

Using Ham Radio to Teach Space Weather

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For Houstonians, Space Weather rarely has local consequences. We get to see aurora roughly once per solar cycle (the storm of March, 1989 and the storms of October 2003), and power outages in Texas are few. However, space weather topics can be integrated into middle-school curriculums using innovative techniques. The one clear space weather influence noticeable in Houston is radio propagation, and the "Ham connection" can be fun and educational. Ham radio is experiencing a renaissance because of its clear connection to homeland security. Kids who enjoy tinkering with ham radio are much more likely to become scientists and engineers, and with satellite contacts legal with just a minimum "technician" license, it is becoming a lot more attractive to modern students in the internet era. Even without passing a Morse code test, students can talk to the International Space Station, or talk on linked reflectors across the country. They can also send "slow-scan" or even "fast-scan" TV images over the airwaves, or download images, movies and data from balloon launches. They can participate in public service activities such as long bike rides or canoe races, and even participated in the search for Columbia debris.

The science that can be taught in a ham context includes electronics, currents, antennas, etc, as well as how to talk courteously! Since space weather can influence both long-range and short-range propagation, knowing the Sun's state can mean whether they can talk to Japan or not! The emergencies of recent years (e.g. 9/11, the Blackout) have shown that ham radio has a significant place in homeland defense and isn't just a hobby for old geeks. Plus, it's a great hands-on introduction for students into circuits, antennas, waves, and radio propagation. Summer camps are a great stress-free way to pique student interest and get teachers involved in this fun and educational hobby.

In 2002 we offered two one-week ham radio camps, one for 8-9 year olds and one for 10-12 year olds at the Houston Museum of Natural Science. Out of 39 students, ten (4 in the younger group) "did their homework" and earned their "Technician" license! In 2003,



two one-week camps for 10-12 year olds ran sequentially (July 7-11 and July 14-18). The second week, Houston-area teachers also participated, learning how to teach kids as well as having the opportunity to become licensed themselves. The first teacher intern, Lollie Garay, has already herself taught another teacher and six of her students, three of whom are licensed, so the Master teacher program is proceeding famously! In all, six new teachers have received ham licenses and are now "on the air"! It only takes a minimum "technician" license to communicate with the Space Station, for example – no Morse code is necessary, and schools can sign up for a contact! However, Morse code *is* necessary for a license to talk on



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HF frequencies around the world, and that is the next step for the Redd school club.

In 2002, the hands-on part of the course was

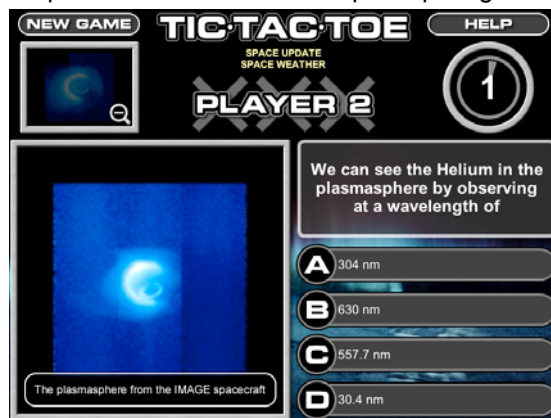


taught by Crosby Middle School teacher Jeff Greer WD4ET, assisted by his daughter Melissa KD5OYB. The younger group made AM crystal radios and the older kids made shortwave receivers. Jeff ably demonstrated that having a vision disability doesn't diminish your capability for the hobby. The crystal radio kits came from Lance Borden WB5REX. The theory part of the camp was team taught by volunteers from the Northwest Amateur Radio Society (www.w5nc.org). Other teens who helped with the class included Lindsey Eakin KD5MES and Patrick Snodgrass KD5QDF in 2002 and Colin Jenkins KU5B in 2003. In 2003 the assisting teachers included Greer, Kevin Robedee, Katrina Miguez and Anastasia (Katty) Furitsch.

Most of the students had never worked with a circuit before, and at the beginning of the course couldn't make a flashlight from a battery, a bulb, and a single wire. Pat had to invent a new mnemonic for the resistor color code... the one she learned in college just isn't appropriate for young students! Our new mnemonic is "Black Bears Run On Young Grass By Violets Growing Wild", which helps the students remember Black for 0, Brown for 1, Red for 2, Orange for 3, Yellow for 4, Green for 5, Blue for 6, Violet for 7, Gray for 8 and White for 9 (and the mnemonic also helps to distinguish the three B's and two G's)!

In addition to teaching the basics of ham radio, the course covered an introduction to space weather and how it affects radio propagation, and the sun and its particle and electromagnetic radiation. They learned how radio waves bounce off the ionosphere and how a "solar max" sun is better for ham radio, until the storm comes! The class, sponsored by IMAGE (<http://image.gsfc.nasa.gov>)

in 2002 and by CISM (Center for Integrated Space Weather Modeling) (<http://www.bu.edu/cism/>) in 2003, provided funding for master teachers to help teach the class and startup equipment for the teachers who passed their licenses. Teachers from the Houston Independent School District got a stipend from their district for participating.



To help the students pass their technician exam (which introduced a new question pool this year), we have developed a special "ham radio" TicTacToe game. Since the question pool is public, with a small fraction of the questions asked in the actual exams, sample quizzes are frequently used as a study guide. We developed a game that allows the students to choose whether to quiz themselves (or play each other) in the questions for just one section of the license exam, or to have all sections randomly mixed. We also have a "space weather" TicTacToe game as well, which teaches the basics in a fun way. Both games (plus the powerpoint which teaches the class) are available free for teachers via a digital download (contact connect@space.rice.edu for instructions).



For more info: <http://earth.rice.edu>
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