



Radio Waves

News you can use for license instruction and radio science education

Winter 2014

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High School Students Put Packet Radio to Work for Local Environmental Study



Lake Roosevelt High School teacher Ralph Rise, KG7DDE, instructs students Isaiah Baty (left) and Jordan Charles, KG7GVA (right), on building eggbeater antennas. Isaiah is scheduled to take the ham license test in February.

At Lake Roosevelt High School in Coulee Dam, WA, students learning Next Generation Science Standards (NGSS) will soon be exploring climate science using collected, real-time weather data transmitted by packet radio. Their newly acquired Technician class licenses have provided them the ticket to do it.

Lake Roosevelt teacher Ralph Rise, KG7DDE, says the school will use grant funding to build 2.4 GHz WiFi transmitters that can send data from environmental monitoring sensors to a local WiFi receiver connected to a ham radio with a Terminal Node Controller (TNC).

The local station will automatically send information as ham radio packet data

through student-made repeaters back to a school-based ham radio with TNC. The data will be transferred to a computer and converted into a format Excel can graph. It will then be made available to NGSS students via the Internet.

“Our interest in gathering real-time environmental data comes from a partnership with the Bureau of Indian Affairs foresters working with the Colville Confederated Tribe of Indians,” says KG7DDE. “We want to monitor weather data to establish climate data and see if climate influences the spread of the Spruce Bud Worm through the Tribal forest.”

School Tool Tip

David Anderson, K1AN, has produced a video for World Genesis Foundation that explains the educational relevance of amateur radio. Check it out on the home page of the project website at www.RadioQRV.com or at <http://youtube/ivUMIADFSDw>.

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Please let us know what approaches have been useful to you in teaching Amateur Radio — or what you'd like to read more about to help in your classroom. Send your suggestions or requests to Debra Johnson, K1DMJ, ARRL Education Services Manager, at djohnson@arrl.org.

Licensing Classes and Learning Activities

Club Boasts Fourfold Increase in New Licensees/Upgrades

The Federal Way Amateur Radio Club (FWARC) Training Team has some very exciting news to share: After a revamp of its approach to marketing and conducting its licensing classes, the number of people the Washington State club helped get their first license or an upgrade was four times higher in 2013 than in past years.

Daniel Stevens, KL7WM, FWARC President and Training Coordinator, believes the changes that had the biggest impact were promoting the classes as free — but requiring nominal materials and test fees — and advertising them two to three months in advance.

Regularly scheduled classes were offered in several locations, usually over 2 Saturdays every 3 months. Students who missed one Saturday were able to make it

up months later, giving them both flexibility and time for lesson absorption. Additional classes were held at the request of some outside parties.

The quality of the classes was improved, says Daniel, KL7WM, through better training material and a team-of-teachers approach. Not only did each teacher bring examples and illustrations from their own experiences, but they also had access to substantial resources, including a specially developed, 27-page illustrated handout and PowerPoint training slide decks provided by MicroHAMS (www.microhams.com). A social net demonstrated for 20 to 30 minutes each class helped enliven the material. The 95% pass rate students achieved is a ringing endorsement of FWARC's new approach to its amateur radio classes.



Dustin, KF7FK and Mike, KJ7WC offer a hands-on demonstration at a FWARC training class.

Success by the Numbers

FWARC's "tweaks" in marketing and materials proved magic. Here are the particulars:

FWARC held 17 VE tests at nine locations in five cities. A total of 224 people were tested and 204 passed at least one test for a license. They held 11 classes — seven Technician, three General, and one Extra.

Breaking it down further:

- 169 new hams were licensed (128 Technician, 38 General who passed elements 2 and 3, and 3 Extras who passed all three elements).
- 15 upgraded to General; 20 upgraded to Extra.
- The VE Team signed 204 CSCEs for 128 Technicians, 53 Generals and 23 Extras.

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Update on Recent ARISS Activities

The Amateur Radio on the International Space Station (ARISS) program continues to provide exciting opportunities for students in the US and around the world to conduct scheduled interviews with astronauts via Amateur Radio.

In one particularly inspiring effort, sixteen-year-old Rebecca “Becca” Rubsamen, KJ6TWM, returned to her old school, Rancho Romero Elementary in Alamo, CA, to serve as head engineer for an ARISS contact with astronaut Mike Hopkins, KF5LJG. The November 13, 2013, event gave more than 100 students who gathered in the school’s playground a chance to learn about the science of space and of radio, and to experience an 8-minute-long QSO with Hopkins.

Rebecca, KJ6TWM, a sophomore at Bentley School in Lafayette, CA, built the VHF radio and the two antennas used in the contact in her backyard, helped by her father, Reid Rubsamen, N6APC. But, according to N6APC, his daughter was definitely the driving force behind the contact, approaching the Rancho Romero Elementary School with the idea. “She drafted the application, helped develop the curriculum, and convinced astronaut James

Van Hoften to come to Science Night to help promote the contact,” he said. A video of the event can be found at www.rebeccarubsamen.com/photos.html.

Another successful contact occurred on October 30, between astronaut Hopkins and the Kopernik Observatory and Science Center in Vestal, NY. This non-profit learning institution promotes interdisciplinary education in the fields of Science, Technology, Engineering and Mathematics (STEM).

A telebridge contact with the Cradle of Aviation Museum, Garden City, NY, was conducted via IK1SLD on November 4. Astronaut Luca Parmitano, KF5KDP, answered questions during the exchange. He also spoke with students at Warren County Technical School, Washington, NJ, that same day.

Sixth-graders at Berkeley Middle School, Williamsburg, VA, packed their gymnasium to pose their questions to astronaut Hopkins on January 8.

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



Rebecca Rubsamen, KJ6TWM (far left), leads an ARISS contact at Rancho Romero Elementary School as students line up to ask questions of astronaut Mike Hopkins, KF5LJG.

“[Rebecca] drafted the application, helped develop the curriculum, and convinced astronaut James Van Hoften to come to Science Night to help promote the contact.”
— Reid Rubsamen, K6APC

An ARISS Opportunity

Contact Debra Johnson, K1DMJ, ARRL ARISS Program Manager, at djohnson@arrl.org, if your school, local museum or other educational organization is interested in participating in a scheduled ARISS contact during the Fall 2014 – Spring 2015 time period. An educational plan describing the learning activities that will be provided for students leading up to and following the contact is necessary. To learn more about the ARISS program visit www.arrl.org/amateur-radio-on-the-international-space-station.

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Instructor Corner — News, Ideas, Support

Instructor Qualifications.

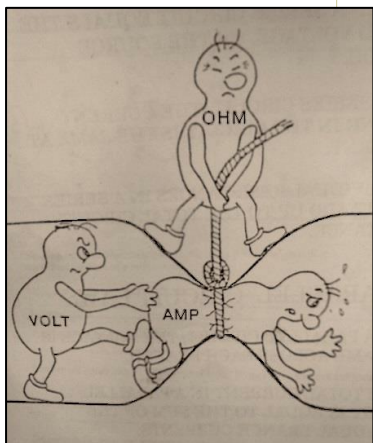
We're often asked by hams who are being recruited as instructors for local license preparation classes if the ARRL offers recommendations for what's required to serve in that role. Recently a committee of the ARRL Board has taken up that discussion. The resulting list of suggested qualifications is intended to serve as a guideline for those thinking about taking up the challenge and for clubs considering which members are best suited to serve in that capacity. These qualifications are listed on the ARRL website at: www.arrl.org/license-instructor-qualifications.

Instructor Survey. If you participated in our recent online survey of ARRL

registered instructors — thank you! We had a strong response: 528 to be exact. This survey helps us get a better handle on the format of classes that are being offered and the resources that instructors are using. Although the survey is now closed, if you still have suggestions for further improvement of our *Ham Radio License Manual* or for our *Instructor's Manual*, please send them to me at djohnson@arrl.org. We really appreciate getting all your comments and suggestions about the resources you would like to have.

Revision of ARRL Technician License Publications. You are probably aware that the new question pool for the

Technician license exam has been released by the National Conference of Volunteer Examiner Coordinators (see page 7 of this newsletter for more). Accordingly, the ARRL publications team is working on developing a new edition of our student study manual, *The Ham Radio License Manual*, to be released in April. We will also be revising our ARRL *Instructor's Manual for Technician License Courses*, which is designed to coordinate with the presentation of topics in *The Ham Radio License Manual*. We plan to have the revised instructor materials available in June.



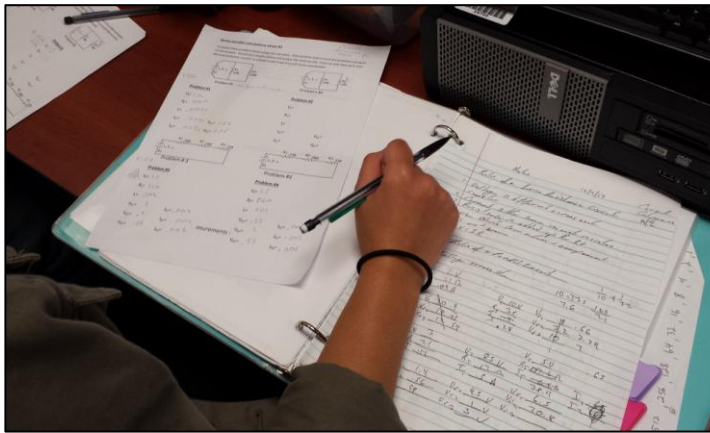
Visuals help students “go with the flow” in an electronics unit. (Cartoon thanks to Dick Harman, WA4USB)

Share Your Own Teaching Tips On Gain, Decibels and Logarithms

Most students preparing for their first amateur radio license or for an upgrade to a General license find gain, decibels and logs to be challenging topics. Many instructors use “rules of thumb” to help students remember the correct responses to exam questions, but that method may not result in comprehension. Everyone — students and instructors alike — would benefit if we could teach this topic more effectively. If you have resources that you find helpful, or a strategy that you find successful, please send them to us! We'll develop a reference library to share on our instructor resource page (www.arrl.org/shop/Instructor-Resources/). Send your strategies to Debra Johnson, K1DMJ, ARRL Education Services Manager at djohnson@arrl.org.

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In The Classroom...



A new twist on an old formula helps students grasp electronics concepts.

Teaching Ohm's Law

By Bill Richardson, N5VEI

In the STEM course that I teach to eighth-graders in Olde Towne Middle School in Ridgeland, MS, the students now get really excited by electronics.

My class learned the familiar triangle or circle depicting E (or V) over IR. While the math was basic, visualizing it as a unified formula was a challenge for some. One technique that helped them understand voltage, current, and resistance was using comparisons to lakes, streams, water towers, and dams.

Once students had mastered Ohm's Law we moved on to series and parallel circuits. The concept of parallel circuits was harder for them to grasp, but using visuals of pipes splitting into parallel structures helped many of them. One common difficulty they had was being able to quickly find common denominators.

The main problem I saw with the students learning the formula was because of the way it is usually written:

$$R_{total} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots}$$

While most of us learned it this way, I once saw a video of an engineer whose approach really made sense. He explained parallel resistance to a group of students using this formula:

$$R_{Total} = (1/R_1 + 1/R_2 + 1/R_3 + 1/R_N)^{-1}$$

While the two formulas are virtually the same, the second presented the concepts in a way my students understood, and they could now work diligently on mastering the skills on paper for the upcoming lab: building a series and parallel breadboard.

The happy outcome of the lesson was that the vast majority of students passed the test on the unit. I was also pleased to find that many of the girls were interested in electronics and in building the projects we were learning.

Next, my students will work on parallel and series circuits, drawing a conclusion or hypothesis about each. They will then build the circuits, take all critical measurements, and prove or disprove their hypotheses. After that, we'll go into series and parallel LEDs.

Bill Richardson, N5VEI, has taught middle and high school for 14 years and holds an Amateur Extra class license.

"The happy outcome of the lesson was that the vast majority of students passed the test on the unit."
— Bill Richardson, N5VEI

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School Club Roundup

The club station at Mill Springs Academy (MSA) in Alpharetta, GA, an ARRL Education & Technology Program (ETP) grant-recipient, hums with activity through the School Club Roundup (SCR). MSA science teacher and radio club trustee Martha Muir, W4MSA, a grad of the ARRL Teachers Institute TI-1 and TI-2 sessions, recently shared some of the school's SCR experiences, saying,

"We're trying to get as many students on the air as we can. We've scheduled a different level of our school to come by on different days this week and work with a volunteer from NFARL [North Fulton Amateur Radio League] to get on the air. Yesterday, Jim Stafford, W4QO, graciously/patiently/masterfully helped a crew of 4th graders have a conversation with another marvelously patient guy in Arkansas (AC5UG). Word from 'up the hill' is that they went back to their classes all excited about what they had just done."



Teachers do analog-to-digital conversion of temperature readings from a thermistor at the TI-2 Remote Sensing, hosted by Dayton Amateur Radio Association in Dayton, OH, July 2013. (Photo courtesy of Joe Brassard, KA8C)



Students at Mill Springs Academy participate in their first School Club Roundup in October 2013.

For more news on SCR happenings, see the January QST article, "[Working the School Club Roundup on VHF](#)." The next opportunity to participate in the contest is coming up February 10–14. Make sure to visit the ARRL SCR web page at www.arrrl.org/school-club-roundup for rules, results, and ideas to get started.

Education & Technology Program News

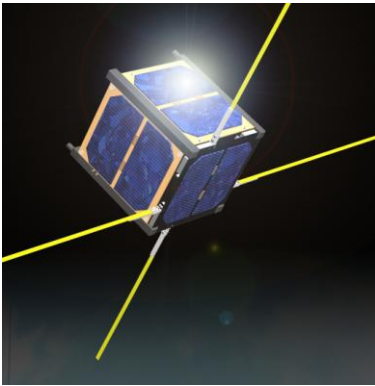
Teachers Institute Schedule for 2014. The ARRL will again offer three sessions of the Teachers Institute (TI). There will be two sessions of the *Introduction to Wireless Technology* (TI-1) and one session of the advanced Teachers Institute (TI-2) on the topic of *Remote Sensing and Data Gathering*, as outlined below:

2014 Teachers Institute Schedule	
Dates	Location
TI-1 Introduction to Wireless Technology	
June 23–26	Dayton Amateur Radio Association, Dayton, OH
July 22–25	ARRL Headquarters, Newington, CT
TI-2 Remote Sensing and Data Gathering	
July 8–11	ARRL Headquarters, Newington, CT

For more information and an application for this four-day, expenses-paid professional development opportunity, visit www.arrrl.org/teachers-institute-on-wireless-technology.

Contact ARRL Education Services at etp@arrrl.org if you would like printed copies of our TI brochure to distribute to interested teachers.

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With the launch of AMSAT-UK's FUNcube satellite this past November, students and hams around the world have the opportunity to learn from a materials science experiment launched on the satellite.

FUNcube Guide for Educators

AMSAT-UK said its FUNcube project was designed "to create an educational CubeSat which is intended to enthuse, excite and educate students about radio, space, physics and electronics. It will also support educational science, technology, engineering, and mathematics (STEM) initiatives."

A new FUNcube guide developed by ETP Director Mark Spencer,

WA8SME, aims to maximize the educational focus of the satellite. Spencer's *Pragmatic Guide for Using the FUNcube (AO-73) Materials Science Experiment in the Classroom* prompts readers to dig beyond FUNcube's transponder and telemetry uploads and downloads and "take a closer look at what is really going on" as the satellite orbits Earth.

Spencer's *Guide* is shared on the ARRL's ETP classroom resource page at www.arrl.org/classroom-library-satellite-communications.

For more on the educational opportunities presented by the satellite, read the ARRL's [news story](#) and visit the FUNcube website at <http://funcube.org.uk/>.

Other New ETP Resources to Connect Classrooms to Space Research. The ARRL ETP page mentioned in the FUNcube story above also offers links to many other instructional resources recently developed by Spencer to help teachers take advantage of experiments that will be launched later this year or early next year on AMSAT's Fox satellite. This includes experiments to study satellite "wobble" employing a gyroscope and on Maximum Power Point Tracking (MPPT) that demonstrates how the power generated by the satellite's solar panels is managed for maximum efficiency.

Recent Grant Awards. The ARRL received six applications for station equipment and other

instructional resources under its ETP this past November. Four applications were approved, awarding grants to the following schools:

- Edward S. McBride High School in Long Beach, CA
- North Mac Middle School in Girard, IL
- Forest Knolls Elementary School in Silver Spring, MD
- Olde Town Middle School in Ridgeland, MS

Teachers affiliated with each of these schools have participated in professional development training through ARRL's Teachers Institute. For details about the grant awards, read the [news story](#) on the ARRL's website.

The next deadline for grant applications is November 1, 2014. For more information and to download an application, visit www.arrl.org/etp-grants.

As with all resources developed for schools through donations to the ETP Fund (www.arrl.org/education-and-technology-fund), hams and instructors in the Amateur Radio community are invited to employ these materials in their work with Scouts and in other educational venues, or for their own self-enlightenment. We are able to offer anything we hold in inventory to clubs and individuals at cost plus a small increment donation to support the ETP. Please ask if you are interested in acquiring any of the resources described.

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Input for General Class License Exam Invited

The Question Pool Committee (QPC) of the National Conference of Volunteer Examiner Coordinators (NCVEC) has concluded its review of the Technician question pool, and it is now starting the process of reviewing the General class question pool in preparation for a new release for exams, effective July, 2015.

Now is the time to be heard if you have specific suggestions about topics to add or remove, or changes or updates to specific questions! Send your input to qpcinput@ncvec.org.

You may also send suggestions directly to the members of the QPC listed on the NCVEC website at: www.ncvec.org/.

Be assured that when a comment is made to them, they will discuss the issue, and you are promised a reply by the committee chairman.



2013 Licensing Statistics

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

Somma notes that new licensees increased by 7% over 2012 (28,886 in 2013 versus 27,082 in 2012). Licensed US Amateur totals as of December 31, 2013 were at a new high of 717,201, a 1% increase over the 2012 year end total of 709,575.



The ranks of licensed hams continue to grow, thanks in part to classes held by organizations like the Federal Way Amateur Radio Club. (Photo thanks to Daniel Stevens, KL7WM)

NEW AND UPGRADED FCC LICENSES ISSUED BY YEAR

FCC License Activity	2011	2012	2013
Technician	21,316	23,974	25,621
General	9,667	10,132	9,567
Extra	3,426	3,259	3,023
Total Issued	34,409	37,365	38,211

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Resources for License Instructors:

www.arrl.org/resources-for-license-instruction

Resources for Teachers:

www.arrl.org/amateur-radio-in-the-classroom

Education & Technology Program:

www.arrl.org/education-technology-program

Teachers Institute on Wireless Technology:

www.arrl.org/teachers-institute-on-wireless-technology

ARISS Program:

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

2014 Upcoming Events, Opportunities and Deadlines

The School Club Roundup for the Winter/Spring Term will occur from **February 10–14**. The primary means of submitting a score and log are now via the Web. Visit www.arrl.org/school-club-roundup for more information.

The Foundation for Amateur Radio (FAR) is inviting applications for the Amateur Radio-related scholarships it administers. Applications are due by **April 30**. For more information, visit www.arrl.org/news/foundation-for-amateur-radio-far-invites-scholarship-applications.

Applications for ARRL's Teachers Institute on Wireless Technology are due May 1. Visit www.arrl.org/teachers-institute-on-wireless-technology for more information.

Herb Brier Award Nomination Deadline

The Herb Brier Award, named after long-time CQ Novice Editor Herb Brier, W9AD, is given to a recipient who exhibits the spirit of effective, caring Amateur Radio instruction. It is co-sponsored by ARRL and the Lake County Amateur Radio Club and bestowed by the ARRL to recognize the very best in volunteer Amateur Radio instructors. This is a wonderful way to recognize the efforts of an effective instructor or instructor team. The nomination **deadline is March 15, 2014**. You can review the requirements at www.arrl.org/herb-s-brier-award and use the nomination form provided on the ARRL website. Do note the documentation requirements that must accompany a nomination, which may take some preparation time.

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