Radio Waves

News you can use for license instruction and radio science education

ARRL — The national association for AMATEUR RADIO

Spring 2015

INSIDE THIS ISSUE:

Don't Miss...

Amateur Radio attracts many people with disabilities, so instructors need to stay current on how to best help students with special needs. *Radio Waves* readers will want to check out the article on the topic in July's *QST*, written by Patrick Tice, WAØTDA, Coordinator, Courage Kenny Handiham Program. It describes technology tools and tips that make the path toward licensing and upgrade easier.

Scaling Heights to Teach Remote Sensing

BY THOMAS ASK, AC9L

Motivated by the ARRL Teachers Institute TI-2 workshop "Remote Sensing and Data Gathering," I dusted off my old Drake TR 22 radio and set off for the cliffs in the nearby McIntyre Wild Area with a goal in mind: data collection.

I'm a professor in the Industrial and Human Factors Design department at the Pennsylvania College of Technology, an affiliate of Penn State University, and I wanted to put what I'd learned to good use for our SIMS (Society of Inventors and Mad Scientists) club, for which I am the faculty advisor. The workshop introduced, among other hands-on projects, a buoy system for deploying sensors for environmental studies. By making some gentle tweaks to the original design, I adapted it so I could investigate microclimates of the cliffs.

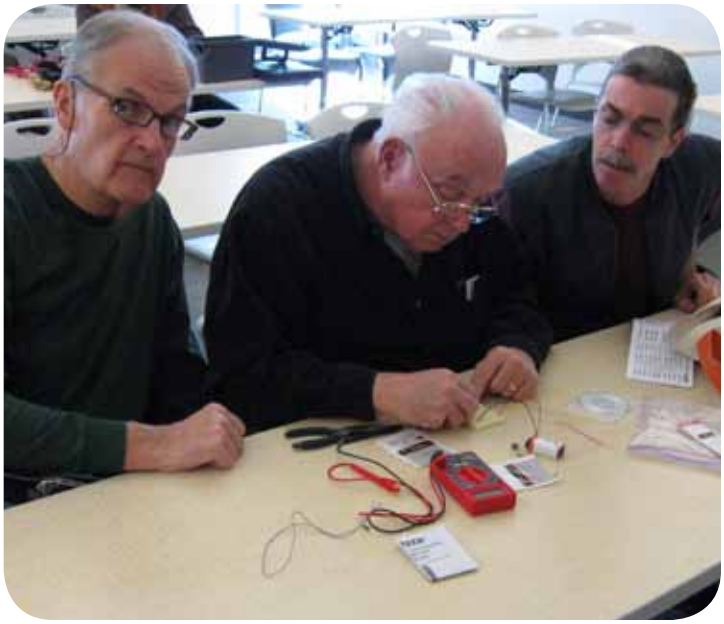
I routed a ¼ vertical antenna to the top of the cliff and wedged the radio, microcontroller, and battery into a sheltered rock shelf. From this equipment, I ran cables into a couple of interesting cracks and measured rock face and air temperature. I used a pen cap as a radiant shield for the air temperature and foam-taped the thermistor to the cleaned rock surface. I could now explore the changing temperatures deep in cracks where all sorts of creepy things live.

Elayna Ask (author's daughter) testing cliff radio. (Photo by Thomas Ask, AC9L)

The system worked great and I enjoyed watching data stream in from the comfort of my office chair. The APRS-routed sensor data showed how different rocks, with their differing thermal conductivities and shapes, affect interior temperatures.

This, however, is just one possible application of Amateur Radio remote-sensing technology for my engineering and sustainability coursework for second year students in the program. My students will also be using rockets and aviation photography to learn learn about basic control systems, data processing, and sensor technology.

Thomas Ask, AC9L, is a licensed Professional Engineer with a doctorate in industrial design. He holds an Amateur Extra license.



Tom Morehouse, KD2BFR (from left to right) assisting Cyril Lynch, KD2HMH, and John Cayton, KD2HMJ, with breadboarding at Basic Electronics. (Photos by Bruce Baccaro, K2ULZ, OCARC club president)

Club's Instruction Initiative Leads to Growth

BY GORDON SHACKLETT, KB2SSZ

The Orange County (NY) Amateur Radio Club, OCARC, has offered Technician License classes since 2009. A team of 10 to 12 instructors, made up of club volunteers, supplies the free instruction, all in the spirit of Amateur Radio and passing on our hobby. The Orange County Emergency Communications Center in Goshen, New York, authorizes use of its classrooms for the courses. We use a question pool approach integrated with Amateur Radio concepts within the series of classes, which usually take place over five 3-hour Saturday morning sessions. The FCC license exam is administered immediately following the course. To date, we have had over 150 registrants, from a five-county area, register for our Technician License classes and take the VE exams. Many of them have joined and become active in OCARC.

Going Beyond

A companion follow-up program from OCARC consists of "Elmer Nights" and "Upgrade-to-General" instructional sessions, designed to assist Tech license holders.

One of our most experienced instructors, Saul Rozinsky, WA2KOT, also stepped forward with a series on Basic Electronics, offered to the current Tech class and to OCARC members as well. This series of three 3-hour sessions is an extension of the concepts covered in the question pool for the Technician license and was approved by the club board of directors.

In Saul's own words:

> We are going to be conducting a nine-hour course covering basic applied electronics. We plan to cover assembly, testing, and measurement of simple circuits. Emphasis will be on making measurements and learning about circuit operation from those measurements. Students will be using plug-in breadboards and simple digital VOMs [volt-ohm meters]. We have a stock of components and demonstration equipment that came from donations to the club.

OCARC intends to continue these offerings aimed at recruiting new hams, refining our methods, and involving our club's pool of talent to serve the Amateur Radio community.

Due to the positive response to our recent session of Basic Electronics, we scheduled a second round for this past March. In those sessions, Saul extended the instruction into tuned circuits and RF measurements.

The Results Speak

Our club has enjoyed a significant membership growth (approximately 30%), which we believe is due primarily to our instructional initiatives: 1) Tech License classes (six sessions since 2009); 2) "Upgrade-To-General" coaching sessions: 3) "Elmer Nights"; and 4) this series of Basic Electronics. Our next scheduled Tech class begins on September 26, 2015, with five Saturday morning classes.

For more information visit **www.ocarc-ny.org**.

Gordon Shacklett, KB2SSZ, was first licensed in 1955 as KN6JPT. Today he holds a General class ticket and is a proud member of Orange County Amateur Radio Club, where he serves as education director.

Update on Recent ARISS Activities

Astronaut Samantha Cristoforetti, IZØUDF, always takes her time when answering the questions of young people who speak to her aboard the ISS via Amateur Radio on the International Space Station (ARISS). The following are recent contacts between Samantha and hundreds of lucky learners.

A direct contact with students at **Riversink Elementary School, Crawfordville, Florida**, via K4WAK, was successful on February 26, 2015. Cristoforetti answered 13 questions for students.

A direct contact with students at **Council Rock High School South, Holland, Pennsylvania**, via K3DN, was successful on February 19, 2015, at 18:18:27 UTC. (See sidebar.)

A telebridge contact, via IK1SLD, with students at **W.T. Sampson** (a Department of Defense Education Activity school), **Guantanamo Bay, Cuba**, was successful on February 11, 2015, at 15:58:00 UTC. (The DoDEA is one of two federally operated school systems whose purpose is to coordinate education for active duty military and Department of Defense civilian families.)

A Dream Becomes Reality with ARISS

Science and technology students and their teachers from Council Rock High School South, Holland, Pennsylvania, realized a dream when they spoke directly with astronaut Samantha Cristoforetti, IZØUDF, on the International Space Station (ISS) as it flew over the Philadelphia area.

Council Rock South science teachers Jerry Fetter and Jeff Warmkessel, who have been involved in NASA's NEAT (Network of Educator Astronaut Teachers) program since 2004, got the idea of applying for a contact through the Amateur Radio on the International Space Station (ARISS) program when Fetter's astronomy classes were talking about living in space. "They kept asking questions which only astronauts would know how to answer," said Fetter. "I remember thinking how great it would be if we could just ask them directly. To be able to ask the astronauts while they fly overhead is beyond my wildest plans!"

ARISS, a donated ham radio system and antennas, and the expertise of the Warminster Amateur Radio Club made it all happen last February.

The hardest part? Figuring out what questions were important enough to ask an astronaut in the approximately 12 minutes the ISS flight path brought it in radio range!

Read more about the contact in a local news story **here**.

Students at Council Rock High School South lined up on stage to ask astronaut Samantha Cristoforetti, IZØUDF, their carefully chosen questions. (Photo by Andy Vavra, KD3RF)

Enrichment — MOOC on "Understanding Wireless: Technology, Economics, and Policy"

How do mobile smart phones and tablets convert digital information to and from electromagnetic signals in the radio frequency (RF) spectrum? How do radio designers and spectrum regulators avoid harmful interference within a network or among different wireless services? These are just a couple of the topics being addressed in a Massive Open Online Course (MOOC) offered by University of Notre Dame. One of the instructors is Barry Keating, WD4MSM. Find more information **here**.

Instructor Corner — News, Ideas, Support

Licensing Approach for Would-be Hams with Dyslexia/ADHD

Candidates with pronounced dyslexia/ADHD tend to repeatedly fail license exams even after weeks of study and attending a license exam class. The repeated exam failures lead to frustration, causing candidates to give up on getting their licenses. Fred Benson, NC4FB, has developed a variety of special resources to assist with instruction and self-study.

If you are working with a dyslexic/ADHD candidate and are looking for some advice, visit **www.nc4fb.org/wordpress/helping-dyslexic-adhd-license-candidates**.

Instruction Junction: Clarification on Use of *E* vs. *V*

There is a distinction between the phenomenon of *electromotive force*, or *EMF* (that which causes electrons to move), and the measurement of it (the *electropotential* between two points). Electropotential has been renamed "voltage" and is measured in units of volts (abbreviated *V*) in honor of Italian physicist Alessandro Volta, who invented the battery and made many contributions to the understanding of electricity.

In general — and this is not always followed, even in textbooks — in equations that describe fields and forces on electrons, the symbol *e* or *E* is used. In an equation based on the difference in voltage between two points, *v* or *V* is used. There is a difference, but it rarely matters in wired circuits where EMF and voltage are almost always the same thing, so you see *e* and *v* used pretty much interchangeably. If you are talking about free electrons moving around in a volume of space or some material, or perhaps motors and generators, then you should use *e*.

To make things even more interesting (i.e., confusing), capital *V* is the symbol for the units of measurement for both EMF and voltage: the volt. There are even finer-grained distinctions, mostly of interest to physicists, that I am ignoring.

The amateur-hobbyist literature is a mixed bag of usage that will never be sorted out, no matter how many technical editors are employed, so it's best just to tell students where the various letters come from and help them understand that as far as circuits are concerned, $E = I \times R$ is the same thing as $V = I \times R$.

There is a small sidebar in recent editions of the *ARRL Handbook* (section 2.1) that may offer useful language for students. It glosses over the convention so as not to get wrapped up into distractions, but that may change in upcoming editions. It reads as follows:

"Beginners in electronics are often confused about the interchange of *V* and *E* to refer to voltage in a circuit. When should each be used? Unfortunately, there is no convention. Nevertheless, in ham radio *E* is usually used when referring to an electric field or the electromotive force around a circuit. *E* is also commonly used to state Ohm's Law: $I = E/R$, *V* is used when describing the difference in voltage between two points in a circuit or the terminal voltage of a power supply or battery. *V* is always used when referring to units of volts."

—Submitted by Ward Silver, NØAX, extracted from a discussion among instructors on ham_instructor@yahoogroups.com

If you have any resources that you find helpful, or a strategy or tip that you find successful, please share them with us! Send your ideas to Debra Johnson, K1DMJ, ARRL Education Services Manager, at ***djohnson@arrl.org****.*

Outreach

Girl Scouts Get Food for Thought During Thinking Day on the Air

Stan Pozerski, KD1LE, coaches Mia H. in the fine art of sending Morse code. Mia was one of about 85 Girl Scouts introduced to geography, science, technology, and radio during Thinking Day on the Air. (Photo by Ralph R. Swick, KD1SM)

Thinking Day is a day of celebration for Girl Scouts and Girl Guides on February 22. Each year Girl Scouts and Girl Guides participate in educational and cultural activities that connect them to girls in other countries. Les Mitchell, G3BHK, who established Jamboree-on-the-Air (JOTA), also conceived Thinking-Day-on-the-Air (TDOTA). While many in the Amateur Service know of JOTA, few know of TDOTA.

After learning about TDOTA, Jill Galus, KB1SWV, thought it was an opportunity local Girl Scouts shouldn't miss. "If I hadn't been having conversations with Debra Johnson [K1DMJ, ARRL Education Services Manager] and the rest of a team of leaders working on a Radio and Wireless Technology patch for Girl Scouts, I would not have known that TDOTA existed," says Galus. With the help of the local Amateur Radio Club and other local sponsors, Galus was able to plan TDOTA as a free event for Girl Scouts in Southeastern New Hampshire.

More than 85 Girl Scouts attended. At the TDOTA event the girls learned about Morse code, the phonetic alphabet, and time zones; planned what to say; and made some contacts. A second-grade Brownie Scout got off the air and ran to her friends to say, "Guess what?! I just talked to some guy named Belgium!"

NFARL Hosts Radio Booth at STEM Event

Members of the North Fulton Amateur Radio League (NFARL) EduTeam in Fulton County, Georgia, offered students and other members of the public an opportunity to experience ham radio. The EduTeam hosted an Amateur Radio booth at the Sandy Springs Education Force's Super STEM (Science, Technology, Engineering, Math) Event on March 5, 2015, at North Springs Charter High School. The theme was Communications Technology.

Event participant Martha Muir, W4MSA, a teacher at Mill Springs Academy in Alpharetta, Georgia, said, "One of the special things about [the event] is that three of my ham students went with us and served in key positions in our booth. My students were teaching the students and other visitors to our booth."

Event details are shared in an ARRL website news story **here**.

Video with Vision

Teachers looking to inspire their students about technology and space should check out the short video produced by MTN Global. It's a useful outreach resource that captures the magic, excitement, and world-expanding possibility of radio. Point your browswer to **www.youtube.com/watch?v=hxU1ZhINaHk**.

Education & Technology Program News

Kenosha, Wisconsin, high school teacher Timothy Overrocker shares his mapping of high school Next Generation Science Standards to Amateur Radio content. Find his analysis at **www.arrl.org/curriculum-connections-and-benchmarks**.

Southport Elementary School Unpacks New ETP-Financed Station

The beaming smiles on the faces of 5th grade students Daron (above) and Tatum (right) of Southport Elementary School in Kenosha, Wisconsin, convey their excitement as they help unpack the radio equipment received through the school's recent grant from ARRL's Education & Technology Program.

Their teacher, Nathan McCray, K9CPO, says, "The equipment will be used to set up an Amateur Radio station for our school's ham radio club. We'll use the station to make VHF and HF contacts. Our first goal is to work all states."

Learn more about the ETP Grant Program at **www.arrl.org/etp-grants**.

(Photos by Nathan McCray, K9CPO)

Slow scan TV image downloaded from the International Space Station by K5LBJ members (see text).

LASA High School Club Builds Satellite Station

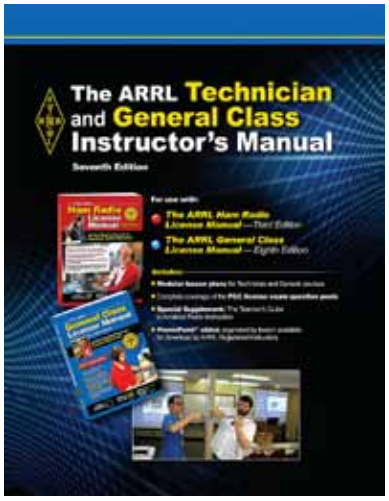
K5LBJ, the Amateur Radio club at Liberal Arts & Science Academy (LASA) High School in Austin, Texas, first went on the air over 10 years ago with equipment provided by the ARRL Education Technology Program.

Last year, K5LBJ members assisted in building a satellite tracking/communication station to expand into satellite modes, an effort initially undertaken to conduct the MAREA (Mars Lander Amateur Radio Robotics Exploration Activity) classroom simulation. Learn more about MAREA at **www.arrl.org/marea**.

K5LBJ plans to complete the MAREA project in Fall 2015, but in the meantime, it's been testing its newfound satellite capability. In September 2014, the club made its first voice contacts via satellite, using SO-50. In October 2014, K5LBJ digipeated its first successful packet via the International Space Station (acknowledged by XE1MEX). Recently, students have been downloading slow scan TV images from the ISS.

Read the full story in the June 2015 *QST* and listen to K5LBJ working stations via amateur satellite SO-50 at **www.arrl.org/articles-and-stories**.

Licensing Updates



New Edition of ARRL General Class License Manual, Instructor Manual

ARRL has published the new *ARRL General Class License Manual*, 8th edition, to prepare students for the FCC exams beginning July 1, 2015. This edition is available from the ARRL store and can be purchased by ARRL Registered Instructors with a 25% instructor discount.

ARRL has also published a new instructor manual, the *ARRL Technician and General Class Instructor's Manual*, 7th edition, authored by Rick Crockett WØPC, Ron Ochu, KOØZ, and Ward Silver, NØAX. It includes lesson plans for General license instruction coordinated to the content in the new *ARRL General Class License Manual*. This print publication also includes all the lesson plan content previously published online as the 6th edition of the *ARRL Technician Instructor's Manual*. Find details on ordering both new manual editions at **www.arrl.org/shop/Instructor-Resources/**.

ARRL Registered Instructors can also access and download PowerPoint® slides that correspond to each Technician and General lesson module on the ARRL website. Visit **www.arrl.org/instruction-arrl-resources** to be directed to these resources.

Mill Creek Elementary School students Priya Mantraratnam, KM4HBQ, and Callie Scroggins, KM4GJY, beam with delight after receiving their Tech tickets. "Callie is preparing for the General class license and will probably take the test in February," says Jackie Smith, KJ4SVQ, 5th & 6th Grade STEM teacher and proud radio elmer. (Photo by Jackie Smith, KJ4SVQ)

Recent Licensing Statistics

The following report of FCC licenses issued is supplied by Maria Somma, AB1FM, ARRL VEC Manager. Somma notes that, while Amateur licenses issued are down slightly from last year's record-setting pace, they are 8% above the typical totals from previous years. Upgraded licenses are up 9% compared to the same period last year. The total number of U.S. Amateurs has continued to grow each year since the FCC license class restructure in 2007. As of March 31, 2015 the number of licensees reached an all time high of 728,146.

NEW and UPGRADED FCC LICENSES ISSUED PER YEAR BY QUARTER

FCC License Activity	2011 1st quarter	2012 1st quarter	2013 1st quarter	2014 1st quarter	2015 1st quarter
Technician	5,077	6,654	6,850	7,950	7,381
General	2,527	2,728	2,507	2,810	2,925
Extra	861	974	789	902	1,040
Total Issued	**8,465**	**10,356**	**10,146**	**11,662**	**11,346**

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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

Announcements, Upcoming Events, Opportunities, and Deadlines

Boy Scouts Recognize ARRL Amateur Radio Service to Scouting Award — The Boy Scouts of America's National Awards and Recognition Committee has officially recognized the ARRL "Amateur Radio Service to Scouting Award" as part of its family of Community Organization awards. The ARRL award recognizes active Scouting leaders who provide Scouts with a memorable and valuable Amateur Radio experience. Nominations for the Amateur Radio Service to Scouting Award are made through the appropriate ARRL Section Manager. Details on submitting a nomination and an image of the ARRL award are posted on the ARRL website at www.arrl.org/amateur-radio-and-scouting.

Goldfarb Scholarship Recipient — The ARRL Foundation Board of Directors has named Jacob Nunez-Kearny, KF7DSY, of Mesa, Arizona, as the recipient of the 2015 William R. Goldfarb Memorial Scholarship. A senior at Desert Ridge High School in Mesa, Nunez-Kearny plans to attend Purdue University in the fall and pursue a career in aerospace engineering. More on this year's recipient can be found here. For more on ARRL Foundation scholarships, visit www.arrl.org/scholarship-program.

ARRL Field Day, June 27 – 28, 2015 — Information about this great opportunity for public outreach and getting young people on the air can be found at www.arrl.org/field-day.

Jamboree on the Air, October 16 – 18, 2015 — It's time to plan for this annual event. For a recap of last year's activities, read Jim Wilson, K5ND's article, "Jammin' and Hammin' with the Scouts," in the June 2015 *QST*.

ARISS Proposal Window, September 1 – November 1, 2015 — Details and opportunities to participate in Information Sessions will be posted at www.arrl.org/hosting-an-ariss-contact.

ETP Grant Application Deadline, November 1, 2015 — Find out more at www.arrl.org/etp-grants.

You are subscribed to receive the ARRL Instructor/Teacher E-Letter. If you have an ARRL website user account, you can manage all of your e-mail preferences at www.arrl.org/myarrl.

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