The Make Operating Radio Easier (MORE) Project

BACKGROUND

One need only listen to Amateur Radio broadcasts for a short while (especially during a contest) to realize that there are relatively few high-pitched voices (such as from youth and non-males) in the mix. Estimates of licensees identifying as female have remained fairly constant at about 15% in U.S. surveys since the early 1990s. Non-males, of all ages, have had a more difficult path to entry into Ham Radio. As an example, the largest Scouting event in the world, Jamboree on the Air (JOTA), had its origins in 1957 <http://www.arrl.org/jamboree-on-the-air-jota> and now attracts the participation of over a million Scouts and Guides world-wide. There, the gender disparity is very evident, with only 1/6 as many girls to boys participating. In the USA, girls have been precluded (until recently) from taking the very popular Boy Scout Radio Merit Badge course (which teaches about 2/3 of the material needed to get the initial FCC Technician license), with no similar offerings in the Girl Scout or 4H communities.

Current statistics for youth are more elusive since the FCC stopped posting birthdate information in their database, but they too have also long been underrepresented in the hobby, as early quotes attest:

> *Amateur radio is growing older, more mature. It has long been more than just a hobby for the youngsters: it has now gotten well beyond their reach (in terms of cost and complexity).* QST Magazine May 1938.

> *Amateur radio needs new blood and too many youngsters never even heard of ham radio... What we need is lots more teenagers raising the roof at hamfests and ... shuttling around all the bands.* CQ Magazine August 1948.

In July 2020, the Institute of Electrical and Electronics Engineers (IEEE) featured an article by Julianne Pepitone <https://spectrum.ieee.org/telecom/wireless/the-uncertain-future-of-ham-radio> with the headline "*Software-defined radio and cheap hardware are shaking up a hobby long associated with engineering.*" Howard Michel, former CEO of the American Radio Relay League (ARRL) was quoted there as saying:

> *When our president goes around to speak to groups, he'll ask, 'How many people here are under 20?' In a group of 100 people, he might get one raising their hand.*

Michel goes on to say:

> *There's something about this post-9/11 group, having grown up with technology and having seen the impact of climate change. They see how fragile cellphone infrastructure can be. What we need to do is convince them there's more than getting licensed and putting a radio in your drawer and waiting for the end of the world.*

PROJECT GRANT & GOALS

Internet network 44, known as the AMPRNet™, was allocated to Amateur Radio in 1981, for use in conducting scientific research and experimentation with digital communications. ARDC (Amateur Radio Digital Communications) is a non-profit public benefit California corporation that was formed with AMPRNet funds to further the goals of advancing the state of the art of Amateur Radio networking, and to educate Amateur radio operators in these techniques. ARDC has funded this project as an AMPRNet grant intended to *Make Operating Radio Easier (MORE)* for individuals in the USA, to help narrow the gap for those with less participation and access to the Amateur Radio community.

The MORE Project aims to reduce both gender and age imbalances in Ham Radio, through education and hands-on activities. The hope is that our mentoring, proactive intervention, and inclusivity will help expand Ham Radio's outreach, and also (as knowledge in radio technology can be a gateway for STEM careers) provide encouragement for further exploration and training in many related fields.

The ambitious, but do-able goals of MORE are to:
- train and license 500 new US Radio Amateurs, 50% non-male, and 60% between ages 12 – 18;
- encourage understanding of digital and analog aspects of radio communication through hands-on activities and explorations, including Software Defined Radio (SDR); and
- help these new Hams learn basic communications protocols by observing HF operations and using their own VHF hand-held (HT) radios to make and receive contacts. Getting On The Air (GOTA) plays an important role in the long-term retention of licensed Hams.

STAGE 1:
- The Project Manager (PM) will identify 10 Radio Amateurs who hold a General Class FCC license (or above), who are Volunteer Examiners (VEs) or are interested in becoming VEs.
- They must be willing to devote a total of 30 hours over 10 months to teaching Technician-level classes to groups of 10 students (including time for preparation, record-keeping and feedback).
- Due to COVID-19, some classes may be virtual.
- At least half of the prospective (or current) VEs should be non-male.
- Those who are not already VEs must become accredited within 45 days of agreeing to participate. Information will be provided about the accreditation process, as needed.

STAGE 2: (This can be performed concurrently with Stage 1 as the VEs are becoming accredited.)
- The PM will identify individuals (who may include some of the VEs in Stage 1) that have previously taught the Technician level materials to individuals who want to become licensed Hams. These will be referred to as Super-VEs.
- The Super-VEs will work with the PM to develop materials suitable for an interactive/virtual classroom experience, with the goal of understanding the content as well as passing the test.
- VEs will familiarize themselves with the materials and provide feedback to those who are creating the virtual classroom materials.
- VEs will be issued HF radios (and peripherals) to use for demonstrating Ham Radio operations.

STAGE 3:
- Each of the 10 VEs (including the Super-VEs) will work with the PM and the participating entities (IEEE PCJS, the David Sarnoff Radio Club, and ARC *squared*) to perform outreach in order to identify 20 groups of 10 students who will take the Technician course and license test.
- Each VE will train 2 groups of 10 students, so 200 students will be trained and tested.
- The demographic of the student population should attempt to be at least 50% non-male and at least 60% between ages 12-18.

STAGE 4:
- The PM will work with the 10 VEs to develop an additional hands-on module involving Software Defined Radio (SDR), that will be part of the course they are teaching, but this content will not likely be part of the Technician license exam.
- The VEs will distribute the SDR kits to their students, conduct the activities in the SDR module, and report back the results of this training to the PM, via surveys, forms, interviews, etc.

STAGE 5:
- The PM will work with the 10 VEs to develop a second hands-on module involving the students Getting On The Air (GOTA) using 2 Meter HTs that will be individually issued, as each student confirms the receipt of their Technician license.
- The VEs will distribute the HTs, conduct the activities in the GOTA module, and will provide feedback to the PM (as in Stage 4).

STAGE 6:
- The PM will communicate with other localities in order to replicate the project with 15 additional VEs, each teaching 2 classes of 10 students, for a total of 200 + 300 = 500 students over the course of the entire project.
- Each VE will receive teaching materials, an HF radio, and the SDRs and HTs for themselves and their students.

STAGE 7:
- The PM will collect all feedback and write up the project as a technical paper to be submitted to a conference and/or magazine, as appropriate.
- If time permits, the materials generated by the project may be released in a format that enables them to be hosted and distributed via the Website(s) of one or more of the Participating Entities.

A Roles Spreadsheet showing activities that will be performed by the participants is attached.

TIMELINE

The total project is planned to take two years (24 months), as follows:
    Stage 1 --> 2 months
    Stage 2 --> 2 months (concurrent with Stage 1)
    Stage 3 --> 10 months
    Stage 4 --> 10 months (concurrent with Stage 3)
    Stage 5 --> 2 months (beginning around month 7)
    Stage 6 --> 10 months (beginning around month 9)
    Stage 7 --> 6 months (partly concurrent with the completion of Stage 6)

A Step Chart showing the juxtaposition of the stages with the timeline is attached.

PARTICIPATING ENTITIES

A) IEEE <https://www.ieee.org> and IEEE PCJS <https://site.ieee.org/pcjs/>

The parent body of IEEE Princeton / Central Jersey Section (PCJS) is the IEEE, which has some 400,000 members world-wide and is sub-divided into 10 Regions, of which PCJS is part of Region 1. IEEE Region 1 has about 35,000 members who reside or work in Northern NJ, NY, CT, RI, MA, VT, NH and ME. PCJS abuts IEEE Region 2, which is similar in membership and encompasses PA, WV, OH, DE, MD, Washington DC, and parts of IN and KY. IEEE's Regions 3-6 cover the rest of the USA, and Regions 7-10 span the world, to complete the global membership. The Global and U.S. Regional Maps of the IEEE are attached. The broad range of the IEEE allows for the cross-cultural communications and exploration that Ham Radio also encourages.

With IEEE PCJS well-positioned at the base of Region 1, our project will begin in Northern and Central NJ, but is planned to spread to IEEE and Ham Clubs in nearby Southern NJ, PA, NY and DE. Our long-range hope (following the successful conclusion of the MORE project) is to mentor and propagate the project to all 25 IEEE Sections and Sub-Sections in Region 1, the 21 Sections and Sub-Sections of Region 2, and then provide outreach to the remaining Sections in Regions 3-6 in the USA, thus gaining MORE and MORE Hams! Since training material will be specific to Amateur Radio Licensing in the USA, changes would be needed for other countries around the globe, but the international IEEE Regions and Sections could be encouraged to adapt MORE to their localities.

IEEE PCJS serves some 3,500 local members and has many active Chapters and Societies, including various sub-groups that focus on topics related to this project, such as: Antennas and Propagation [AP], Broadcast Technology [BT], Computers [CS], Education [EdSoc], Microwave Theory and Techniques [MTT], and Signal Processing [SP]. The IEEE's Standards Association [SA] is especially noted for its extensive 802.11 family of wireless communications standards, and SA also plays a major role in ensuring that the standards applied to electrical and electronics systems do not inadvertently create adverse conditions for activities, such as Ham Radio, that rely on the broadcast spectrum. I, and other members of IEEE PCJS, as well as numerous members of the American Radio Relay League (ARRL) have served on standards committees of the IEEE SA. The IEEE's international headquarters happens to be located in Piscataway, New Jersey, which makes their meeting rooms potentially viable for our North Jersey MORE activities. Unfortunately, we would not likely be utilizing their facilities in the foreseeable future, due to COVID-19 restrictions, but hopefully this could be considered at a later time. The grant from ARDC is being managed by the PCJS Broadcast Technology Chapter.

All original materials created in the MORE Project will be issued using Creative Commons licensing, by agreement of the IEEE and ARDC. Terms and conditions of this type of licensing are described at <https://www.ieee.org/publications/rights/open-access/oa-terms-conditions-full.html>.

IEEE frequently publishes articles of interest to Hams, and Ham-related activities are a featured part of IEEE conferences. Two annual conferences of IEEE PCJS -- the Integrated STEM Education Conference (ISEC) <https://ewh.ieee.org/conf/stem/> and the Trenton Computer Festival (TCF) <https://tcf-nj.org> -- directly relate to the educational aspects of this grant, and we plan to involve both conferences in the outreach aspects of the MORE Project.

B) DAVID SARNOFF RADIO CLUB (DSRC)   <http://n2re.org>

The David Sarnoff Radio Club was originally formed on March 6, 1975, as an internal service organization for employees of the former Radio Corporation of America's (RCA) David Sarnoff Research Center in Princeton, NJ. The Club owns and maintains the N2RE repeater mounted atop the former PBS WNJT Channel 52 antenna, adjacent to Route 1 in Lawrenceville, NJ. Prior to COVID-19, the Club would meet at the American Red Cross Central New Jersey Chapter in Princeton, NJ, but currently meetings are held virtually via WebEx.

Now, as an informal, general-interest Amateur Radio Club, DSRC continues to maintain its scientific focus from RCA's research laboratory days, with meetings typically featuring educational talks involving aspects of communications technology. DSRC members are trained for emergency operations and may deploy as unpaid volunteers in the event of statewide and regional disasters to assist the Red Cross with their Princeton station, N2ARC, and also to help operate the W2MER station for the Mercer County Emergency Services Communication Center (MCESCC). Other than providing Amateur radio services on an ad hoc basis, DSRC has no affiliation with either the Red Cross or the MCESCC.

DSRC has long been involved with coordinating and teaching the very popular "Ham Cram and Exam" session at the annual Trenton Computer Festival at The College of New Jersey in Ewing, NJ. DSRC also assists the NJ Scouts in their Radio Merit Badge day each year. Membership in DSRC is open to anyone with an interest in Amateur radio. There are no dues. To become a member, one simply attends a Club meeting and fills out a membership application.

C) ARC^2 (ARC *squared*)   <http://www.arcsquared.org>

ARC *squared*, or ARC^2, is an informal, unincorporated Amateur Radio Club. The members are Amateur radio operators who serve as uncompensated volunteers in times of emergency or disaster affecting the Northern New Jersey Region. The group is not affiliated with the Red Cross, nor does it receive any funding from the Red Cross. The base station, NJ2RC, of ARC^2, is located in the Disaster Operations Center of the American Red Cross of Northern New Jersey Chapter in Fairfield, NJ, and is staffed during emergencies by ARC^2 members who have Amateur radio licenses.

ARC^2 members' experiences with 9/11, Superstorm Sandy, Hurricane Katrina, and other humanitarian disaster response efforts, locally and internationally, have underscored the need for reliable communications in the effective distribution of mass care and to provide situational awareness. These efforts demonstrate the way that critical infrastructure, interoperability, and personnel enable communications with others outside of the Red Cross family who are responding to a national or regional calamity, to help navigate the disaster-struck region and to coordinate aid.

Membership in *ARC^2* is free and open to anyone, whether a licensed Ham or not. *ARC^2* provides regularly scheduled training on all three levels of Amateur licenses, monthly test sessions for Amateur licensing, as well as hands-on training and experience with the Club's equipment.

MORE PROJECT MANAGER -- CONTACT INFORMATION

Rebecca Mercuri, Ph.D., K3RPM (Extra Class). 609/587-1886, 215/327-7105   rtmercuri@ieee.org 116 Grayson Avenue, Hamilton, NJ 08619. Past Chair and Member of the Executive Committee of IEEE PCJS, also Vice Chair of the ACM / IEEE Computer Society Chapter. Radio Club Memberships: DSRC and ARC *squared*.

Timeline for the MORE Project

Stage	Duration	PM	Super VEs	VEs	Students
1	2 mo.	Recruit 10 Super VEs & VEs	Recruit VEs & Potential New VEs	Obtain VE Authorization	
2	2 mo.	Develop Course Get and Distribute Gear for VEs	Work with PM to Develop Course Receive Gear	Familiarize with Course Materials Receive Gear	
3	10 mo.	Develop SDR Course Get & Distr SDRs Assess Feedback	Recruit Students Teach Students Feedback to PM	Recruit Students Teach Students Feedback to PM	Identify Interest Pre-Course Survey Take Ham Course
4	10 mo.	Assess Feedback Revise Course as Appropriate	Test Students Teach SDR Feedback to PM	Test Students Teach SDR Feedback to PM	Take Exam Learn SDR Feedback to VEs
5	2 mo.	Develop GOTA Order & Distr HTs Assess Feedback	Conduct GOTA Feedback to PM	Conduct GOTA Feedback to PM	Receive HTs GOTA! Feedback to VEs
6	10 mo.	Assess Financials Improve Course & Activities Based on FB

Recruit 15 more Super VEs & VEs Get and Distribute Gear for New VEs Assess Course FB Assess SDR FB Order & Distr HTs Assess GOTA FB | Improve Course Work with new VEs Receive Gear Recruit Students Teach Students Feedback to PM Test Students Teach SDR Feedback to PM Conduct GOTA Feedback to PM | Get VE Authorization Familiarize with Course Materials Receive Gear Recruit Students Teach Students Feedback to PM Test Students Teach SDR Feedback to PM Conduct GOTA Feedback to PM | Identify Interest Pre-Course Survey Take Course Take Exam Feedback to VEs Learn SDR Feedback to VEs Receive HTs GOTA! Feedback to VEs |
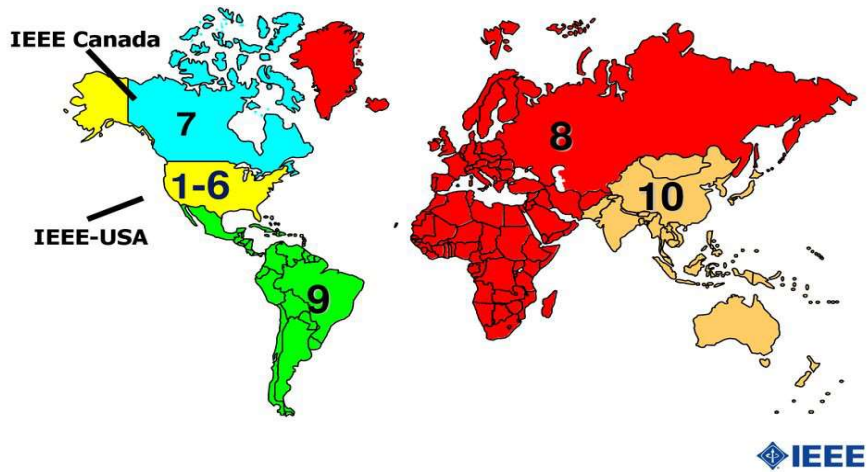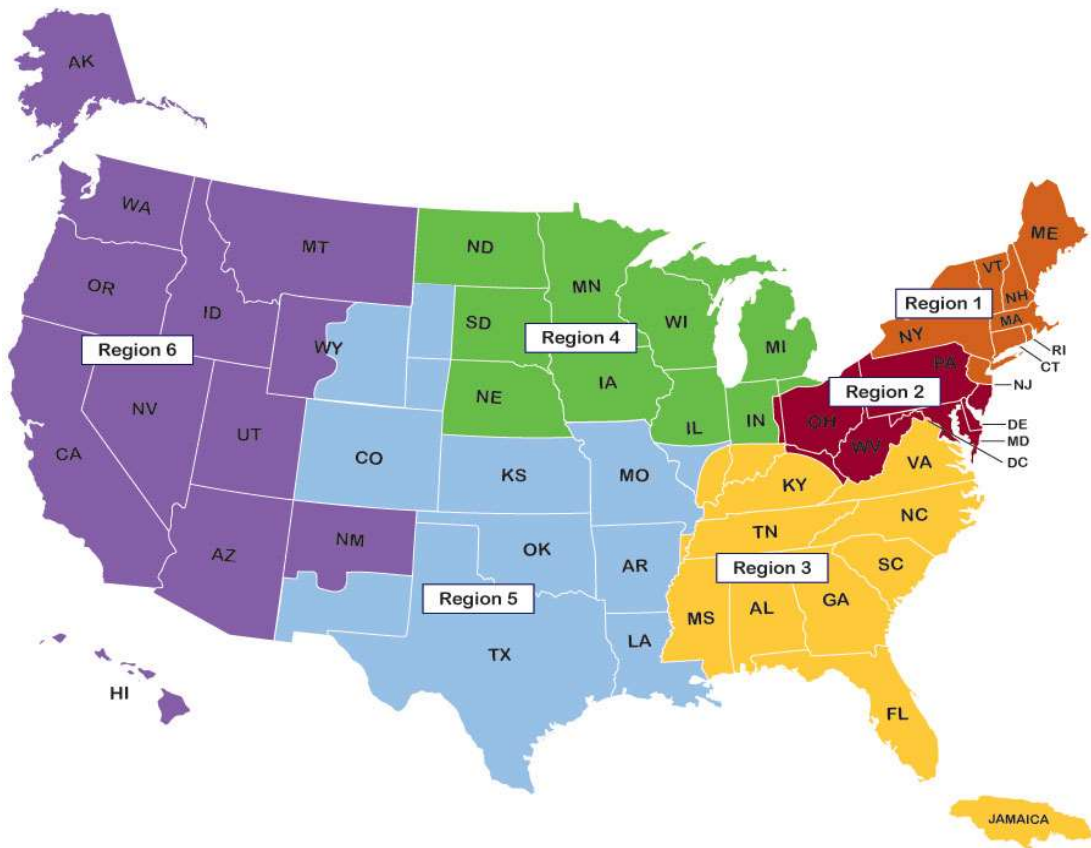| 7 | 6 mo. | Complete All Assessment Write & Distribute Final Report Submit for Publication | Finish teaching, exams, GOTA Submit Final Report to PM | Finish teaching, exams, GOTA Submit Final Report to PM | Retests and GOTA if not Completed |

Roles Spreadsheet

Step Chart

THE GLOBAL & U.S. REGIONAL MAPS OF THE IEEE

Map by Bob Hannah, past President of IEEE Canada

<https://www.ieee.org/communities/us-region-map.html>