Radio Waves

News you can use for license instruction and radio science education

ARRL — The national association for AMATEUR RADIO

Spring 2016

INSIDE THIS ISSUE:

Don't Miss...

Radio Waves' teacher-contributors Ron Rinsinger, KC5EES, Paul Veal, NØAH, Jeff Tolhurst, N6JWT, and Brad Amacker, N5MZ, share their experiences in "Amateur Radio in the Classroom — One Technical Tool, Countless Applications," an article written by Edith Lennon, N2ZRW, *Radio Waves*' contributing editor. It appeared in the April 2016 issue of *Tech Directions* magazine, which you can access **here**.

Amateur Radio as a Tool for Home Schooling

BY WAYNE GREENE, KG4ZQY

My wife and I homeschool our three children, ages 10, 8, and 7, and we participate in a local homeschool cooperative, "Next Generation," and a regional homeschool association, "Coastal Georgia Homeschool Association." After conducting some research and discussing the idea with the ARRL Education and Technology Program, I reached out to the parents of both homeschool organizations about adding Amateur Radio to our curriculum. The response was overwhelming, so I set out to write lesson plans for the first semester of the Coastal Georgia Homeschool Association Radio Science Program.

The purpose of the first semester wasn't necessarily to teach a basic electronics course, but rather to give kids a chance to experience some basic electronics through the lens of history.

We met one night a week for an hour or more. Our study started with French physicist Jean-Antoine Nollet, then progressed through other pioneers, such as the Chappe brothers, Benjamin Franklin, Michael Faraday, Samuel Morse, and Guilielmo Marconi. Throughout the history lessons we looked at basic electric principles like the atom, the flow of electricity, and the electromagnetic wave.

Our lessons included some talks and skits, in which many parents participated. Hands-on experiences included experiments with static electricity, charging a leyden jar, and electromagnetism. We built capacitors, electromagnets, a small version of the Morse telegraph sender/sounder, Morse code oscillators, a simple coherer receiver, and our final project was a crystal radio using oatmeal boxes. We even tried learning Morse code.

Benji and Aiden Singletary building a capacitor. (Photo by Wayne Greene, KG4ZQY)

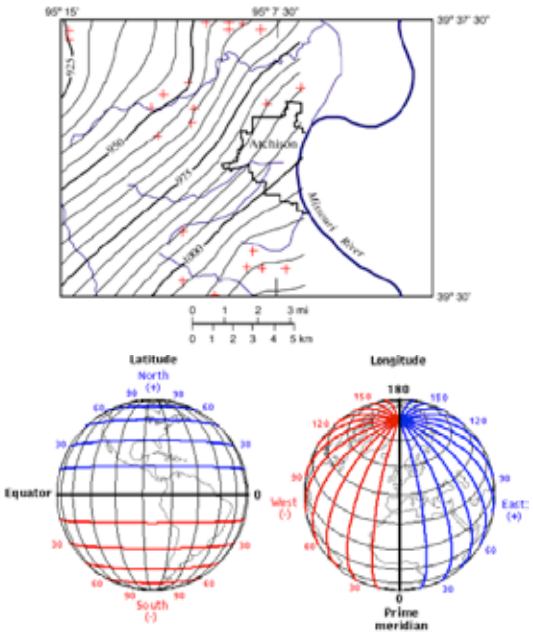
I have no problems declaring our first semester a success. So, I am now busy writing lesson plans for the next several semesters. Next stop…that familiar "basic electronics."

Wayne Greene, KG4ZQY, holds an Amateur Extra class license and provides electronic assistance in criminal investigations for the federal government.

Fox Hunting for Hands-on Fun while Learning

BY CINDY POWELL, KEØFGH

After the fox! The hunt is on for students from Rock Canyon High School. (Photo by Cindy Powell, KEØFGH)



Orienteering/map reading graphics from handouts in fox hunting unit.

Students at Rock Canyon High School in Douglas County, Colorado, recently discovered Amateur Radio Direction Finding (ARDF), sometimes called fox hunting. They prepared for this by learning how to read topographical maps and how to use compasses. They also learned about the 2 meter Yagi antenna, the attenuator, and how radio waves travel. They watched two videos in a flipped classroom (a model in which the typical lecture and homework elements of a course are reversed) that asked questions about ARDF.

On the day prior to the fox hunt, students went through an orienteering course that was set up outside with 50 different colored flags. Each of 10 student groups had a different orienteering course for which they had to read clues, such as number of paces and degrees, to find the next flag. Each flag also had questions for which they had to find a correct number. At the end of each course, students had a codex that allowed them to match up the numbers to letters. If done correctly, the words spelled out names of Colorado mountains.

The following class day, groups of six to seven students were each given a Yaesu FT-60R radio, a 2 meter Yagi (the students built these), and an attenuator. I hid five Byonics Fox transmitters (146.565 MHz) in different locations around the campus each hour so they could not tell fellow classmates their locations. I had maps printed out of the campus and they had to listen to the different signals coded in each transmitter to find the foxes. They had to show their triangulation drawings on their maps as part of the activity. The group that found all five transmitters first received bonus points, which was a strong motivator.

All five of my freshmen earth science students and two other classes taught by another teacher participated. This allowed approximately 230 students to learn about this application of wireless technology. The students really enjoyed the hunt, and it was fun watching them run and look for the foxes. I am grateful to the ARRL Education & Technology Program for providing the grant for the equipment that made it possible to teach this in the classroom!

Editor's Note: Powell has shared the Orienteering lesson background that she used to prepare students for the activity. You'll find it on the ARRL website ***here****.*

Cindy Powell, KEØFGH, teaches physics and environmental/earth science in Douglas County School District.

An ARISS Milestone: 1,000 Successful Contacts!

At 1:07 pm on March 10, 2016, five hundred K-12 students, teachers, University of North Dakota (UND) students, and community members sat quietly in the Memorial Union's ballroom at UND and stared straight ahead, listening attentively. The ham radio, which had been broadcasting silence, suddenly burst with static. The voice of astronaut Tim Kopra, KE5UDN, Commander of the International Space Station (ISS), confirmed he could hear the radio operator "loud and clear." The excitement in the room was palpable — they had established the complex link from North Dakota all the way to an orbiting research center flying 200 miles above us, traveling at nearly 18,000 miles per hour. It was NASA's historic 1,000th Amateur Radio on the International Space Station (ARISS) call — and the first ISS radio call to North Dakota. (*Courtesy of Caitlin Nolby, Deputy Director ND Space Grant & ND NASA EPSCoR*)

Commemorative certificate given to students who participated in ARISS' 1000th contact on March 10 at the University of North Dakota.

The connection was made possible through the collaboration of the North Dakota Space Grant Consortium (NDSGC), the Student Amateur Radio Association (SARA), and ARISS. Media coverage was extensive and readers can share in the experience by checking out a local news story here and NASA's published news piece here. More video links can be found on the ARISS webpage at www.ariss.org/news.html.

NASA Tells the ARISS Story

In celebration of ARISS' milestone, NASA's public affairs office also has produced the following videos telling the ARISS story:

- www.youtube.com/watch?v=bTOiiBd2dCo to hear astronaut Suni Williams, KD5PLB, discussing what the program means to her personally
- https://youtu.be/Z-yHD9IVbH8 to hear astronaut Tim Peake, KG5VBI, explain how the amateur radio contacts are conducted from space
- www.youtube.com/watch?v=DwtLkTpgNMM for a piece featuring comments from several participating astronauts on the impact of ARISS

University of Alabama Club Makes ARISS Magic for Middle Schoolers

Public middle school and home-schooled children from the northern Alabama area recently thrilled to an ARISS contact thanks to the efforts of the Space Hardware Club at the University of Alabama in Huntsville. This engineering club, composed of UAH students who enjoy activities like building balloon payloads, satellites, and rockets outside their regular classes, worked on the contact for over a year and hosted the long-anticipated event at UAH. The lucky students spoke with astronaut Tim Kopra, KE5UDN.

NASA's Marshall Space Flight Center has produced a video about the contact. It features students and staff discussing the significance of having the opportunity to personally speak with an astronaut on the ISS. You'll find it at www.youtube.com/watch?v=ziSQY8E1b9w.

A middle schooler asks astronaut Tim Kopra, KE5UDN, a question.

Update on Recent ARISS Activities

It's been a banner year already for Amateur Radio on the International Space Station (ARISS) program, which celetrated its 1000th contact in March (see page 3). Other highlights include include the contacts listed below. You'll find more event details and some links to audio/video files at **www.ariss.org/news.html**.

STEM Trajectory Initiative with Albuquerque Public Schools, Albuquerque, New Mexico, made a successful direct contact on April 22 via NM5HD. Astronaut Jeff Williams, KD5TVQ, answered only six student questions as the signal was picked up late in the ISS pass.

The **Boys & Girls Club of Washington, DC**, made a successful contact on April 16 during the USA Science and Engineering Festival, Washington, DC. Astronaut Timothy Peake, KG5BVI, answered 15 student questions.

A telebridge contact via IK1SLD with students at the **National Soaring Museum, Elmira, New York**, was successful on April 1. Astronaut Timothy Peake, KG5BVI, answered 20 questions.

A direct contact via N8DEU with students at **Walter Jackson Elementary, Decatur, Alabama**, was successful on March 18. Astronaut Tim Peake, KG5BVI, answered 20 questions.

Students at **Booker T. Washington Senior High, Miami, Florida**, made a direct contact via W4SVI on March 14. Astronaut Timothy Peake, KG5BVI, answered 16 student questions.

A telebridge contact via W6SRJ, hosted by **North Dakota Space Grant Consortium (NDSGC), Grand Forks, North Dakota**, was successful on March 10. About 500 people were in attendance as astronaut Tim Kopra, KE5UDN, answered 19 questions for students from North Dakota and Minnesota. It was the 1000th scheduled contact for the ARISS program.

Students ask astronaut Tim Kopra, KE5UDN, questions during ARISS' 1000th contact on March 10 at the University of North Dakota.

A telebridge contact via K6DUE with visitors at the **Atlanta Science Festival, Atlanta, Georgia**, was successful on March 8. Astronaut Tim Kopra, KE5UDN, answered 20 questions.

A telebridge contact via VK5ZAI with students at **PS97 Harvey Austin School, Buffalo, New York**, sponsored by the National Urban Alliance for Effective Education (NUA), Syosset, New York, was successful on March 1. Astronaut Tim Kopra, KE5UDN, answered 17 student questions.

A direct contact via K4UAH with students at **University of Alabama, Huntsville Space Hardware Club, Huntsville, Alabama**, was successful on February 19. Students interviewed astronaut Tim Kopra, KE5UDN, who answered 18 questions for students.

A telebridge contact via VK4KHZ with students at **Christ the King School, Rutland, Vermont**, was successful on February 4. Astronaut Tim Kopra, KE5UDN, answered 19 questions for students.

For information about upcoming ARISS contacts, visit ***www.ariss.org/upcoming-contacts.html.***

An ARISS Opportunity

The next window for ARISS proposals will open in September for contacts to be scheduled July – December, 2017. For information on applying, visit **www.arrl.org/amateur-radio-on-the-international-space-station**, or contact Debra Johnson, K1DMJ, ARRL ARISS Program Manager, at **djohnson@arrl.org**.

Outreach

Girl Scouts Think Out Loud on Amateur Radio for Thinking Day on the Air

The World Association of Girl Scouts and Girl Guides designates February 22 as Thinking Day. And for the second year in a row, Girl Scouts in Raymond, New Hampshire, marked the occasion by transmitting their thoughts over Amateur Radio during Thinking Day on the Air 2016. With the support of the Nashoba Valley Amateur Radio Club, the youngsters enjoyed a terrific learning experience. Girl Scout leader Jill Galus, KB1SWV, offers the following observations:

> This year [the event] was moved to a larger venue with multiple rooms to improve traffic flow and QRM. Operators from last year felt that 85 girls in one room was one of the factors contributing to the limited contacts. This year the event had three rooms, a large assembly hall for communication experiments, a classroom for code practice — both phonetic alphabet and Morse code — and a code craft, and another classroom across the hall to learn about time zones and to get on the air! Most of the activities were taken from the ARRL Radio and Wireless Technology Patch. This year's event was even more successful than last year's!

Working as a team, Jill and her father, Skip Youngberg, K1NKR, are taking the promotion of Thinking Day on the Air on the road to local clubs and Girl Scout troops. They have prepared a presentation explaining the activity, its opportunities, and the new Girl Scout Radio & Wireless Technology Patch program (see sidebar) that is being shared for use by other clubs interested in reaching out to local Girls Scouts. Check it out **here**.

Anita Kemmerer, AB1QB, made contacts and helped the girls speak to amateur stations during Thinking Day on the Air. (Photo by Ralph Swick, KD1SM)

Girls Scouts Can Now Earn Radio & Wireless Technology Patch

ARRL is offering a new Radio & Wireless Technology Patch program for Girls Scouts. Scout leaders and Amateur Radio volunteers associated with the Greater Atlanta Girl Scout Council and Girl Scouts of the Green and White Mountains developed the program to incorporate information and exploratory activities that provide a backdrop for understanding radio communication. The program offers opportunities to learn about wireless technologies, including Amateur Radio. Girl Scouts will be encouraged to take on activities that engage, educate, and empower them and kindle an interest in Science, Technology, Engineering, and Math (STEM) subjects and careers. The program defines requirements for Girl Scouts to earn the patch at the Brownie, Junior, Cadette, Senior, and Ambassador levels.

More information, as well as an online form to report on patch activities, can be found on the ARRL website at **www.arrl.org/girl-scouts-radio-patch**.

Instructor Corner — News, Ideas, Support

Resources for Classroom Instruction

Instructors looking for new ideas to freshen up their lessons and help students prep for exams as well as operating should check out the following Internet resources:

- Beverly Matheson, WA6BK, teacher at Dorothy Grant Elementary School in Fontana, California, and David Collingham, K3LP, the school's radio club advisor, have developed workbooks and labs for teaching elementary students ham radio operating skills and radio basics. Check out "**Amateur Radio Information & Best Practices Student Workbook, ARS-SWB-1000**"; "**Electronics Theory & Communications Student Workbook, ETC-SWB-1001**"; and "**Electronics & Communications Lab, ECL-SWB-2001**."
- Knowledge and nostalgia meet in a 1940's 10-minute short called, "Sending Radio Messages, Principles of Radio – Part One." Point your web browser to the url found **here**.
- Video courses on radio technology, which run 3 – 5 minutes each and present topics simply and clearly, can be found **here**.

Members of the Dorothy Grant Elementary School radio club, K6DGE, on the air from Fontana, California. (Photo by Beverly Matheson, WA6BK)

Teaching Electronics to Middle Schoolers (and Beyond)

Retired electronics engineer, volunteer science teacher, and occasional *QST* author Charles Kitchin, N1TEV, has made his 7th grade "Intro to Electricity" lesson available on YouTube. Recorded at Wilmington Middle School, Wilmington, Massachusetts, it runs about 30 minutes and covers voltage, current, resistance, plus series and parallel electric circuits.

According to Kitchin, this unedited video provides an excellent hands-on classroom lesson and all necessary materials are available at Radio Shack. You can find "Intro to Electricity" at **www.youtube.com/watch?v=maLt5zVaV6E**.

Higher level students and their teachers may also be interested in his advanced offerings in "Updating Classic Regen and Super Regen Presentation." They can be found at:

Part 1: **www.youtube.com/watch?v=gcr7hSjTqd8**
Part 2: **www.youtube.com/watch?v=3ZHsmVGWIdg**

Cool Tool for Outreach

New Video Release from the Radio Society of Great Britain

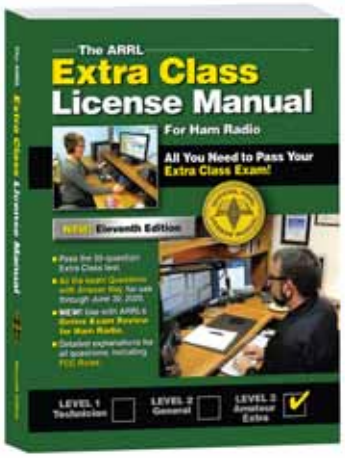
The Radio Society of Great Britain (RSGB) has produced a new and engaging video called, "Amateur Radio — A Hobby for the 21st Century." This lively introduction to ham radio activities also presents opportunities to fire up new recruits! You'll find it posted to the web **here**.

New ARRL Amateur Extra Study Manual

The new *The ARRL Extra Class License Manual* (11th edition) reflects the changes to the new exam. The biggest area of change is digital mode signals. Digital technology is evolving rapidly, and hams must have the proper tools to evolve with it. The *Extra Class License Manual* presents the fundamental "know-how," so the answers make sense and will be remembered after the exam has been passed. Other updated areas include propagation, software-defined radio, electronic circuits and components, and antennas.

There have been a few minor errata noted in the book, which ARRL will be revising with supplements and errata on a regular basis. This can be found at **www.arrl.org/eclm** as a downloadable PDF and includes any errors found in the Q&A as well. While the League tries its best to get everything right the first time, a few slip-ups are inevitable, and we are thankful for sharp-eyed readers who report any problems. Those are incorporated into the errata right away and fixed in any subsequent printing.

The new 11th edition will also be available in spiral bound and Kindle versions. Order print editions from the ARRL store **here**.



New *The ARRL Extra Class License Manual* (11th edition).

Recent Licensing Statistics

NEW FCC LICENSES ISSUED 2011 THROUGH APRIL 2016						
Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Jan	1,200	1,502	1,866	1,999	2,148	1,792
Feb	1,803	2,752	2,496	3,205	2,463	3,328
Mar	2,806	3,278	3,370	3,739	3,764	4,080*
Apr	2,677	2,884	2,762	3,863	3,183	3,041
subtotal	***8,486***	***10,416***	***10,494***	***12,806***	***11,558***	***12,241***
May	2,147	2,618	3,083	3,595	2,594	0
Jun	2,378	2,166	2,097	3,352	2,752	0
Jul	1,556	1,901	2,122	2,309	2,061	0
Aug	1,698	2,021	2,027	1,901	2,384	0
Sep	1,787	1,339	1,891	1,904	1,862	0
Oct	1,967	2,086	2,347	2,449	3,270	0
Nov	2,363	2,589	2,825	2,790	2,994	0
Dec	1,690	1,946	2,000	2,135	2,602	0
Totals	**24,072**	**27,082**	**28,886**	**33,241**	**32,077**	**12,241**

*March 2016 is a record month for new licenses.

This report of new FCC licenses issued is supplied by Maria Somma, AB1FM, ARRL VEC Manager.

Somma notes that the growth of new licensees is continuing through the beginning of 2016. During the first four months, the FCC issued 12,241 new licenses, a 6% gain in new Amateurs over the same period last year.

If this trend continues, we should see 32,000 new Amateurs by the end of this year!

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ARISS Program:
www.arrl.org/amateur-radio-on-the-international-space-station

Access Radio Waves

Find this and other issues of *Radio Waves* in interactive online format at www.arrl.org/radio-waves

Announcements, Upcoming Events, Opportunities, and Deadlines

ARISS Proposal Window, September 2016 — The ARISS Program's proposal window for accepting submissions from educational organizations seeking to host scheduled contacts with the ISS between July – December 2017 will open in September. Details and opportunities to participate in Information Sessions will be posted at www.arrl.org/hosting-an-ariss-contact.

School Club Roundup (SCR), October 17 – 21, 2016 — This biannual event fosters contacts with and among school radio clubs. For more information, visit www.arrl.org/school-club-roundup.

Jamboree on the Air (JOTA), October 15 – 16, 2016 — Jamboree-on-the-Air is an annual Boy Scouts of America (BSA) event that uses Amateur Radio to link Scouts around the world, around the nation, and within communities. Contact your local Scout council, a local ham, or a local Amateur Radio club to see what may be planned in your area. Register your station on the BSA website here.

Education & Technology Program Grant Deadline

Education & Technology Program (ETP) Grant Application Deadline, November 1, 2016 — This ARRL education support program offers two types of grants: ETP School Station Grants and ETP Progress Grants. Find out more about the grants and the application process at www.arrl.org/etp-grants.

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