SPARK

"Seniors Programming Amateur Radio for Kids"

Putting the "Amateur" back into Amateur Radio

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Version 1.0

My inspiration for this proposal actually took place over fifty years ago. When as a youth of 15, I sent "CQ" (calling any amateur station) and signed with my newly minted FCC issued call sign "WNØKXS".

To my utter amazement, through the speaker on my Hallicrafters S-19R receiver amid the chirps, whistles and static, I heard not one but two stations responding to my call! Picking the loudest of the two signals and with sweaty palms I tapped "5-9-9" on my code key giving the calling station the best "readability, strength, tone" signal report. I didn't want to lose my first contact by giving he or she a marginal signal report even though I hadn't even glanced at the S-19R's "S" meter.

The simple exchange was much too brief to qualify as a "QSO" (conversation) in ham speak, but it forever gave me a heartfelt love for this exciting medium we label simply "radio". Beginning in high school and for the next 35 years I worked professionally in radio (which included a brief stint in television) and on retiring in 2002 returned to the excitement of amateur radio becoming licensed as KC0QCO in 2003.

My inspiration for SPARK has grown out of the past five years during which I served as chair for the local ham club's scholarship award. Our group, the South East Metro Amateur Radio Club (SEMARC) established the award in 2008 as a memorial to the club's founder and first president, David E. Harrell, K0BTE. "Dave" as he was affectionately known organized hams from Cottage Grove, MN and surrounding communities into the area's first formal ham group in 1987.

Committee members Dick Roberts, N0UC; Richard "Skip" Jackson, KS0J; John Regan, KA0HYR and myself have worked with area school administrators to establish the $500 scholarship within portfolios of eight area schools. These include six public high schools: Cottage Grove Park, Woodbury, East Ridge, Hastings, So. St. Paul and Simley of Inver Grove Heights and two private schools: New Life Academy and the Math and Science Academy, both in Woodbury.

While amateur radio incorporates all the elements of science, technology, engineering and math, known more popularly as the STEM disciplines, it has become apparent to us that while the school administrators acknowledge the generosity of the club, there are no mechanisms within their systems to promote it.

Our first award was made to Caleb Boe, KD0OZK, of Cottage Grove in 2011. Caleb, a high achiever academically and a superior applicant in all other particulars, did not come to us from either an area public or private school but rather was "home schooled".

Now that the scholarship has been established, criteria set and the first award made, I see this proposal as one which further memorializes Dave Harrell's passion for teaching kids radio fundamentals and helping them earn their amateur license. Early photos from the club's first 25 years show Dave demonstrating a piece of ham gear to an attentive group of Cub Scouts. Current members also recall how he loved to teach kids Morse Code which was still required to pass the license test. The Morse Code requirement has since been dropped.

During this year, 2014, with the American Radio Relay League (ARRL) celebrating 100 years of serving amateur radio operators and working to protect the amateur's band of frequencies from incursions by other interests, I believe this proposal is timely.

At the time I was first licensed, 1953, and years since certain training models and teaching methods served the amateur community well. Even in rural communities, a youth could usually find a local TV – Radio repairman who was also a ham. He would help us understand the fundamentals behind the questions as we studied for the test. Also, usually a skilled code operator, he would teach us the code and critique our sending to help gain the speed necessary to pass the test.

Dave Harrell and many with similar backgrounds in metropolitan areas such as the Twin Cities filled similar roles. Dave, himself, a video technician for local TV station, KSTP, had the professional experience and education to fulfill this need. Pick up a rural phone directory today and see how many local TV – Radio repair shops are listed.

There have also been dramatic changes during the past 50 years that kids could learn about amateur radio and electronics. "Popular Electronics" and similar magazines have disappeared from retail magazine racks. They have been replaced by publications dedicated to video gaming, computer software and PC's and MAC's. "CQ" may soon appear only in an on-line edition leaving only ARRL's "QST" available in print.

"Radio Shack" which has carried electronic components for many years, recently announced it was closing 1100 stores nationwide. Leo Myerson's "World Radio Labs", Omaha, NE. and Stan Burghardt's "Amateur Radio Supply", Watertown, S.D. have disappeared from the retail scene. Here in the twin cities we still have "Radio City" in Mound but it's not located where a kid might find it.

"HeathKits" which were so popular with my generation have, despite two recent comeback attempts, been relegated to amateur radio history. But we do have several companies that continue to manufacture kits: Elecraft, Ten-Tec, YouKits among them. Any kid lucky enough to come become aware of them, could with some basic soldering skills, build an "entry level" kit.

Any youth today, with sufficient determination, can go to the internet and probably find the necessary components to "home brew" a simple code practice oscillator, however. After all, a recent study by the Kaiser Family Foundation recently found that today's teens spend an average of 54 hours a week "screen time" on both the internet and tv. So, most, are very familiar with "search" techniques.

My concern, and my motivation for SPARK, is not so much for today's youth who have a contact within the amateur radio service, a relative or friend, for example, but for the other 99 percent who have no way of knowing about the service and what it can offer them.

In the March, 2013, QST, Khrystyne Keane, K1SFA noted in her "Happenings" column that "2012 Marks All – Time High for Amateur Radio Licenses" with a total of 709,500 for 2012. But we in the amateur radio community still make up less than one percent of the total U.S. population. (Khrystyne Keane, K1SFA, QST, March, 2013, p. 79)

Those in my generation had many opportunities to come in contact with the general field of "radio science".

Family radios, (and, no, they didn't have any type of "screen") in the stand alone floor models (such as our Zenith) usually were equipped with a "band switch" enabling one to switch from "broadcast" to "shortwave". We weren't always certain what we were listening to, but we recognized foreign languages and some voices who always put a combination of letters and numbers after their names: hams.

Nearly, all news racks carried one or more "electronics" magazines with such enticing headlines as "Build your own Tesla Coil" or similar. Those dealers selling a sufficiently high volume might also carry such magazines as "73", "CQ" and "QST" that were dedicated to "Amateur Radio".

Today, there is virtually nothing in popular media to "spark" the interest of a young person to become aware of "radio science" and by extension "amateur radio". If, by happenstance, one encountered either of these phrases, he or she might "Google" a search and would find information which could lead them into a deeper search.

During our first five years as the scholarship committee, Dick, Skip, John and myself have promoted the scholarship to area school counselors each fall, set up displays and promoted it at area schools' scholarship "open houses", made a presentation describing how amateur radio operators often follow careers in electronics and computer science and worked with an area teacher who applied for an was accepted into the ARRL's "Teacher's Institute on Wireless Technology".
To date we have not had any qualified candidates come forward and apply for the scholarship as the result of any of these activities.

I envision SPARK as a total "stand alone" curriculum independent of area public and private schools. We, in the local ham community, will not be dependent on the long odds of a teacher being hired who is also a ham and who will then spark interest in the fundamentals of radio science / amateur radio licensing.

Such curriculum will be based on three fundamental precepts formulated by Dick, Skip, John and myself, one: technology changes but not the basic science. "Smartphones" and other modern "mobile devices" still depend on transmitting and receiving radio frequency energy just as in the very earliest days of radio. Two: kids today need a much deeper and broader understanding of radio science fundamentals than simply rote memorization of answers in order to pass a license test. Three: students learn best when fundamentals are repeated and reinforced throughout their school career.

Finally: the curriculum will be based on the lecture / lab model. The lab will be based on learning by doing "hands on" experiments. Most importantly, the lectures / labs must be FUN !

In order for FUN to become part of the process, several intellectual processes must be in place. First: the student must bring to lectures and labs an intellectual curiosity, "an inquiring mind". No amount of fanning a "dead ember" can lead to a "flame" of learning.

Second: an instructor who rises above the level of mere competency in the subject matter has the ability to not only educate but motivate. We all have memories of "gifted" teachers who motivated us to go deeper into the subject simply by fanning that "spark" of interest we brought to class.

Gifted teachers share their enthusiasm for the subject with such an intensity that inspires us to "stretch" intellectually beyond limits we did not think possible. In the words of John Quincy Adams, "If your actions inspire others to dream more, learn more, do more and become more, you are a leader."

Teachers with a command of their subject become the leaders who students willingly follow and who themselves one day become leaders. Students become absorbed in the "fun of doing"; one of the most under-rated "teaching aids" ever devised.

My vision for the SPARK curriculum is that it have a strong instructor component. There are many capable teachers now who instruct kids in amateur licensing classes. My proposal is to develop a curriculum that is both more basic and more advanced than the scope of today's licensing requirements. Such an expansion will require much more of instructors. Therefore, another key of the proposal is developing a class of instructors to be known as "Volunteer Instructors" (VI's) who will meet certain requirements and be accorded commensurate respect just as today's "Volunteer Examiners" (VE's).

A second major component is developing laboratory projects allowing kids to "learn by doing" just as now in schools' science classes: chemistry, physics and other disciplines. The intellect, the "cognitive" component, must necessarily be engaged for learning to take place. But, learning is enhanced, in disciplines that provide "hands on" opportunities through lab experiments. Radio science allows for many such opportunities for "tactile experience".

In the words of Forrest M. Mims III, in his book "Getting Started in Electronics" he states "Remember this: you will learn more from building, testing and using electronic circuits than by simply reading about them." (Forrest M. Mims III, "Getting Started in Electronics", Master Publishing, Inc., Niles, IL, p. 5)

The SPARK curriculum includes but is not necessarily limited to the following Basic Fundamentals:

*Components of Electricity, Ohm's Law

*Meters: analog, digital

*Schematic Diagrams, Block Diagrams

*Resistors, Capacitors, Inductors

*Transformers

*Semiconductors: Diodes (including Light Emitting Diodes), Bipolar Transistors, Unijunction Transistors, Field Effect Transistors

*Digital Integrated Circuits: Binary, Transistor Gates, Sequential Logic

*Assembling Basic Electronic Circuits: Code Practice Oscillator, Mark Spencer, WA8SME; Dave Hassler, K7CCC, arrl.org/no-code-cpo-version 1, 10-30-03 (app. 2)

Study Aids: Doug DeMaw, W1FB, "Meet the Versatile Diode", QST, July, 1984, p. 30-33; Doug DeMaw, W1FB "The Magic of Transistors", QST, August, 1984, p. 38-41

SPARK incorporates the "Technician Class License" course (app. 3). Students will have an opportunity to take the Technician Class test at the conclusion of the course administered by a SEMARC Club VE.

An intermediate "hands on" project is Mark Spencer, WA8SME's "An Almost-No-Solder Electronic Organ" a successor to the "No-Solder Code Practice Oscillator" project, arrl.org/news/features/2004/02/28/1(app.4)

For the advanced instruction, SPARK incorporates "ARRL's Hands-On Radio Experiments" Vol. 1 by H. Ward Silver, N0AX. In the Foreward to the book, he says "The articles of Doug DeMaw, W1FB and Bill Orr, W6SAI, among many others, inspired me to tinker and build and eventually become a professional engineer." He continues "…as hams heat up soldering irons, plug in components and learn what makes their radios work." H. Ward Silver, N0AX, ARRL Publications, January, 2008.

Again, the advanced portion of the course includes but is not necessarily limited to the following:

H. Ward Silver, N0AX, "ARRL's Hands-On Radio Experiments" ARRL Publications, January, 2008:

"Experiment #1 – The Common – Emitter Amplifier: Why the CE amplifier? It is the most common amplifier configuration of all – it is found in analog and digital circuits, from dc to microwaves and it is made of discrete components and fabricated in integrated circuits (IC's). (p. 17)

"Experiment #2 – The Emitter – Follower Amplifier: "This handy amplifier doesn't offer much in the way of voltage gain (it has none), but it provides buffering or isolation for sensitive amplifiers and muscle for output circuits for driving loads like headphones or coaxial cables." (p. 19)

"Experiment #6 – Recctifiers and Zener References: This month begins a three – part series of experiments on power supply circuits. We'll start with a basic rectifier and a Zener diode voltage reference. (p. 21)

"Experiment #9 – Designing Drivers: Transistors make great switches as well as amplifiers. In fact, computers are built of millions of transistors acting as switches. Any circuit that controls or supplies power to a heavy load is called a driver. In this experiment we will learn how to make a transistor switch that can turn a heavy load on and off reliably. (p. 21)

"Experiment #12 – Field Effect Transistors: The field effect transistor, or FET, is an attractive replacement for bipolar transistors in switches and amplifiers. Why? The FET offers high input impedance, excellent gain and easy biasing. We'll revisit the first "Hands-On Radio experiment and find out how these characteristics fit the common – emitter design. (p. 27)

"Experiment #19 – Current Sources: Voltage and current sources are the twin power sources of electronics. Batteries and power supplies do a credible imitation of an ideal voltage source." (p. 29)

H. Ward Silver, N0AX, "ARRL's Hands – On Radio Experiments", ARRL Publications, January, 2008 (continued)

"Experiment #3 – Basic Operational Amplifiers: Op – amp is an abbreviation for operational amplifier, a term coined 70 years ago. Complicated mathematical equations were often solved by analog computers. Amplifiers were used to add, multiply, integrate, or perform other "operations" on signals. (p. 35)

"Experiment #17 – The Phase – Shift Oscillator: Any system having gain and a little output to input feedback can quickly become an oscillator. Anyone who has operated a public – address system can attest to that fact! This month we'll look at a very basic circuit that illustrates the fundamental principles of oscillators – the phase – shift oscillator." (p. 85)

As the SPARK curriculum is developed and refined, other experiments by H. Ward Silver, N0AX first volume could be added. His second volume has just been published which offers further experiments.

ARRL has also just published a new book, "Radio Science for the Radio Amateur" with the subtitle "Ham Radio and The Pursuit of Scientific Exploration and Discovery" by Eric P. Nichols, KL7AJ which pulls together many aspects of electronics. This book could provide new experiments for an advanced SPARK class.

My inspiration for SPARK really began in October of 2010 when as one of several SEMARC members volunteering with the local 'scouts "Jamboree on the Air" JOTA. SEMARC member and local scout leader, Dan Franz, WD0GUP, has led he local area JOTA for more than ten years. Dan has always provided opportunities for 'scouts to earn communication related merit badges as part of the event.

In 2010, the National Boy Scouts of America offered the opportunity for 'scouts to earn the "Signaling Merit Badge" which was available to them for one year only before being permanently retired.

One of the elements for the badge required the ‘scouts to construct a code practice oscillator (CPO). Dan searched the internet for components and put together kits (verb: kited) Mark Spencer, WA8SME’s and Dave Hassler, K7CCC’s transistor “bread board” no – solder code practice oscillator.

John Regan, KA0HYR, provided a 4 x 8 sheet of plywood for the bases. Their combined efforts provided kits for 45 ‘scouts at $2.72 each. About one tenth the current retail cost of the same CPO design. A pretty remarkable achievement.

The initial JOTA construction session was so popular that ‘scouts told other ‘scouts and two sessions were held later to accommodate the demand. SEMARC volunteers helped at all three sessions.

For myself, also a ‘scout in my youth, it was a remarkable experience. Fifty years of some of the most remarkable technological advancements in recorded history, and yet there were the ‘scouts unspooling copper wire, screwdrivers in hand, studying the schematic and attaching components! The “lights” that accompanies discovery in the ‘scouts eyes were the same as my generation had been.

Dan had glued the schematic diagram to the plywood base. Reaching into plastic bags, they pulled out the components, matched them to the diagram, placed screws where indicated and attached the components to the board and wired them together. The final steps included fitting a copper strap (the code key) and a speaker (about the diameter of a quarter). Depress the copper strap to the screw below and ‘Voila a tone sounded from the speaker! What had been parts in a plastic bag, was now a code practice oscillator.

A generation, raised on social media, targeted by marketers to play icons on screens for instant gratification and who now conducted most of their commerce by plastic cards representing coin of the realm, had just experienced something “magical”.

They listened to the instructor (lecture), watched his demonstration and then put something together (lab) which had only existed as parts in a bag while getting the tactile feedback of working with their hands. Not unlike several youthful generations before, who resurrected a Model A Ford spark coil, transformer, spark gap, capacitor, battery, antenna and telegrapher's code key and communicated by "spark". Today's youth, however, have an easier time of it: they communicate by a series of long and short tones (dits and dahs) or by voice.

This group of 7th to 10th grade 'scouts then adjourned to hallways of the building where they had constructed their code practice oscillators and began sending and receiving "signals".

It's difficult for today's youth to put what they learn in basic radio science in the context of future career goals. But there is substantial evidence that opportunities are out there.

Mike Lindstrom, a retired industrial technology teacher from Coon Rapids, MN, who is active in the Minnesota Technology and Engineering Educators Association notes, "Manufacturing jobs in Minnesota pay an average salary of more than $56,000. But some companies find it hard to find enough qualified workers." Theresa Schermerhorn, human-resources manager for Graphic Packaging, a company in Crosby that builds packaging machines notes in the same article "Shortage of vocational workers starts in high school" and that she recruits across the state for candidates with a background in robotics or computer – aided machines and for individuals who have electrical or mechanical skills. (Associated Press, "Shortage of vocational workers starts in high school", St Paul Pioneer Press, Local, 4-14-13, p. 12B)

Dr. Eric Haseltine, amateur radio operator call sign, AB3DI, in a 2008 interview in CQ magazine offered his take for those planning careers in science and technology.

Dr. Haseltine has been an engineer and an executive at Hughes Aircraft, a theme – park ride designer and an executive for Disney, Director of Research for the National Security Agency (NSA), and Associate Director of National Intelligence for Science and Technology, what he describes as the Chief Technology Officer for the national intelligence community.

In response to a question by the CQ interviewer, Dr. Haseltine responded, "I agree that the decreasing interest of our young people in science and technology is a huge threat to our national security," Eric replied, "But I'm more worried about what causes that, as a threat, than that itself. Is that a symptom or the underlying disease? … If you ask kids, as I have done, 'are you interested in going into science? If not, why not?' the answer I usually get is, 'Oh, it's hard,' or 'Ohh, those are like geeks and nerds.' So somehow the disease is not the fact that kids are choosing fields other than science and technology, but why they would want to 'not' choose that field…".

The CQ interviewer asked Dr. Haseltine whether he thinks amateur radio continues to be relevant to young people today, and if so, how he would promote it to them. "Ham radio, when you look at what it can do," he responded, "really isn't as powerful as what other things can do, like your cell phone, WiMax, WiFi, ultrawideband, Bluetooth and so forth. However, ham radio is much more accessible if you want to get in and do it yourself. If you're not content with just using what other people have already done, but if you want to get in and learn how to do it yourself, ham radio is a lot more accessible. There are a lot of people who can show you how to do it. There's a lot of opportunity for doing new things."

Finally, Dr. Haseltine notes, "I think that (we need to be) able to somehow let kids know that this is a great place to pursue their curiosity, and it's an important place for the future, because the stuff they're doing here isn't some arcane hobby of old (men); it's a place where a lot of the future is going to be invented." (Rich Moseson, W2VU, Dr. Eric Haseltine, AB3DI, CQ, April 2008, p. 13, 19, 21)

An article titled, "No Average Joe" originally published in the April, 2006, issue of the Radio Society of Great Britain's RadCom magazine and published in the July, 2006 issue of QST with the subtitle: "Who better to ask about the future of our hobby than (Dr.) Joe Taylor, K1JT?"

Dr. Taylor "designs cutting edge software 'just for fun'" and is a great fan of Amateur Radio. He also "jointly won the Nobel Prize for Physics in 1993 for discovering a new type of pulsar that opened up new possibilities for the study of gravitation. But many hams will know him best for his work on WSJT software, which has revolutionized weak – signal VHF/UHF communications."

In response to the interviewer's question, "How did you originally get into Amateur Radio?", Dr. Taylor said, "I was a farm boy. My best friend and companion was my brother Hal, just 18 months older. We loved gadgets and machinery. We built crystal sets, taught each other the code, bought the ARRL Handbook, and built radios from junk TV sets. We were licensed as KN2ITP (me) and KN2ITQ (Hal) when I was 13."

Asked where he thought the amateur radio hobby will be in ten years', he said, "I hope that our hobby can remain attractive to smart, technically minded youngsters. To do so, it must evolve in step with rapid advances seen in other areas of communications and electronics. Probably, this will mean an increasing use of high – level integrated devices, both digital and analog, in our radios. This is too bad, in a way, because it can make building your own equipment and understanding how it works more difficult; but surely it is necessary to progress. A good step in the right direction will be to maintain the present high levels of interest in building fairly simple but very capable QRP gear."

As to how we can encourage more people to get involved in amateur radio? Dr. Taylor responds, "Today's young people have a bewildering range of potential activities competing for their attention."

(Dr, Taylor continued), "We need to help some of them find the especially satisfying enjoyment that can come from hands – on experimentation with technical devices and equipment – things that may start as play, but can lead to deep self – motivated education. … I understand some Amateur Radio clubs have been holding "bring a youngster" meetings, and that these have been quite successful." (Alex Kearns, M3LSZ, "No Average Joe", QST, July, 2006, p. 47)

Mike Lindstrom, Dr. Haseltine, and Dr. Joe Taylor, have somewhat differing perspectives, but all agree that today's kids who will become tomorrow's leaders in science and technology must have a grounding in the fundamentals.

Of those responding to QST's "QuickStats" column replied to the question, "If you were to apply for a job, would you mention your Amateur Radio experience on your resume?", 63% yes, it depends on the nature of the job 32% and No 5%. (QST, April 2013, p. 138)

Some defining of terms is in order for my proposal. First, my definitions for SPARK: "Seniors" anyone from high school seniors to retired seniors. "Programming" a plan of action familiar to today's youth as 'a sequence of coded instructions' for a computer, "Amateur" a person who takes part in sports or pursuits for pleasure and not for pay, "Radio" the wireless sending or receiving of signals by means of electromagnetic waves, "Kids" grade school 3rd – 6th grade (Level 1) and middle school 7th – 10th grades (Level 2). (Based on definitions from "Webster's Intermediate Dictionary", Merriam – Webster, Inc., Springfield, MA, 1972)

The goals for my proposal: First, get kids interested in and excited about science (Level 1); Second, get kids interested in and excited about radio science (Level 2); Third, teach kids fundamentals of electronics and prepare them for amateur radio's entry level Technician License exam (Level 2); Fourth, provide kids with a survey of potential science and technology career goals.

Career goals include but are not necessarily limited to: manufacturing, certified computer technicians and network specialists, aircraft avionics specialists, wind turbine maintenance, broadcast engineers (including newly allocated frequencies for community low – power stations), missionaries, international emergency responders, seismologists, meteorologists, volcanologists and as possible communication specialists in the US military to name a few. As technology expands exponentially, career opportunities will expand as well.

The course would include a survey of the "General Radio Operator's License", its requirements and potential applications.

To answer the question which I posed at the beginning of this proposal: "Putting the 'Amateur' back into Amateur Radio" I go back to where our forefathers began 100 years ago, when they began the exciting transition from "spark" to "vacuum tubes".

Our forefathers, had to begin with discoveries by Heinrich Hertz, Faraday, James Clerk Maxwell and others applying the fundamentals of electricity and magnetism. They had to begin at the beginning: they had no other choice. They came to personify the characteristics of amateur radio operators throughout our 100 year history: they were inquisitive, innovative, inventive, flexible and self reliant.

But it all began with the fundamentals. The ARRL published "A Course in Radio Fundamentals" (copyright 1960) by then Technical Director and QST Technical Editor, George Grammer based on the Radio Amateur's Handbook that covered electricity and magnetism up to receivers and power supplies.

Grammer opens Part One with a foreward, "The fundamental facts of electricity and magnetism form the foundation upon which the whole structure of electrical communications rests. The connection between such things as frictional electricity and a radio circuit may frequently seem somewhat obscure, but the concepts of charge and field are basic to both."

(George Grammer continued), "Many of the essential ideas can be demonstrated by experiments using apparatus constructed from odds and ends of metal and wood. There is no better way to grasp the principles involved than to perform such experiments, simple though they are." The he goes on to outline Assignment 1: "Study the 'Handbook sections on electric fields, resistance, capacitance or capacity, and capacitors. Perform Exps. Nos. 1, 2 and 3.

1) What is meant by the electrostatic field, and how is its strength described?
2) Define capacity or capacitance.
3) In what way would you expect the following factors to affect the capacitance of a capacitor? After performing Exps. 2 and 3, what would you give as the reason in each case?
   A) Area of the plates;
   B) Separation between plates;
   C) Dielectric material between plates;
   D) Number of plates, when the capacitor consists of a set of interleaved plates with alternate ones connected together.
4) What is meant by the resistance of a conductor?
5) What is the nature of the force between two electrostatic charges if
   a) Both a positive
   b) One is positive and one is negative;
   c) Both are negative
6) What is the meaning of electromotive force?
7) Nave five conductors and five insulators.
8) What is the fundamental particle of electricity?
9) What is the nature of positive and negative charges?

(George Grammer, "A Course in Radio Fundamentals", The American Radio Relay League, The Rumford Press, Concord, New Hampshire, U.S.A., 1960, p. 7)

As stated earlier, the technology changes, but the basic science does not.

In this proposal, I've identified five traits which I believe, have characterized amateur radio operators since the very earliest days of our service over 100 years ago. Traits, for those who seek to rise to the challenge, and, I believe, that need to be reemphasized in order to put the "Amateur back into Amateur Radio".

The first: "inquisitiveness": curiosity may have harmed the cat, but it surely is necessary to motivate one for delving into the mysteries of science and ultimately radio science. Once one has gained some mastery over the fundamentals, then one must gain some insights into how it all comes together: the applied science.

Previously quoted sources such as Forrest M. Mims III book: "Getting Started in Electronics" and H. Ward Silver's,N0AX "ARRL's Hands-On Radio Experiments" Vol. 1 are excellent. A third is "The Radio Amateur's License Manual" published by the ARRL in 1977 with a foreward by then General Manager, Richard L. Baldwin.

Do we understand terms that often appear in technical articles and product reviews? For example, in the 'License Manual", p. 34: "Reactance Combined: We've already seen that inductive reactance and capacitive reactance have opposite effects: In an alternating voltage, capacitive reactance 'pushes' the current ahead of the voltage, and the inductive reactance 'pulls' it behind the voltage." On p. 34, "Impedance: In broad terms, impedance is a number you get by dividing the voltage applied to a circuit by the current flowing into it."

The "Manual" on p. 47, "The Receiver: The ability of a receiver to find or detect signals is called its sensitivity. Another word which sounds like sensitivity is selectivity which is the ability of a receiver to separate a desired signal from undesired signals. And stability is a measure of the ability of a receiver to continue receiving one particular frequency. In general, then, a good receiver is very sensitive, selective and stable."

"The Radio Amateur's License Manual" (1977) continues on p. 53. "The Transmitter: A basic beginner's transmitter is shown in block form in Fig. 34A. It consists of a crystal oscillator followed by a power amplifier. A crystal oscillator uses a quartz crystal to keep the frequency of the radio signal constant". Of course, these are very basic explanations. Block diagrams, schematic diagrams and text get increasingly complex throughout the balance of the manual.

The second trait is 'innovation". If we in the amateur radio service had not been "innovators" there would not be such a service today. In the "Early 1920's, it was assumed 'the lower the frequency and the longer the wavelength, the better and 'very large antennas and very high power were the rule'. Amateur radio experimenters were the first to discover that the short wave spectrum, far from being a wasteland, could support worldwide propagation." (Geoff Atkinson, VK3TL, IARU, R 3 Director, "The Creation of the "International Amateur Radio Union", ARRL website, February 27, 2014)

The third trait is "inventiveness". If amateur radio operators had not been "inventive", we would not enjoy such receiver improvements as regenerative, tuned radio frequency, direct conversion to superhet designs with continuous improvements in both sensitivity and selectivity. Remembering also: digital tuning, notch filters, roofing filters, attenuators, noise blanking and other features.

Transmitters are no longer "rock bound" depending on a single "crystal" for frequency control but have variable frequency (VFO) and beyond capabilities. For voice transmission, "The year 1947 will go down in amateur radio history as one of the big ones, since it was in October of that year that the first amateur 14-Mc. Single sideband suppressed-carrier transmissions were made."

This quote from: Ward Silver, N0AX, "A History of QST, Volume 1: Amateur Radio Technology, 1915-2013", Amateur Radio Modes and Networks, The American Radio Relay League, 2013, p. 7

The fourth trait is "flexibility". For everyone in our increasingly competitive world, and certainly for amateur radio operators, the ability to remain "flexible" is a key to surviving and thriving. Our Amateur Radio Emergency Service (ARES) operators routinely build flexibility into all their training drills.

ARES operators arriving at a two room city hall of a small unincorporated town on the banks of a river swollen by flood waters know they will not find wall mounted coax connectors for their VHF and UHF radio antennas. They place a 30 ft. aluminum mast with antenna near a window, route the coax feed line through it and are on the air. If HF is required, they know how to set up a Near Vertical Incident Skywave (NVIS) antenna for close in communications.

All operators who set up stations within budget constraints know the value of "flexibility".

The fifth and final trait "self reliance" sums up the previous four. Whether a newly licensed Technician Class or a thirty year veteran Extra, all will at one time or another have relied on one or more of these traits.

In summary, I've discussed how we as a nation have become increasingly urban and how changing technology has eliminated an entire profession: that of the Radio – TV Repairman. Small, rural communities, where I lived when first licensed over 50 years ago, are largely gone and with them potential ham radio mentors.

Even here in the South East metro area of the twin-cities, we do not have a single ham who is a teacher to serve as a mentor.

While no readership surveys are available, a quick scan of a local news stand will typically not reveal any electronics or amateur radio publications. At least one survey has found that today's teens spend an average of 54 hours a week "screen time" on both the internet and tv. We don't know how many Google "amateur radio" to find out more about what it is and how to become licensed. If they find the ARRL website, it does provide links as to how to become a ham and how to find its affiliated clubs, however.

In this SPARK proposal, I've outlined the need for a strong instructor component. An instructor who not only has competency in the subject matter, but one who can draw students into class discussion and elicit inquiry (curiosity) and FUN.

In looking for an instructor we do have many institutions of higher learning in the twin-cities metro and surrounding area that have strong science programs to draw from. In addition to the University of Minnesota (seniors majoring in electrical engineering), we have several two year tech colleges including St. Paul Technical College with full time instructors.

If our club decides to adopt this proposal, we may find it necessary to pay a fee to a senior at the "U" or an instructor from one of the two year colleges. Such instructor would then train Volunteer Instructors (VI's) who would serve as lab assistants during the first time through the SPARK course. The VI's would then move up to instructor status and train new VI's who are serving as lab assistants in a continuing process. In the "train the trainer" fashion.

Again, the SPARK curriculum goals are to: First get kids interested in and excited about science (Level 1); Second, get kids interested and excited about radio science (Level 2); Third, teach kids fundamentals of electronics and prepare them for the Technician License exam (Level 2); Fourth, provide kids with a survey of potential career goals.

A possible book that could serve to help get kids interested in science Level 1 is: "Questions and Answers: Science" Arcturus Publishing Limited, 26/27 Bickels Yard, 151 – 153 Bermondsey Street, London, SE 1, 3 HA, copyright 2008 which is 30 pages hardbound with subjects: Matter, Light, Sound, Heat, Electricity, Magnets, Forces and Motion, Land Transport, Water Transport and Air Transport.

Our club, the South East Metro Amateur Radio Club (SEMARC) has established a scholarship as a memorial to the club's founder and first president, David E. Harrell, K0BTE.

SEMARC members have ratified the criteria for the award and committed themselves to the financial underwriting. The foundation for the award has been set. But there is still no mechanism within our selected schools for promoting it.

Kids who have participated in Level 1 (3rd – 6th graders) and Level 2 (7th – 10th graders) would be in position, assuming they have passed the Technician Class License, and have achieved the required academic standing, to apply for the scholarship.

Recruiting kids for Levels 1 and 2 is the remaining challenge. Building on the club's long standing affiliation with area Cub Scouts, Boy Scouts and Girl Scouts would be one. Others include 4-H, administered through our various county's extension services, Civil Air Patrol Cadets and extra – curricular clubs such as computers, robotics and rocketry and taking Level 1 and 2 to "at risk kids" in low income areas.

Promoting SPARK though our own SEMARC website is another possibility although finding ways to direct kids to it will be a challenge. The ever evolving social media is another promotional area although risks and benefits of using it need to be explored.

In this proposal, I've outlined my recommendation for the basic

Curriculum, suggested ways to "train the trainers" and offered some suggestions for getting kids enrolled in the program. But how will it work?

My recommendation for the first time is to organize the lectures / labs for one Saturday a month to parallel the September through May school year. Lectures would be from 9AM – 10 AM with a fifteen minute break for refreshments with labs running from 10:15 until Noon. Total session time would be 2 hours 45 minutes. (2.75 hours x 9 = 24.75 hours).

One other program I've come across that is similar in the time required is the "Halifax, Nova Scotia, 2012 Course Outline: Basic Amateur Radio Licensing Course, Erik Hein, VE1JEH, coordinator" which has fifteen class sessions between September through December for what I estimate are two hours each. (2 hours per session x 15 = 30 hours).

The course begins with "Getting down to Basics: Fundamental Concepts and Definitions".

Our club could also become a catalyst for forming a coalition of local organizations dedicated to inspiring kids to become interested in science: the aforementioned school affiliated clubs such as those involved in computers, robotics and rocketry and others. Such relationships would be mutually beneficial helping each of us to strengthen our respective programs.

Deciding what electronic equipment would be required for teaching SPARK classes and labs, would come only after the Level 1 and 2 curriculums were refined and finalized. An oscilloscope (4 –channel, 100 Mhz) is suggested by H. Ward Silver, N0AX. We could look for one that could be interfaced with a digital projector for showing waveforms on a screen. However, a "white board" with felt tip markers would work initially. Voltmeters (analog and digital), function generators and affiliated equipment

Would need to be considered. A budget for the equipment would need to be developed and presented to the club.

It is hoped kids from Levels 1 and 2 would become club members.

Benefits beyond those already mentioned include: getting kids interested and involved in –

*ARES drills
*Exploring new digital modes
*Field Day
*Fox Hunting (Radio Direction Finding)
*Kit construction and home brew building competition
*Satellite communications
*Short Wave Listening (also scanners)
*Search for Extra Terrestrial Intelligence (SETI)
And others.

During our club's first 25 years, members have developed and continue to expand participation in the top four categories. This proposal would need to be considered as yet another area of growth but one that would complement and not compete with existing programs. But I do understand this proposal both by its depth and scale would require substantial amounts of time and energy from those who chose to participate.

My motivation to study high school algebra came directly from an ARRL fundamentals book. The formulas in that book looked very much like the formulas in my algebra book. I knew I had better learn algebra if I was ever going to begin to learn radio science.

Is our SEMARC club ready to start a SPARK?

Addendum

James V. Boyd was first licensed as a Novice, WN0KXS in 1953. He was inactive during a 35-year career in broadcasting becoming relicensed as Technician Class in 2003 and General Class a year later. His broadcasting career included positions as announcer: South Dakota radio stations, KORN, Mitchell; KBRK, Brookings and KYNT, Yankton, 1955-1957; radio – TV announcer and tv meteorologist, WOC – Radio – TV, Davenport, IA., 1957 – 1962; announcer, KBRK, Brookings, S.D. 1962 -1966; reporter and midday tv news anchor, KCAU – TV, Sioux City, IA, 1966 – 1968; city editor, Estherville Daily News, 1968 – 1970; program director, Public Radio KESD –FM, South Dakota State University 1970 – 1971, station manager 1971 – 1978; Minnesota Public Radio affiliate KRSW – FM, station manager, 1978 – 1984; instructor, radio – TV production, (proprietary school) School of Communication Arts, Minneapolis, MN, 1985 – 1988; corporate / media communications director, G. R. Barron & Company, St. Paul, MN., 1985 – 1990.

Education: BS, 1967, South Dakota State University

His favorite amateur radio activities include chasing DX, operating CW and working with young people seeking their Technician License.