be successful, and most of the time the contacts are.

After we submitted our plan, I began rounding up the needed equipment. As an active satellite operator, I had a lot of the needed gear, but other CIRC members loaned us items which were critical to the success of our contact. Ralph K9ZO let us use his 2-meter 'brick' amplifier and a matching power supply. Ed KC9GF loaned his Yaesu FT-847 transceiver, which served as the backup station transceiver. Tom Planer KJ9P got interested in the backup antenna problem. After some research and some help from Dick DuBroff W9XW, Tom built an omnidirectional antenna modeled after the EZ-Lindenblad, a design by Anthony Monteiro AA2TX which was published in QST for August 2007. With Tom's changes, this antenna performed very well, and was another critical piece of our ARISS station.

During the spring and summer, work progressed. I set up our main antenna in my driveway, a ten by ten element circularly polarized Cushcraft Yagi antenna. After a few false starts I got it tuned up and working nicely on 2 meters. Tom KJ9P got some initial matching problems ironed out and built a very sturdy EZ-Lindenblad antenna out of 1-inch aluminum tubing and plumbing parts from the local home center. Hari VU2SPZ, continued to work with our ARISS mentor and coordinated the local activities and meetings with our contacts at CJHS, CDM, and CLC. Mrs. Dee Hopper from CJHS did a lot of extra work getting the students involved, getting questions submitted and selected, getting the releases all signed and doing the hundreds of other things which needed to be done at the school.

Since we were unable to practice making contacts with the ISS, we decided to listen in when other schools in the US made their ARISS contacts. We could test our antennas and radios to see how well they were receiving signals from the ISS, even though we could not transmit back up. A good receiving antenna is usually a good transmitting antenna as well, after all. In July 2017 there was a SSTV special event from the ISS. Over an extended weekend the ISS transmitted Slow Scan Television images via the same transmitter used for ARISS contacts. We were able to get excellent imagery with both our main and back up antennas. And we were able to copy the ISS well during the other school contacts which we were able to monitor.

I wanted to be sure that we would get a nice audio recording of our contact, and I wound up building an audio 'splitter' with a microphone input (to record the students), microphone level output (to drive the transceiver), and line level output (for recording). I started with a simple circuit I had used in the past, made some 'improvements' and finally got it working.

Dhruv Rebba KC9ZJX, was assigned the role of Station Operator for W9AML for the School Contact. He completed his homework successfully, putting 100 QSO's in his log over the summer and completing several practice sessions with me using hand-held FRS radios. By Fall he was ready to go.

We learned in the early summer that we would have our contact during the week of October 23-28, 2017. By mid-October we knew we were getting close to our contact date, but we still did not have a final date from ARISS. We decided to go ahead with a practice session, so the students would be

comfortable talking on the Yaesu FT-847, our primary transceiver. Most of our students were from CJHS, with a smaller number being students from other schools who had participated in activities at the CLC. Dee Hopper rounded up the students, and got us permission to use the CJHS library. For the practice session, Tom Planer KJ9P acted as our practice astronaut (reminding me of David Bowie's old hit Space Oddity. "Ground Control to Major Tom..."). We used a 2-meter simplex link from the library at Chiddix to the Children's Discovery Museum. The Yaesu FT-847, our main station transceiver, and a simple $\frac{1}{4}$ wave Mag mount antenna outside the library window made up the station at CJHS. KJ9P was stationed at the CDM with his portable 2-meter station. His answers were great, and the practice gave us a chance to time ourselves and see whether we could hope to get all 16 of our students through during the short (10 minute) ISS pass. It seemed, with a little luck, we should be able to get each student a chance to speak to 'our' astronaut.

Working with ARISS we were given a list of possible passes for our contact, and we hoped that we would get an afternoon time slot later in the week, perhaps on Thursday or Friday. Instead, on October 18, we learned that we were 'on' for Monday morning, October 23. Fortunately, the weather cooperated, and we were able to put up our antennas on a pleasant fall afternoon on Friday, October 20. The Monday morning time slot presented logistical challenges, however. Our setup, testing and final practice would have to fit into the time slot between 7:00 am and 10:31 am when the ISS would be flying over.

When the 23rd arrived, we met at Chiddix at 7:00 am with light rain falling and began setting up our radios and computers. The rooftop antennas had survived some weekend wind and rain with no problems. Cables were run from the roof into the library at Chiddix where the contact would take place. The students arrived for their practice session at about 9:00 am. They quickly learned to move to mic, ask their question, and then step aside for the answer. Dennis KE9UA monitored our transmissions and responded to the students confirming that they were getting through on the radio. By 10:00 the media and guests began to arrive. And at about this time, our audio recording laptop decided it was time for a Windows update! Fortunately, the computer update ended after 10-15 minutes and Ed KC9GF was able to reconfigure Audacity in time to record our contact. Our 3 $\frac{1}{2}$ hours had evaporated and it was 10:31.

Interestingly, when the ISS first came up over the horizon, both Dennis KE9UA and Keith AC9S were able to hear calls from the ISS from their home stations a few moments before we heard them at Chiddix. Both Dennis and Keith were listening on simple vertical antennas located on tall towers (75-100 ft.). Looking at all the factors which affect line-of-sight VHF propagation, I think that our delay in hearing the ISS was simply the location of our antenna at roof-top height, and the fact that we were aiming directly across the Town of Normal with buildings, trees, etc. between. By the second or third call from NA1SS (approx. 20 seconds) the ISS was above this 'ground clutter'. We could hear them clearly at CJHS and we received a "Loud and Clear" signal report from the ISS.

Our students remembered the lessons learned during our practice sessions, asking their questions clearly and promptly. Our Astronaut, Joe Acaba, did a great job of interacting with the students and answering their questions. We were able to move through the questions smoothly and all sixteen students got to ask their questions. In addition, we had 4 of the students prepared with a second question in case we had extra time. We were able to get all these second-round questions asked as well. Mrs. Hopper was on standby to say "Thank-you" to our astronaut if time was available, and she did that following the last of the questions. Dhruv thanked Joe at NA1SS on behalf of the students at Chiddix, and signed off. Joe wished us well and signed off from NA1SS. Then we looked at our clock and

realized that we still had 2 minutes of time remaining! A very successful contact, indeed. Several members of the audience commented to me on how well they could hear the astronaut.

During our contact, Dhruv Rebba KC9ZJX operated the main station radio for W9AML. I controlled the radio and monitored the Doppler tuning. Ralph Bellas K9ZO operated the backup station. Ed Deutsch KC9GF monitored the audio recording computer. Tom Planer KJ9P monitored the emergency power, which he made available for both our main and backup stations. Dennis Mills KE9UA helped from his QTH by monitoring our uplink signal and reporting any problems. Hari Rebba VU2SPZ helped with general setup and with photography and video recording. He also coordinated our Contact with W5KUB and his Amateur Radio Roundtable, so the event could be webcast. Jim Baker WB9EDL helped with general setup and antenna monitoring. He was up on the roof 5 minutes before our contact making last minute adjustments! Mike Sallee KC9FWL helped with photography, Gregg Kellerman KC9WVR, and Rick Suhadolc N9CKL helped with antenna setup and there are doubt others whom I am no forgetting to credit.

An ARISS school contact probably requires more preparation than any other type of QSO in amateur radio. The 'hours of preparation time per QSO' ratio is huge. But, I think our "over-preparation" contributed to the success of our School Contact. And the enthusiastic support for the operation by the CIRC and was also critically important for our success. So, I will use this opportunity to thank the many CIRC members who contributed time, talent, energy, and equipment to this operation. And special thanks to Jim Allen, the principal at CJHS for his support. And to Dee Hopper at CJHS, Stacey Shrewsbury at CLC, and Rachel Carpenter at CDM for their work and support. Without their help this School Contact could not have taken place.

Grant Zehr

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