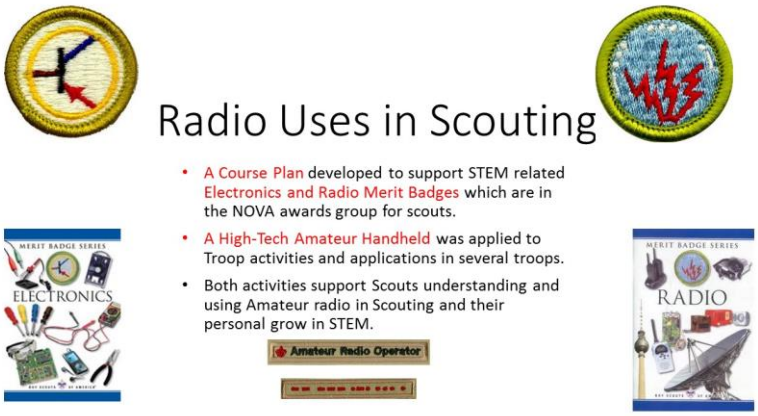


WIRELESS IN SCOUTING AND YOUTH PROGRAM

SEA PAC 2014

ABSTRACT

Two STEM Merit Badges, **Electronics** and **Radio** are completed in a one day workshop; this process is described. Kits, Radio Electrical Demonstrations & Experiments and flip charts are used in 10 fast moving sessions using up to 30 HAM volunteers. These Merit Badges cover many skills needed to obtain an Amateur Radio license.

It is more likely for Scouts that have prepared before the class to pass the Amateur test following the Merit Badge training, however all are given the chance for the experience if they would like to try. This process material can be used for other youth groups. These new HAMs will need help using their new license in scouting; ideas are provided.

Amateur Radio communication skills can fit into the Scouting process and have very positive impact on troop Safety, Scout's Self Development and the Patrol method of leadership.

Amateur Equipment using modern ("High Tech") Digital Radios, exampled below, can make a significant contribution to a scout's ongoing interest in Science, Technology, Engineering and Applied Chemistry and Physics while working toward STEM merit badges and the NOVA awards.

All of this is very difficult to accomplish via individual efforts. Greater success will be achieved through cooperation of ARRL clubs, ARRL members, and the new Section Youth Coordinator organization.

Phil Sohn, Dave Wickert, Eric Jarvi, Tim Myers and Horace Hamby

[Course title]

TABLE OF CONTENTS

The Story---Amateur Radio Applied to Scout and Youth Activities; Merit Badges and Training

A small team of experienced Radio Amateurs who are also active or experienced in Scouting as Scoutmasters, Assistant Scoutmasters and Merit Badge Councilors have been focusing on radio uses in scouting, ways to increase use and developed course plan for teaching Radio and Electronics Merit Badges for Scouts. These merit badges are related to the NOVA awards and if completed, address most of the requirement for an Amateur license. They also can be viewed as fun applications of Science, Technology, Engineering and applied mathematics (STEM). A merit badge course was developed and has been used several times in which Scouts have been successful in gaining these merit badges; plus approximately twenty percent successfully became amateurs. The course is designed to be fun as the merit badges requirements activities are explored; what awards are obtained are up to the scout and how they prepared for the event. The course description is attached. As many as 30 HAMs are required to execute the course and Amateur test in one day. As Scouts became successful, the question arises how and where Amateur radio is used in Scouting and who do you talk to with the radio. JOTA was used as a fun event to show some of the uses of Amateur Radio with radios and modes and making contacts World Wide. Several of the team members are currently active in scout troops; thereby making it possible to implant several sets of high Tech radios in their troops and observe how they would be used by scouts as they work through scout requirements. High Tech radios have additional modes and applications available, more than just one or two frequencies. This report fits in with the alliance between ARRL and Scouting. The report begins to address the question of what to do and how can the alliance be implemented. The ICOM 31 radio was chosen for the experiment as example of a High Tech radio, since it is a modern handheld with digital radio capabilities and a lot of potential applications useful in scouting installed on the unit. The project is still a work in progress but the discussion today will give an up to date summary and plans. Radio is used so extensively today in our society, ***Scouts need to learn to use the radio tool and how it works; it is just as an important tool for the scout as the square knot*.** Radio, bands, modes and frequencies that could be used for communication scouting can be found as CB, FRS/GMRS, Commercial, cell phone, bluetooth, Amateur bands and repeaters. All, may have a place and Amateurs need to be active in placing them if they are viewed as needed.

How Radio can be used in Scouting

1. **Safety** – Individuals, patrols and troops to stay in constant communication or can establish communication if needed regardless of location. Stay in touch on trails, camps and driving to and from outings. Identify Safety potential Hazards and Safety concerns then: communicate to neutralize with others with information and directive action. Radio when used with the Scout Methods will reduce accidents and improve safety.

2. **Management of Troops on the move** – This will reinforce the Scout led troop with communication as needed between Scoutmaster, SPL and patrol leaders and adult support. SPL calls the shots and others take action. Communicate and practice basic scout skills between each other. It supports Scouts leading the troop with adult leaders monitoring and allows more independence for

developing young leaders. Radio will improve the effectiveness of the very effective Scout troop leadership system.

3. **Allow the Troops to work with other community organizations and be more effective** in Community Service Projects. Radio can help Scouts be more effective in community service and meet their goals in this area.

4. **Career Tool**—Teach and maintain Scout's interest in STEM skills that they will use in military and other careers plus learn basics to further education. Radio is a fit in the NOVA awards and demonstrate STEM applications.

5. **Reinforce other Scout skill learnings** like – Emergency Preparedness, Orienteering, Geocaching, Search and Rescue, learn basics of communication in disaster recovery. Seen in Appendix II.

6. **Establish the ability to communicate under all conditions and locations**. Learning to establish communication under all conditions with appliances and modes available; example: crowded camporee or remote location communication, SOTA. Radio teaches Scouts to anticipate, plan, engineer, adapt to the situation they face.

7. **Great Transformation base as** following Scouting into and continuing with Amateur Radio, college clubs or other technical hobbies. Radio in scouting can be a strong base for the scout as they move into other technical ventures: Engineering, Military, Scientist Environmental and Bio Science and etc…...

8. Radio helps put meaning in **Be Prepared and Prepared for Life**.

Key Learnings and Recommendations

1. Amateurs need to support Scouts in establishing proper radio equipment for their communication needs and maybe not limit the choice to just amateur type equipment which requires all operators to hold a license. Amateur communication practices such as setting up nets, emergency call out and other Amateur radio communication processes could be applied immediately toward safety. Amateur radio offers more communication alternatives than public or commercial bands. For example, Amateur Ham radio can offer: hundreds of specific frequencies, within multiple bands, using various modes, Antenna selections, RF power levels, Power supplies and etc. However, it is difficult to maintain all scouts and scouters as licensed Amateur radio operators and can require a lot of training to apply. Hence, don't wait, consider applying other types of radios like CB, FRS/GMRS, while developing the skills of amateur radio communication.

2. ARRL should consider petitioning the FCC for a youth license on the 2 meter and 0.7 meter bands at low power; low power, analog and digital modes for youth groups to use. This would speed up the implementation of Amateur in scouting the scouts could gain he benefits quicker.

3. Electricity, Electronics and Radio merit badges can be as important as the Ham license to a scout and their start of technical development. They teach the fundamentals of frequency, electricity, magnetism, AC/DC, circuits, Battery operation, Chemistry and Physics and applied math. This information can be used for continuing education and careers. These Merit Badges are

important milestones to Scout's Self-development and awards like NOVA. The HAM license opens doors to skills and a hobby that moves at the speed of light, offers continuous skill improvement and the excitement of discovery and innovation with practice for a lifetime.

4. Where possible several of the Scout adult leaders in a troop should be HAMs; Scouts learn by example. The scout leaders, trained in scouting can apply the Ham techniques to enhance their scout skills. The leaders can mentor and help the scout learn key elements of Amateur Radio and Scouting.

5. Encourage the Scouts to think of the license test as a different kind of test where you acquire knowledge by the learning answers of the questions. Think of it as another merit badge form where you complete the sentence with the correct answer! All the question add depth and breadth to what is being learning. A neat way to study and see all the sciences introduced.

6. Encourage Scout troops to activate a Communication / Safety Instructor position on the scout level. Scouts need these leadership positions to become an Eagle and this is a good position to utilize. However it is the HAM/scout leader or adult scouter and SPL that will makes this position work; they have to use it. The Communication Instructor in responsible for the Communications used for all events, establishing the troop's channel list, nets and emergency call out process. The position is responsible for keeping the radios for the troop ready to perform. They also explain who will be net control and troops list of channels to be used. The position should be the contact point for the ARRL Hams along with the Scoutmaster. The position will also be responsible and keeper of the Safety Data base, teach Safety hazard identification and also lead the safety discussions for the troop before each event. They set up the troop's simplex channels, emergency callout list and looks for contacts to repeaters at each event. This is really important at camps where there is a lot common channels.

7. A troop unique channel list is the troop's standard list of specific radios, modes, frequencies and scouts that can be expected to be on the mode. Scout will use mostly simplex and one or two local repeaters. As example: using the IC 31A Ham radio the troop channel list might be 6 channels, 3 simplex analog and 3 digital, with 2 repeaters one analog and one DStar for a total of 8 channels. This channels refer to the different memories used on radios added to channel list. As scouts come into proximity they know which channel to call to the group on. The same approach will apply to other RF equipment in service by the troop. Setting up Troop used frequencies and RF appliances for each event can cause a lot of confusion.

8. If a Scout gets a license they need some assistance fitting into the troop or youth group, in finding someone to talk to, obtaining access to a radio and setting up the radio on troop channels list. It has proven beneficial to manually program the troop's channels. It is like learning to build a fire with flint and steel; learn the basics first.

9. ARRL groups need to adopt scout troops and youth organizations. Establishing a functioning relationship can take a long time. This is where annual events like JOTA can help.

10. Try and arrange for Scouts to have Merit Badge books (pamphlets) for Radio. The pictures and diagrams help with the mastery of the radio and principles of operation. Clubs should furnish them with the registration or put multiple copies in each scout troop's library.

11. Hands on electrical kits are a great learning tool. The prime kit is the Electronics Merit Badge. Each kit needs to have a good explanation, diagram and key measurements for the scout to make. Use hands on kits as much as possible. It is possible that parts for Kits could be bought and packaged by older scouts for use by others for Electronics.

12. Youth needs Amateur Radio and Amateur Radio need Youth for each to reach its prime goals in the future. For youth, it is a vehicle toward technical careers; For Amateurs it means experienced technical based members in the future. Therefore Amateur radio should give youth training and experience the same priority as other goals, objectives and activities of the ARRL organization.

13. Youth and their groups are hard to find and establish relationships with. ARRL clubs and all HAMS should try and establish relationships with scouts, 4H clubs and schools clubs; remember parents or other adults will have to present with all activities. Follow all rules of social contact with youth and take required training. As a general rule worked in trained pairs with parents and follow rules of the groups. Never set up and work with youth "one on one."

14. ARRL clubs should set up youth training programs and activities making it possible for Youth to reach Extra class by leaving High school; this might start in the 4th grade. This will support STEM subjects, careers in military or college placement. This is will require a big effort by Amateurs.

15. Amateur groups should consider supplying radios, accessories and lesson plans for making antennas to the youth groups.

16. ARRL **Scout Mission**: Provide activities fitting within the scout program that stimulate the acquisition of immediate practical radio skills; inspire longer term interest in the STEM core subjects: (Science, Technology, Engineering and mathematics) and practice social responsibility.

17. The views, expectations and needs are sometimes viewed differently by the main players involved, HAMs, Scout/youth and Parents/Adults and this has an enormous impact on the ultimate outcome. Adults and most parents view Amateur Radio as backup emergency communication for the cell phone and expensive. For the youth, Amateur Radio can provide a demonstration of Science, Chemistry and Physics and they can do it and it can be fun. This can give them a key to the future; another scouting goal that can be reached, provide growth of the individual. It reinforces what they see used in NASA, community and military. If the parents don't support and see the need chances are it will not happen. Expense can be a problem; but, HAM clubs can help with as example, equipment choice and help here a lot.

The IC 31A Experiment in Scouting.

The IC 31 was chosen for its on-board applications that could be applied to Scouting. You have to have at least two IC 31A's present in the troop to take advantage of the apps and their synergy on the radio. The radio is basically an RF robot. Some of the apps investigated

were: Digital Voice, Digital Data, Search for local repeaters, Proximity alarms, automatic reply, Latitude & Longitude, GPS, Back tracking, Station to station bearing, Digital Simplex, Tie to Dongle tie to Reflectors, IRLP, Vox, APRS, SD recording of messages, Band Scope, DRats, and memory searches. Two troops were picked to investigate the apps on the IC 31A, One troop, Phil Sohn, K7APS, is training with the unit for Philmont and is interested in trail communication, GPS and solar powering the radio for an ever-fresh power supply. The other Troop, Eric Jarvi, AD7F, is studying the other Apps below including biking, games and hikes.

- The IC31 has just one band, 0.7 meters but with analog and digital modulation both on the band. 0.7 meters works well in urban areas and when working simplex station to station which are in close proximity. Scouts mostly will use simplex most of the time.

- It is very important to get a common troop channel plan agreed to and manually installed on the group's radios and any personal radios in use. The troop channel plan ties the memories and the frequency used, stored as a common channel in the troop channel plan. The Scout troop channel plan should have about 10 channels for each handheld's memory locations and corresponding frequencies. Use several frequencies on analog and Digital with a couple of analog repeaters. These memory locations with the frequencies stored are then referred to as channels by the group. The scouts then know "the sign in simplex frequency" and can change channel as directed by the SPL. The local DStar repeaters can be found by the IC 31A radio using the GPS on Board.

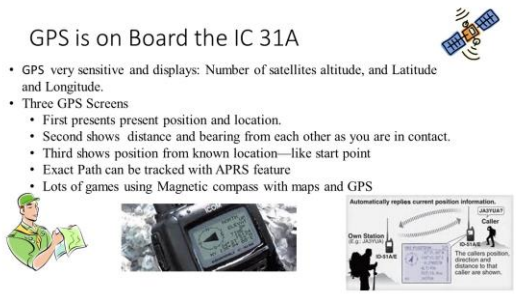
- It is suggested that all hams in a youth group or troop be supplied with the same radio where it is then possible to use the applications and access to reflectors where possible. For example, the advantages of the IC 31A are completely neutralized if digital cannot be used due to keep one analog radio in the net. It is also true the HAM radios are neutralized to keep a commercial community frequency or channel in the net. Truly a chain is strong as its weakest link; but a weak link for safety is better than no link. The answer of course is train, train and train. Or, and use high tech radios just with trained leaders, special games and demonstrations. There was a time that Morse code was required for first class rank in scouts. This was not for radio in any form; but it was for other electromagnetic radiation devices via --- flash light, mirrors and waving signal flags. Radios have never been used in USA scouting; but, are used in other countries.

- DStar is a good mode with its wide spread application of modulation of a digital signal that broadcasts concurrently with Digital Data mode for id and simple messages and location. Digital modulation will be the trend in the future. Power used, signal clarity DV and DD Band widths are in progress.

- IC 31A uses a Lithium battery chemistry and its charging system is on board. The Lithium system is in common use in a lot of other applications from cars to cell phones; this knowledge will serve the scout well in the future. The lithium chemistry, charge rate, solar power charging, discharge rate with different appliances being used and different power settings were studied and on going. The voltage shown on

the radio can be related to remaining power to be used. The apps can be adjusted if needed. The goal is to have solar power source that can provide ever-fresh power available on the trail for scouts operating on 0.1 watt. This is like being on a space ship and fun to do.

- DVAPs and Raspberry Pi take the IC31 Worldwide on Reflectors via wireless or internet. One Raspberry Pi is in operation and several DVaps. Where wireless is available then DStar repeaters and Reflectors are available.



- There is GPS is on board the IC 31A. It seems very sensitive and reads: speed, elevation, bearing, APRS maps and Latitude and Longitude. There are three GPS screens; one to establish start from home or other known location and it will tell you bearing and distance from point. A second screen shows several DStar units it, can tell the distance and bearing from each other as you are in contact by call. The third, shows the position information of the handheld. These are adds and supporting to Scout programs in Orienteering and Geocaching. These features will work either in simplex or via repeaters and reflectors. There, also, is a proximity alarm that go off where you can play hide and seek or set up a treasure hunt. It is a fun display. The GPS position information can be presented on an APRS screen or saved to the SD card. This has been used with the SD card as a crumb trail to review later.

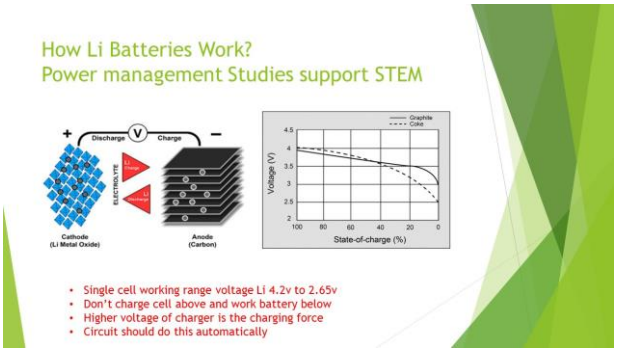
- IRLP can be used with analog repeaters and tied analog reflectors.

- With the microphones and ear pieces the VOX system becomes a great communication aid. This works will for bike hikes and canoes.

- Portable Antennas are fun to make and use with the unit. The IC 31A has been used with cross linked IC 2820 to reach distant repeaters in a JOTA operation.

- The SD cards for recording GPS positions and plotting them later on maps. Net conversations can be recorded. It is also used to store different configurations and memory loads.

- DRats tied to the lap top or SURFACE tablet is a terrific feature with either simplex or via repeaters or internet. Scouts are able to send e-mail to each other. Also location can be plotted for individuals in the group. This is an important trend of tying the radios, to Dongle, to computer and internet. Scouts like to do this and ties them to the scout world community and they us all digital equipment.

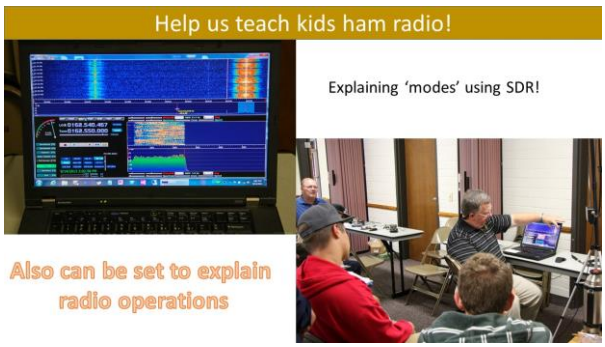


- It is recommend that you stick with leading edge radios as your STEM radio; and the radios could be phased out about every 5 years. Many thanks to the HAM equipment suppliers who support us and who keep the high quality radios coming.

- Applying the IC 31A radios for troop use will take a very long time to learn to use all the apps on board the radio. **Print out the instruction manual** and you will understand all the complications; expect several years to apply all the applications. It in a radio with computer on board. Remember you will need at least two units to see all the benefits. Supply the radio with a fun sets of games to teach all the applications.
- Think of the IC 31A as a computer, robot, with a Li battery with a lot of Apps. For this generation of youth it is like the old Ford or Chevy with a lead acid battery that you might have worked on. It takes tons of time to get all this stuff working.
- The troops have had a lot of fun exploring these features on hikes, boat trips and fun runs. Plan on several years to use and understand all the applications. Tons of fun.

Electronic and Radio Merit Badges use for Scout (youth) training

With the three sessions using this material plus JOTA 2013, the scouts plus other youth have earned approximately 170 Radio Merit Badges. In addition there were approximately 130 to 150 Electronics and 20 to 40 Electricity merit badges, 50 to 60 amateur radio licenses. Individuals that got a license most likely had prepared before the event; the event was not planned as a license training session; although, links on the signup sheet refer to license training areas. The youth sessions were open to all troops, youth and groups. Parents attended with their kids. The building where you have this event has to be about to accommodate about 150 people. Lunch is a break and run around time for the kids. The goal was to have fun with Amateur Radio; each person had to set their own goals. The total youth attendance 190 to 210. Remember all youth groups are welcome to come; have fun, hopefully learn something and may choose not to get the merit badge or license. Sometimes kids come to just have fun; the choice is theirs.

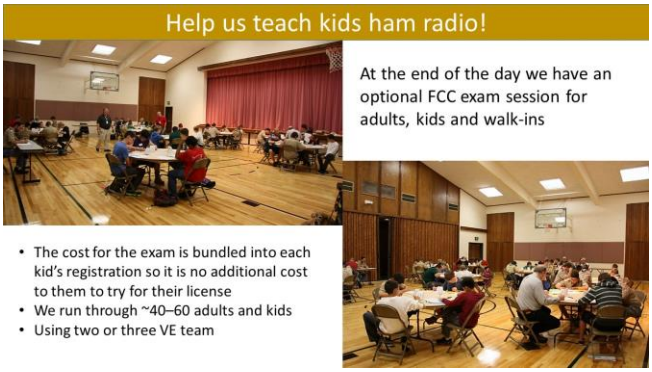


"Learning Coaches" – Mostly Hams, they teach one 25 minute MB session at one of six tables in the morning and a different one in the afternoon. Learning Coaches and a partner will repeat the same material as groups of about 9 to 10 kids rotate between stations; six groups in the morning and six groups in the afternoon. Slides of the material covered will be provided as hard copies to use at the event. Slides found here: http://sdrv.ms/V0XZ1a ; Look under Presentations N Handouts (E1 to E6 for Electronics and R1 toR6) for radio. Approximately 15 Learning Coaches are required; parents rotate with their kids.

Ed Morin, WB7UBD, designed the key oscillator which comes with a simple key. The instructions are very clear with pictures explaining how it

works. Key measurement are made with Volts, current and shown on an oscilloscope; the kit is assembled in 20 min. The April 26th, the day of the event, most likely Ed had the only example of kids working on a 555 key oscillator that could be converted into a telegraph system and other uses, in the city and nation! Ed also has built an RETO electricity kit for teaching basic electricity to youth and adults in classes.

HAM VEs Administer the FCC exam. Non VE's, helped handing out tests, keeping the room quiet, shepherding kids out of the room that are not taking the test, etc. Dave Wickert, AE7TD, organized two testing teams of Extra VEs and the Test was Open. 12 to 13 VEs can make things go smoothly. See Dave Wicker, AD7TD, for details.



The Scouts have had the material on Merit Badges and Amateur License Prep for several weeks. Some of the Electricity Merit Badge will be covered in the above sessions and can be signed off. However, a large part will have to be covered in the Scout's home working with parents, and this will need to be signed off by them. Also the training session was not a license training course; scouts studied material on their own and took practice tests and some took the test for experience. However, the material to study for a license was given out in the signup sheet for the class. Pass rate was about 20 to 30 percent. You can never predict who would pass. In one case a scout got the merit badges passed the HAM test and his parents refused the license. In another case a Cub Scout passed the test but was not in scouts and could not get the merit badges; but, can wear the Scout Radio Operator patch. What a great day to answer his call on the K7LWH, 145.49 MHz repeater as he demonstrated his radio in "Show and Tell." The Cub Scout now is beginning to realize he is different; no one in his room including the teacher is a HAM or has worked with a 555 chip. Who is going to tell him what his potential is. This is what we are about with Youth training. Each person determines what they can accomplish. The goal is to have each young person realize they can do STEM if they want to.

Immediately any Scout that passes needs a mentor to be successful. If this does not happen the license, will not be used; this also true for most adults.

Key Team Members

Phil Sohn, K7APS, Assist. SM, Woodinville ARES, Lake Washington Ham Club

Dave Wickert, AE7TD, Merit Badge Counselor, MicroHams, Lake Washington Ham Club, Woodinville ARES Advisor

Eric Jarvi, AD7F, Assist. SM, Lake Washington Ham Club, MicroHams

Tim Myers, KK7TM, Merit Badge Counselor, MicroHams officer, Lake Washington Ham Club

Horace Hamby, N7DRW, Former Scoutmaster, Present Merit Badge Counselor, Lake Washington Ham Club Secretary, Woodinville ARES Advisor

Ed Morin, WB7UBD, Kit Designer, Lake Washington Ham Club

Many Thanks to the 30 to 50 plus Hams the helped as Learning Coaches, VE, JOTA coaches from multiple organizations.

Conclusions and Path Forward

The decision by ARRL to take the Section Youth Coordinator Section structure nationwide is very welcome; many thanks to our West Coast leaders who worked on this for years. Ham Clubs need to embrace local youth groups and tie to the SYC position; and that position tie to the Section, Division and National. The youth focus needs to receive the same emphasis as other programs in ARRL; yes even greater than the wonderful emergency communication program now in operation. America's youth need your support for their chance at Science, Technology, Engineering and Applied Mathematics and they will pay you back in the future.

Important links and References

- www.ARRL.org
- ARRL Western Washington Section http://wwa.arrl.org/
- BSA http://www.scouting.org/
- Lake Washington Ham Club www.lakewashingtonhamclub.org
- Woodinville ARES Group http://www.woodinvillearesgroup.org/
- MicroHams http://microhams.com
- Wireless in Scout and Youth Program Power Point

APPENDIX I

Radio and Electronics MBs and FCC amateur Radio License Exam

Register online on the Events page of www Radio & Electronics MBs &

FCC Amateur Radio license exam

$25 April 26, 2014, 9am – 5pm

7720 126th Ave NE, Kirkland

Join us for a one day workshop on the Radio and Electronic merit badges. We will also cover the material for the FCC ham radio license. The radio merit badge will be completed in the morning and the electronics merit badge in the afternoon. If you attend both sessions, you will have learned the majority of the topics required to earn their FCC ham technicians license. The registration fee of $25 covers the materials for electronic kits as well as the fee for the FCC exam.

What is Ham Radio?

It's the most fun you can have with a radio. It's a way to talk to people around the world, or even orbiting the world; to send e-mail without any sort of internet connection, and to keep in touch with friends while you're driving around town. But it's also a very important communications system -- when cell phones don't work, regular phones don't work, the internet doesn't work, ham radio does still work. There are many aspects of ham radio such as:

- Keep in touch and geo-track during outings
- Talk all over the Puget Sound & the world with a handheld radio
- World Wide & Emergency Communications
- Talk to Satellites & the Space Station
- Bounce Radio off of the Moon
- Build your own Radio
- Radio Tracking
- Looks great on your college application and resume!

The day will be spent rotation between stations. Scouts will spend 30 minutes at each station where they will learn, participate in discussions and hands on experiments, and have a chance to fill out the merit badge worksheet. This is not a MB clinic or factory, in order to earn the MB, work must be completed and reviewed by a BSA MB Counselor at the last station.

Learning Stations

Radio

1. Overview of Amateur Radio
2. VHF and Repeaters
3. Antennas

4. HF and Callsigns
5. QRP and CW
6. Propagation
7. Radio Careers & MB Completion

Electronics

1. Digital and Ohm's Law
2. Electrical Principals
3. Electronics
4. Solder Practice
5. Morse code keyer construction
6. Careers & MB Completion
7. FCC License Exam (not required for MBs)

In the afternoon, scouts and adults will have the opportunity to take the FCC ham radio test. We will have covered the material for the scouts. To address the wide range of areas and questions that are covered on the FCC ham test, it is strongly recommended, especially for adults, to review additional material before the class. Here are some excellent resources:

- **Study guides**. There are two good books. Make sure you get one published since 2010 because the questions were updated then. You might be able to find these at your library. Get one of these books and get started now.
  - The ARRL Ham Radio License Manual Revised 2nd Edition
  - 2010-2014 Technician Class by Gordon West
  - www.hamradioschool.com
- **Podcast**. You can listen to these on your computer or music player. http://myamateurradio.com/become-a-ham/2010-2014-us-technician-class-amateur-radio-exam-audio-review/
- **Online practice exams**: http://www.hamradiolicenseexam.com
- **More are listed here**: http://www.lakewashingtonhamclub.org/?page_id=145

All scouts and adults who wish to attend must pre-register. We encourage adults to attend with their children. It is always more fun when at least two people in the family have their radio license. There is no fee for adult attendance, but there is a $15 fee for adults taking the FCC exam. (It is included in the youth registration fee.)

Classroom sessions are taught at the Jr High School level. Special sessions can be arranged for learning disabled student groups. Contact us by email for additional information.

Follow up Activities

Scouts who earn their FCC Technician's license will receive the brand new "Amateur Radio Operator" patch shown at the top of the page. We will also how follow up activities for licensed scouts such as high altitude balloon launch and recovery, fox hunting for hidden transmitters, and Jamboree on the Air.

Contact Phil at philsohn@alum.mit.edu or 425-318-2371 with any questions.

.SeattleBSA in 2014.

APPENDIX II

Amateur technology, Examples of How to use Radio in Scouting plus Benefits -- Be Prepared

This information was assembled from a review of the 2013 Scout Book, Scout Rank Requirement and Merit Badge requirements. The team also brainstormed their experience. The writer served as a Scoutmaster for 12.5 years plus extensive camping and outdoor experience and has been a HAM for 35 years. The commercial handheld was introduced in the Chemical Process Industry and teams similar to scout patrols were managed and directed via nets. Safety and operating process were developed using the radio where today these facilities cannot be operated safely without the Handheld. The information assembled below is based on these experiences. It is hope it will stimulate the reader on how they can use radio in scouting with scout methods. Horace N7DRW, BSA Scoutmaster

1. **Safety** – Radio will enhance Individual and or Troop / patrol activities – Self and Scout Leadership skills are gained.
    a) Individuals and groups to stay in constant communication or can establish communication regardless of location. Radio can reinforce Patrol method skills.
    b) Move groups safely from point A to B. *Blue Italic—Examples are fictitious radio calls based on real experiences of writer* SPL: *Eagle Patrols this is Great bald Eagle SPL: Hold position**, HOLD, HOLD, HOLD**, until safe trail is marked and safety rope established, confirm this message, confirm with ASPL NOW and record all QSOs and your position trail sketch on map and radio. Red Eagle patrol: message received; Silver Eagle Patrol: Message received; Gold Eagle Patrol: messages received. ASPL: Patrols holding*
    c) GPS of individual or patrol positions can be monitored via computer or handheld.
    d) Learn Electrical safety practices.
2. **Management of Troop**. *Bald Eagle SPL to Patrol Leaders: Confirm GPS with Magnetic compass be advised there are ferrite deposits in area; confirm both readings with pocket knife direction method.*
    a) Troop Leadership can meet on internet or air and even be on the move – Group calls – Radio Nets to discuss and make decisions and the action happens. *Scoutmaster to Bald Eagle SPL that's a log in the surf keep troop 50 yards away from surf line. Scouts were killed on this beach in the past. Maintain Radio's on VOX and auto reply*
    b) Add Radio Communication as a Management Organization tool.
3. **APRS / GPS** – Location Tracking of individual and groups. Orienteering, /Geocaching
    a) Games using maps or following instructions; scavenger hunt
    b) Balloon tracking and recovery
    c) Model planes, boats, cars and etc…
4. **A Scout Career Tool**--Police, Fire, Process Management and Military all use Radio for Safety, Management and Location of Resources. This is good training for Scouts
    a) Develop and train these technology modes: Winlink, DRats, Repeater, HF, VHF/UHF, GPS and digital.
5. **Disaster Recovery**--The Girl Scouts are thinking Disaster Recovery; how do we organize to quickly get things back to normal.
    a) Planning and training of skills are first to be addressed.
    b) Next is communication as to situation and needs.
    c) Use Internet or Wireless Technologies.
6. **Community Service** - Fun Runs, food drive pickup and etc…….

7. **Emergency Preparedness** – Reacting to Disasters and setting up communications. *Headquarters this is EAGLE Troop SPL: Vector this troop to nearest road we have high winds in the NW Forest. SPL to all Eagle Patrols: Report the location of widow makers to this station. Copy your location and listen for vector set out of this forest and around the Clift from Headquarters; Keep patrols 100 yards apart and keep moving in pairs together always just in sight with patrol sound off on the 5's. Headquarters we now have FOG—monitor patrol locations and call direct switch to T magnetic. Eagle patrols this is SPL: Ride those vectors and keep moving; use maps to plot vectors and advise Headquarters direct with any issue. Move, Move, Move*

8. Learn to use in the most effective and safe way to use power systems: battery, solar and Generators.

9. **Amateur radio Operating skills** are part technology and a lot of art -- you have to practice it to learn it. Computer skills and Amateur Radio skill are tied together.

    a) Developing, training and practicing keeps older boys in the troop and they develop skill for life.

    b) Drill, Practice and Drill some more – Learn to make contact – *SPL to Red Eagle Setup Hill Hop VHF to town*

10. **HF / Video** Communication – have to be engineered for every application

    a) Remote Location Communication. -- Scout might like doing that and making schedule with other troops on outings. Establish location and exchange communication. Hill activation or Geocaching location

11. **The role of Adults can be enhanced** as parents and troop leaders. Adults can monitor youth leaders as they perform without abnegating their role. Parents are required to play a role in scouting and all their children's activities today; enhanced wireless communication can give youth more independence and a chance to practice their new skills; while still under supervision of others from a distance.

    a) Example remote monitoring of Orienteering and Geocaching activities

12. **Wireless promotes STEM subjects** from a **fundamental science view**, Chemistry, applied math, engineering and Physics, electrical fundamentals and waves; **then Skill application** and development from a troop activity and leadership view.

    a) Understanding of electricity, power, transmission waves, Chemistry of batteries, solar, resistors, conductors, semiconductors. *A simple little battery has a billion dollar fleet of planes grounded. Is STEM important???*

13. **Special troop projects** – community service, chase the balloon, remote off trail camping. QRP rigs, Search and Rescue

    a) QRP Teams join or let scouts join them on remote hill top activation sites....

14. **Establish radios in troops and camps**. Camp frequencies for schedules, Safety Issues and leadership. Troop frequencies for troop communications.

15. **Scouting and Amateur Radio Together Further Distinguish the Scout** – the added skills from both areas add more depth and breadth of skills to the basket to BE PREPARED for Life.

Short List for Applications of Wireless in Scouting

--Wireless fundamental and skills need to be dispersed over the Scout Rank Level and activities

- Self-Leadership
- Scout Leadership
- Service Projects
- Be Prepared "to help others at all times"
- JOTA – Know the community, nation and world

- Cell Phone and how to use it
- Evergreen Power for Radios
- First Aid – Stabilize -- Call for help
- Swimming – Life Guard Net
- Camping – Part of trip plan safety
- Current Weather and location info
- Hiking, Canoeing – Stay found
- Camping – *snow camp caves overnight net "are you warm and dry- call in any time tonight if you have a problem call this frequency"*
- 50 Miler – Meet logistics
- Navigation – Radio One of the major tools
- Jamboree – Several Frequencies – leadership and teams
- Skills for each Rank – Tenderfoot, Second Class, First Class, Star, Life and Eagle
- Safety MB
- Electricity, Electronics and Radio MB
- Computer MB
- STEM Subjects
- Energy, Engineering, Chemistry MB
- Orienteering MB
- Rifle Shooting MB
- Water Sports MB
- Swimming MB
- Lifesaving MB
- Canoeing and Small Boats MB
- Geocaching MB
- Climbing MB
- Back Packing MB

- STEM / NOVA Strips

Articles

1) Article, QST September 2012 : http://www.scouting.org/filestore/jota/pdf/JOTAarticlesept2012.pdf
2) AST link: http://www.arrl.org/news/view/radio-scouting
3) Gundigest link: http://www.gundigest.com/survival/emergency-radio/always-prepared-boy-scouts-on-the-air-this-weekend
4) Check article and Video – Use SURFACE to play Video…..Boys life magazine – Articles regarding Scouts http://boyslife.org/about-scouts/scouting-around/23040/jota-is-coming
5) NOVA / STEM http://www.scouting.org/stem.aspx
6) Can one imagine putting a team into the forest fire without a radio? Thanks --Horace N7DRW

APPENDIX III

Congratulations you are a Ham- What to do next? ARRL can Help!

Congratulations to the New Amateur Radio Operators

Enjoy your new Amateur Radio license! Objective: Get on the Air and Have Fun

Amateur Radio is a continuous learning process: about radio procedures, learning how radio works and your service to your Community with the responsibilities of your license. Accept and Meet this challenge and continuously develop your skills.

You learn and grow by operating a radio and then teaching others. So learn how to get on the air, both simplex and repeaters; engage in family, club, and scout events and talk and practice your new skills.

Read Below for tips on picking a radio, getting it on the air and getting your troop on the air.

First, there are some "cool" events scheduled on Lake Washington Ham Club: Look for Club meetings, Nets, Field Day and club activities on their web site. Best of all this will be fun to enjoy Amateur Radio and your new HAM friends. LWHC is offering you a complimentary years Membership. This will help you explore all the things you can do with your license.
Please visit our web site and repeaters:

Web site: http://lakewashingtonhamclub.org/ and

Repeaters: http://www.lakewashingtonhamclub.org/?page_id=39

Plans are to set up nets on the repeaters to discuss Scouting activities like say summer camp or Merit Badges.

Next Club Meetings: Every second Saturday, 10:00am at our Club House in Woodinville. http://www.lakewashingtonhamclub.org/?page_id=149

Once you attend a meeting or have a parent tell us you want to join; LWHC will be sending you invitation to join our club via our Yahoo group called, lwhcmembers. Your dues for one year are part of the cost for your HAM class.

If you join the national association for Amateur Radio, ARRL; use the link www.arrl.org/join/VEC with the web code: VEC. You will get a free ARRL Operating Manual Free. Search Scouts for more going on nationally.

Congratulations from the LWHC, WAG and this Teaching Team of LWHC club members. We will listen for your calls, please get on our Repeaters and ask any question you might have and enjoy talking to your friends.

Dave Wickert AE7TD, Ed Morin WB7UBD, Horace N7DRW, Ron Bailey, KF7REH, Don Sayler W7OXR, Jane Wickert N7JCW, Bill Thomassen N6NBN, Eric, Jarvi, Tim Myers, and other Members of the LWHC, WAG and SYC

LWHC Club President – Chris Shriver, KE7EBL
WAG Club President – Phil Sohn K7APS
MicroHams –Tim Myers

STEP I --- Radio Selection Tips

Radio Selection can be a decision that impacts more than money spent on the radio. Perhaps total time consumed that is directed toward activities other than operating, experimenting and community service of being on the air represents real value that should be considered also. Most people start is the VHF / UHF handhelds. A place to start is the Supplement "Choosing a Ham Radio" in the back of the ARRL license manual and found at the following link. http://www.arrl.org/files/file/Get%20on%20the%20Air/Choosing%20a%20Ham%20Radio.pdf Be sure and look at the radio supplier links in the article. Supplementing this is the Lake Washington Ham Club process for picking a Handheld. http://www.lakewashingtonhamclub.org/ look at the survey "New to Ham radio." Don't be rushed into the HT selection process or spend decision. Come to a club meeting and see the different supplier's radios; perhaps you can borrow one from the club or Scouts. --View the collection of decision data for the HT as part of the fun and part of the learning for all the family. I see these buying process activities: as STEM related and can be good communication with family and groups on what will fit it with the group. You will want to pick a radio that fits in with bands, frequencies and modes that will be used in your family or group. Picking the same radio as a group will save tons of time programing the radio.

STEP II --- On What Bands and modes will it be used?

How will the radio be used? First, make sure it is used. 90% of communication will be with family and scout or other youth groups in Simplex or Simplex net. Occasionally, you will use a repeater and maybe IRLP or reflectors. The bands, specific frequencies and modes chosen are a must consideration. Research this area with care or a poor decision can drive you into a sub optimum position or to a more spend position. This happens when people find they have miss spent their funds and bought a radio that will not take them where they want to go with the hobby. People that buy the wrong radio can get stuck for years as far as getting going with the hobby. In hamming it is always important to figure out who you are going to talk to; with what and how.

Generally the mode for group or family is a Handheld with one or two bands available on the radio which is a combination of FM and or DStar using the 6m, 2m and/or 70 cm bands to pick a frequency. So the decision of the family or group's specific simplex and net mode / frequency for the family and groups to be used will become a must for the consideration of the Handheld planned for use.

Where do I get the simplex frequency? You pick frequency from the Band Plan. Band Plans for 2m and 70 cm are shown below. Here is a frequency chart.

Figure 1—Simplex, Duplex chart with frequency and Mode

MHz	2 meter band		70 cm band	Mode FM or DStar

146.52	National Simplex Calling Frequency	446.00	National simplex frequency	
146.40-146.58	Simplex	445.00-447.00	Shared by auxiliary and control links, repeaters and simplex (local option)	
147.42-147.57	Simplex			
145.50-145.80	Miscellaneous and experimental modes	*432.10-432.30*	Mixed-mode and weak-signal work	DStar

Next you set up your simplex and repeater net plan for your family and or group. You use these simplex frequencies whenever the group members are within 3 to 5 miles and operate in duplex via repeater for longer distances. An example of the Lake Washington Event Net is shown below this can be used in simplex or via duplex with repeaters.

Each Family or groups should have a set of frequencies it plans to use. HAM radio has a lot of Frequencies and modes so the plan is specific to each family or group. The Groups frequencies for simplex and repeaters are stored in memory locations. All the group's memories are the same and can be referred to by the group as channels. So when the group gathers they can meet on Channel 5 using that particular frequency and mode either FM or DStar. All the radios can be cloned the same way. This saves a lot of time. There are typically many more memory location than are used in a radio. The common local repeater can be chosen the same way for the group. Groups know the channel in use as they meet. They form a net unless a sub group goes to another channel. A lot of time can be wasted trying to fill up all the memories available when it is very unlikely they will ever be used. Keep the channels as simple as possible. The group will always operate on one of the channels. Channels can be added for trips, camps or working with other groups as needed. Hand program one and clone the rest for the group. Starting out limit yourself to four simplex and four repeaters. Store your eight frequencies in memory areas as shown in Appendix II Example of how to program below.

Example Figure 2. Group Frequencies stored in Memory location areas.

MHz	2 meter band		Memory Location	70 cm band	Mode FM or DStar	Memory Location
146.52	National Simplex Calling Frequency	446.00	001	National simplex frequency		002
146.40-146.58	Simplex	445.00-447.00	003 - 008	Shared by auxiliary and control links, repeaters and simplex (local option)		009 - 015
147.42-147.57	Simplex		016			
145.50-145.80	Miscellaneous and experimental	432.10-432.30	017 - 029	Mixed-mode and weak-	DStar	030 - 035

	modes			signal work		

Set one up for your groups; Pick the simplex frequency and load the calls of your group on a table or excel sheet.

The power for simplex should be very low, in the 0.1 watt range, and the Handheld unit will run with the "duck" antenna and can handle a lot of the other modes for 12 hours with the on board battery; but this needs to be calculated as part of a STEM exercise. The 2 meter band is the heaviest used. Therefore, the 70cm or 6 m bands and the DStar modes can have very little traffic and be great opportunity for simplex nets in a populated area. Remember RF communication on these bands are "line of sight."

Now let's work through the details of programing a repeater and again a simple example of setting up a frequency for a family or group.

Repeaters are the next consideration.

Repeaters are great for nets over a longer range; "line of sight" to repeater, 2 to 10 miles, and then a repeater power and elevation push the output to a larger area 25 to 100 miles depending on elevation of the repeater.

Check out the LWHC repeater list as to content of bands, frequency, tone, split and modes. http://www.lakewashingtonhamclub.org/?page_id=154 LWHC are open to all; but they are youth/family friendly and offer 6m, 2m and 70 cm on analog and DStar. The repeaters can be split where groups can schedule a frequency for an event. Give the 2 meter K7LWH a try. Setup the A band of your radio to VFO position. Install the repeater output frequency: 145.49 MHz with a negative offset and a tone of 103.5 PL. Set power for 5 watts. Listen for a bit to make sure no one is talking. Then push the transmit switch and Identify your signal with your Ham Call. If the repeater hears your signal it will respond with a beep. Congratulations you have programmed the repeater. Now save you VFO information to a memory cell and you will be recall and use in the future.

IRLP/echo link or DStar reflectors can get your group up via internet to the world or a tie to cell phone. 70cm is a very usable Band in Seattle area. Most likely you will just use 1 or 3 repeaters. If you travel you can pick repeaters from the internet for the trip.

With respect to setting up for Repeaters, you need to pick the band, frequency of repeater output, offset, tone, the mode and power required to reach the repeater. Get on the repeaters you plan to use and get the experience of what works given your location. Once you move out of the simplex range go to the repeater. You can build up your own user data base as to what works well given your location and add them to your memory list. Give a repeater a try.

Repeaters of interest in area.

Repeaters in Western area -- near Scout Camps. Link to find Repeaters. http://www.bing.com/maps/?v=2&cp=44.198297~-116.847504&lvl=6&dir=0&sty=r&cid=5033E9BDF59266A6%218347

Repeaters in Repeater Book… http://www.repeaterbook.com/repeaters/Display_SS.php?state_id=53&loc=%25&county_id=%25&status_id=%25&coverage=wide%25

Memory's used for a very simple group example

Ok, now how many frequencies are we using: Two calling frequencies, four simplex frequencies and two repeater frequencies? This will make up the first ten to twelve of the frequencies that will be on your machine. The best way is to learn to program them manually and to make all the memory locations own your family machines the same and these

will be used with your group. List the simplex and repeater frequencies you plan to use and put them in the radio's memories.

Starting up and programming the new radio

Your New Best Friend – The Radio's Instruction Manual

1) Start at the back on the manual and determine the bands and frequency range the radio will send and receive; plus the power levels.
2) Next work though the buttons on the radio -- this is a little complicated since each button will do more than one function. Look at the picture in the manual.
3) Try to learn how to set up a simplex frequency in VFO position.
4) Let's work on 2 meters first and then 70cm.
5) Get out the frequency and band plan for each of the above bands and confirm we are legal --- note plans below
6) Lets do a little planning -- Lets program all the family radios' memories the same.
    a) Memory location 1 to 10 will be simplex frequency – analog or digital either 2m or 70 cm
    b) Memory location 11 to 19 Calling Frequency and APRS
    c) Memory location 20 to30 repeaters – analog or digital
    d) Memory location 20 -- 2 meter LWHC repeater; Memory 021 -- 70 cm LWHC repeater
    e) Memory location 022 to 030 will be available for more repeaters.
    f) Memory 50+ scout camp repeaters 2m and 70 cm
7) Review the Frequency and Band chart below -- remember HAM can broadcast anywhere in the Band Plan -- but the band Plan is a general agreement -- Always identify after any test or call. If you happen to hit an active simplex frequency pick another one.
8) Learn how to move to the VFO mode and install a frequency. Using the national calling frequency; 2 meter freq as an example -- learn out to key in 6 numbers 146.520; Note depending on the radio there could be VFO A and VFO B
9) Adjust the power to lowest level, program in the mode (FM or DV) and make sure the antenna in screwed in tight.
10) Adjust volume and squelch. Push to talk quickly and ID with your call sign.
11) Learn to store to each memory. Program all simplex frequencies on your list...
12) Now there should be 20 memories with the simplex frequencies you can use for radio to radio on simplex -- Keep power low -- can remain on all the time -- charge each night....Use the radio frequently during the day to see when it will work and when it want. That's Amateur Radio fun trying to make it work.
13) Now Program in Repeaters -- for now use just LWHC repeaters.
14) Look up the repeater info on the internet -- Need repeater output frequency, tone, offset and mode. Here set the radio power to 5 watts. Once these values are determined. Save the 2 meter in memory location 020 and the 70 cm in memory location 021.
    a) Now you should have 8 to 10 stations on each radio A and B with 30+ memory locations. Refer to these memories as channels. Tell the group to move to Channel 5 and that will give all the information to operate on that frequency.

Need help.... Check with LWHC for an Elmers for help. Bring the radio and instruction manual to a meeting.

15) Feel free to ask for help that's how we all learn.... Amateur Radio is continuous learning -- and you have to be willing to help others once you learn. It is very important to operate your radio each day. Use then in the family and make some repeater calls. Carry the instruction manual with you.

STEM or Applied STEM activities

STEM or Applied STEM merit Badge activities are a gift via Ham radio to particularly the youth. STEM- Science, Technology, Engineering and Applied Math are the areas that can open up for youth with the right activity plan. Scouts have really good STEM first exposures to Electricity, Electronics and Radio those merit badges. Radio waves are part of the electromagnetic spectrum; and hence radio is a study of applied radio frequency over the HAM Bands. Then look at how the various modes on board the radio are modulated. STEM gifts include: RF bands, frequencies, tons of communication modes, power supply sources, electricity magnetic fields, antennas, computer programming, Physics of electromagnetic waves, Chemistry of atom structure, reversible oxidation / reduction reactions, Management skills/applications and applied math. The HandHeld or radios you or your group work with can began to open the STEM door. The bottom line is look at what is being supplied with the radio. It is the capabilities on board that what you pay for. So set your criteria; make list of handhelds and then down load the performance specifications on each. Check utube for performance videos. Then list a line of your wants and list what is supplied with the units delivers. There is an advantage of sticking with the same model for whatever radios are used in your group.

Band Plan ---2 Meters (144-148 MHz):

144.00-144.05	EME (CW)
144.05-144.10	General CW and weak signals
144.10-144.20	EME and weak-signal SSB
144.200	National calling frequency
144.200-144.275	General SSB operation
144.275-144.300	Propagation beacons
144.30-144.50	New OSCAR sub band
144.50-144.60	Linear translator inputs
144.60-144.90	FM repeater inputs
144.90-145.10	Weak signal and FM simplex (145.01,03,05,07,09 are widely used for packet)
145.10-145.20	Linear translator outputs
145.20-145.50	FM repeater outputs
145.50-145.80	Miscellaneous and experimental modes
145.80-146.00	OSCAR sub band
146.01-146.37	Repeater inputs
146.52-146.58	Simplex

146.52 National Simplex Calling Frequency

146.61-146.97 Repeater outputs

147.00-147.39 Repeater outputs

147.52-147.6 Simplex

147.60-147.99 Repeater inputs

Band Plan 70 Centimeters (420-450 MHz):

420.00-426.00 ATV repeater or simplex with 421.25 MHz video carrier control links and experimental

426.00-432.00 ATV simplex with 427.250-MHz video carrier frequency

432.00-432.07 EME (Earth-Moon-Earth)

432.07-432.10 Weak-signal CW

432.10 70-cm calling frequency

432.10-432.30 Mixed-mode and weak-signal work

432.30-432.40 Propagation beacons

432.40-433.00 Mixed-mode and weak-signal work

433.00-435.00 Auxiliary/repeater links

435.00-438.00 Satellite only (internationally)

438.00-444.00 ATV repeater input with 439.250-MHz video carrier frequency and repeater links

442.00-445.00 Repeater inputs and outputs (local option)

445.00-447.00 Shared by auxiliary and control links, repeaters and simplex (local option)

446.00 National simplex frequency

447.00-450.00 Repeater inputs and outputs (local option)

Example Group Net.

Set up and use the Group Net made up of Group's Hams, calls, frequencies and modes

- List the Hams in the Group
- Show in red the Group simplex frequency for the group

- Add other Group’s channels with frequency and mode
- Save for all events and gatherings.
- Practice the different style of nets.   Thanks to LWHC for example of Group event net

Lake Washington Event Net				432.22 MHz	Low Power	145.61 DV, 432.21 DV, 147.54 FM 432.22 FM 146.42
			Repeaters	145.49	433.00 DV	Split repeaters where possible
First Name	Last Name	Calls	TIME IN	TIME OUT	DATE	Notes

How to Run a "Directed" Net:

Identify yourself (call sign, first name, & if using a club or group call sign - can substitute that call sign for your personal call sign)

Give a SHORT (I repeat - SHORT) description of reason for the NET

State that this is a DIRECTED / CONTROLLED NET & that all traffic is to go through NET CONTROL.

State what you want participants to do. Emphasize that they need to speak clearly & slowly.

You decide what order you want to have participants check in.

Be polite, talk clearly & slowly. Take a deep breath & relax.

After each person makes a contact, acknowledge them by name or call sign so they know you heard them.

REMEMBER - NET CONTROL is IN CONTROL. You are the traffic cop. You are the boss.

Any questions - remember previous statement - NET Control is IN CONTROL!

How to Change Net Control Operators:

State that you are transferring net control. State call sign & name of new net control & date & time of transfer.

When Ready to Close the Net:

If using a repeater frequency - thank the repeater owner(s) for use of their repeater.

State you are closing down the net, give current date & time, & give your personal & club or group call sign.

At this point you can state that the frequency is now open for general traffic.

A - ALFA	**G - GOLF**	**M - MIKE**	**T - TANGO**
B - BRAVO	**H - HOTEL**	**N - NOVEMBER**	**U - UNIFORM**
C - CHARLIE	**I - INDIA**	**O - OSCAR**	**V - VICTOR**
D - DELTA	**J - JULIETT**	**P - PAPA**	**W - WHISKEY**
E - ECHO	**K - KILO**	**Q - QUEBEC**	**X - X-RAY**
F - FOXTROT	**L - LIMA**	**R - ROMEO**	**Y - YANKEE**
		S - SIERRA	**Z – ZULU**

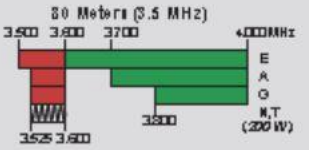
US Amateur Radio Bands

Effective Date March 5, 2012

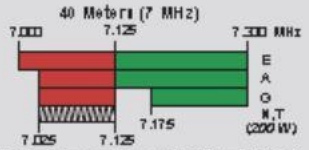
Published by ARRL The national association for AMATEUR RADIO®
www.arrl.org
225 Main Street, Newington, CT USA 06111-1494

US AMATEUR POWER LIMITS

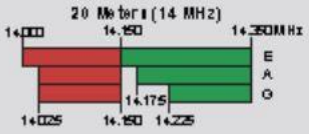
FCC 97.313 (a) An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

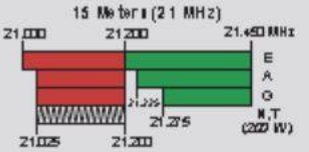


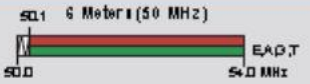
General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated output of 100 W PEP. Permitted operating modes include upper sideband voice (USB); CW; RTTY, PSK31 and other digital modes such as PACTOR III as defined by the FCC Report and Order of November 18, 2011. USB is limited to 2.8 kHz centered on 5332, 5348, 5353.5, 5373 and 5405 kHz. CW and digital emissions must be centered 1.5 kHz above the channel frequencies indicated above. Only one signal at a time is permitted on any channel.



Phone and image modes are permitted between 7.075 and 7.100 MHz for FCC licensed stations in ITU Regions 1 and 3 and by FCC licensed stations in ITU Region 2 West of 130 degrees West longitude or South of 20 degrees North latitude. See Sections 97.305(c) and 97.307(f)(11).
Novice and Technician licensees outside ITU Region 2 may use CW only between 7.025 and 7.075 MHz and between 7.100 and 7.125 MHz. 7.200 to 7.300 MHz is not available outside ITU Region 2. See Section 97.301(e). These exemptions do not apply to stations in the continental US.







*Geographical and power restrictions may apply to all bands above 420 MHz. See the ARRL Operating Manual for information about your area.

All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	10.0-10.5 GHz*	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3300-3500 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	75.0-81.0 GHz	All above 275 GHz

* No pulse emissions

KEY

Note:
CW operation is permitted throughout all amateur bands.

RTTY and data above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.

Test transmissions are authorized above 50 MHz, except for 219-220 MHz.

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems only

E = Amateur Extra
A = Advanced
G = General
T = Technician
N = Novice

See ARRL Web at http://www.arrl.org/ for detailed band plans.

ARRL
We're At Your Service

ARRL Headquarters
225 Main Street, Newington, CT 06111-1494
860-594-0200 (Fax: 860-594-0259)
email: hq@arrl.org

Publication Orders
www.arrl.org/shop
toll-free: 1-888-277-5289 (860-594-0355)
email: orders@arrl.org

Membership/Circulation Desk
www.arrl.org/membership
toll-free: 1-888-277-5289 (860-594-0338)
email: membership@arrl.org

Getting Started in Amateur Radio
toll-free: 1-800-326-3942 (860-594-0355)
email: newham@arrl.org

Exams: 860-594-0300 email: vec@arrl.org