

# A New Vision for the Amateur Radio Service

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## Vision Statement Concerning the Future of Amateur Radio

Amateur radio as a hobby has reached an important turning point. Many can point to various examples of why things are changing; however, some of these examples are real and some are only periodic in nature, but the trend of activity and interest now as compared to five or even ten years ago is changing. The real issue which we must face is 'does the amateur radio service (ARS) base its future on the precepts created and tested over the last twenty years or do we look at new and novel ways of growing, sustaining, and protecting the hobby that we love?'

As active members in the ARRL, since first licensed, active members at various internal levels of the League, and very active in the area of amateur radio technology advancement that TAPR represents, we would like to take a few moments of your time to share some important thoughts on the matter.

## The Commercial Future of Amateur Radio and how the ARS can benefit from the change

Amateur radio has prospered over the last twenty years as commercial manufactures were able to grow radio sales in the US, with the amateur radio community as a secondary market to their already existing commercial markets. This resulted in a tremendous growth and usage of VHF/UHF and to some extent, HF, over the last several decades.

We now find many amateur radio vendors and manufactures reducing their presence or even leaving the amateur radio market for other markets or to refocus on their older commercial markets as new communication systems threaten to take market share away. Some stores that have been in existence for sometime have even begun closing their doors. This is to be expected with the sales of amateur radio equipment dropping off. Keep in mind that some say this is sunspot related, but can sunspot activity also explain the drop in the VHF/UHF market as well? Amateur radio is in the midst of a paradigm shift from the vast majority of communicators currently on the bands to a more balanced population representing technical, experimental, and hobbyist who just like to communicate with radios.

As vendors continue to leave the amateur radio market, it is up to organizations like ARRL, TAPR, and AMSAT (the three major non-profit amateur radio organizations in existence today) to grow our technology internally, instead of waiting for external forces to discover amateur radio as a market. If we wait for external market forces to come into play, we will find that these companies will probably rather seek out commercial markets where there is more profit potential, then the hobbyists market which uses our radio spectrum for recreation, learning, and public service.

TAPR has begun working in this direction, by working with the remaining manufacturers and looking elsewhere to non-traditional funding

sources like the National Science Foundation (NSF). We see grants and other such efforts as just a beginning in which to grow more money and more research that will hopefully benefit all of amateur radio in the long term. However, the amateur radio rules are going to need to be more proactive to allow for these types of new technology-oriented ventures to take hold and grow. Amateur radio must have rules that allow experimentation with new modes, without the need to get an STA or waiver each and every time someone wants to do something new. If we don't see this necessary flexibility in the future we will find that most potential amateur radio projects will end up operating under Part 5, Part 15, or any of a number of other services. Or worse yet, amateur radio operators will just ignore the current rules and build and operate equipment to provide the kinds of services that they desire.

While amateur radio has a great history with a rich tradition of introducing new ideas and technology, that process seems to have slowed as more communicators joined the hobby. It became more important to make sure these communicators and people who simply enjoy the hobby aspect of the service had no problems operating and the introduction of new systems and experimentation slowed as a result. It is true that while we have seen a lot of work in new digital and RF areas niche interest, none of this research has been widely adopted or been beneficial to the larger majority of the members of the service.

As an example, an organization like the ARRL is in a position to greatly influence the realization of expanded growth of amateur radio by supporting the efforts of small, innovative companies making contributions to the hobby and not large manufacturers whose primary business and marketing interests are in other areas than amateur radio. It is in the best interest of amateur

radio service (ARS) to grow this cottage industry, because these groups could well become the next Collins, Drake, and other amateur radio-founded companies in the future. What we see today is that various members of the service are starting companies, but these new organizations are focused on other services, because the current FCC rules and the 'climate' of the hobby don't really allow for the easy introduction of new types of technology. These same companies are the ones that are now asking for more spectrum from the FCC for their products and services -- and where do they look? They look to amateur radio spectrum because they understand full well just how under utilized that spectrum really is.

What is to keep the ARRL or TAPR from creating its own "Co-Op" approach like REI or many other such organizations? Together both organizations have the membership base to easily support such an effort and the potential impact on the purchasing power from the total membership could lead to an environment where product development decisions were being made based on the needs of amateur radio operators in the US, instead of those requirement being secondary to existing market needs and requirements as viewed by technology manufacturing companies located in other countries.

#### **Experimental and Technological development are keys to the future**

It has been a concern of ours and TAPR's for some time that there is a tendency to resist change when something new or novel appears on the amateur radio scene. TAPR, AMRAD, AMSAT, and other organizations represent the spirit of change and development within the ARS. Amateur radio can either choose to support various efforts within the community for the most advancement of new

technology or wait for external commercial forces to quickly take advantage and look for additional spectrum, most likely being the current ARS allocations. Not many amateur radio groups or individuals can sustain the effort required to make change happen under the current restraints to the introduction of new technologies. The expense of development, manufacturing, marketing, and to some extent the rules themselves affect the introduction of new technologies to the service. Most new operating interests within the hobby have been a result of the usage of other external technologies (i.e. Personal Computers, Internet, etc.), not of something grown from within the hobby itself.

It is important that ARRL, TAPR and AMSAT watch out for the interests of its diverse membership, but at the same time it must be working on providing support for various efforts elsewhere in the community that are emphasizing new technology and change. The ARRL doesn't have to lead, but it must be fully supportive of change and be willing to facilitate it as much as it can. While an open support policy might threaten some, it is imperative that ARS grow from within and it is equally important that the organizations take a leading role in helping to encourage the growth of new operational modes and techniques.

#### **Amateur Radio should develop its own spectrum sharing partners**

With regard to spectrum, we believe that the ARS can either continue to defend the spectrum we have, or look for those services whom we want to share our bands. We have to locate others that can help fully utilize our valuable spectrum, but not take away from the mission and operating flexibility of the ARS. This could be the form for instance of the creation of a low-power educational wireless service which

could be overlaid on some part of the existing ARS spectrum or some other similar approach. The League successfully used this tactic several years ago when it joined with Apple Computer in lobbying the FCC to designate the 2390-2400 MHz band as a shared band with only the ARS and U-PCS as the incumbents.

The ARS should think about what services would be the most 'tolerable' on our bands. We can't say no to everyone forever, because that will likely result in our losing even more spectrum over time. By finding and locating or creating friendly sharing partners we 1) protect our spectrum on our own terms, 2) create a commercial need for equipment, if done correctly amateurs can leverage these devices into operational 'ham ready' units, and 3) bring users from the shared spectrum services into the ARS where applicable. This is one reason we have suggested the educational communication service concept. It would get members of the ARS into schools helping install wireless networks that might have rules like Part 15, but this direct contact with schools could easily lead to students getting interested in amateur radio because of the close working relationship formed when the local/regional ARS organization helps get the school wireless connections to the Internet.

#### **TAPR Response to ARRL New Repeater Concept**

TAPR has been working on a new 'high concept' repeater system that makes use of spread spectrum technology, in particular, frequency hopping to act as a stepping stone to a new generation of devices that can provide new levels of function and operational flexibility to the amateur radio community.

TAPR on its own has been working in this direction for the last two years. Its first steps in this direction was the submission to the

NSF of a proposal for what has come to be called the 'Internet Access Radio' (IAR) in the Fall of 1996. The first member in a family of such radios is currently under development and information on it can be found on the TAPR website at: <<http://www.tapr.org/tapr/html/taprfhss.html>>.

TAPR believes that today's communications technology is moving toward all digital transmitters and receivers. These advances in technology, combined with the swift evolution of cell based transmission and switching protocols is opening up a new set of possibilities for unique new services utilizing intelligent networks which will contain smart transmitter, receivers and switches. Today's Internet is perhaps the best example of the a self regulating structure which embodies these new technological approaches to communications in the networking domain. However to date, many of these innovations have not made it over to the wireless networking arena. What TAPR feels that the radio networks of the future will involve a mixture of links and switches of different ownership, which terminate at the end-user via relatively short distance links. What will then be required is an built-in, distributed, self-governing set of protocols to cause the networks behavior to make an more efficient use of a limited, common shared resource, radio spectrum. Creating such a self-regulating structure for the optimal sharing of spectrum will require much effort. One of the major problems which stands in the way of these new approaches today is the current FCC regulatory environment and the manner in which spectrum is managed and allocated under its rules.

One of the major hurdles that an wireless entrepreneur faces who wishes to develop innovative new communications products which involves radio is access to the requisite amount of spectrum. This

process makes the involvement of the wireless entrepreneur with the government mandatory, which immediately puts them at a disadvantage when compared to entrepreneurs in the computer sector where government involvement is minimal. As a result, innovation has occurred at a much slower pace since the use technologies such as spread spectrum require the use of more spectrum and not less in order for their advantages to become apparent when it is used for high-speed data transmission.

Historically, the current regulatory approach to radio has been based upon the technology that was in use at the time that the Communications Act of 1934 was framed, basically what we would call today, dumb transmitters speaking to dumb receivers. The technology of that time required reserved bandwidths to be set aside for each licensed service so that spectrum would be available when needed. Given this regulatory approach, many new applications cannot be accommodated since there is no available unallocated spectrum to 'park' new services. However, given the new set of tools available to the entrepreneur with the advent of digital technology, what once were dumb transmitters and receivers can now be smart devices which are capable of exercising greater judgment in the effective use and sharing of spectrum. The more flexible the tools that we incorporate in these devices, then the greater number of uses that can be accommodated in a fixed, shared spectrum.

While the IAR proof-of-concept (POC) radio is under development, TAPR intends to make the case to the FCC that the current rules should be changed to reflect that use and advantages that smart spread spectrum packet radio devices can realize. TAPR's position is that a major improvement in spectrum use is feasible in the concepts to be

employed in the IAR POC radio are put into widespread use. However, given the radical nature of some of the approaches in this project, it is appropriate to first, confirm the technical theories that we are putting forth and then to define the operational parameters for the implementation of these theories once they are confirmed. Then we will be able to approach the Commission with proposals that have a sound basis in fact and which should hopefully then be acted upon in a favorable fashion.

While development of the IAR POC is underway, TAPR has several projects underway that utilize existing Part 15 spread spectrum radios that are being adapted to meet amateur radio operational requirements and which will be used for general packet radio and Internet access over wide-areas. One project uses OEM modules from Lucent Technologies and the other uses a radio provided by a member of TAPR's sister organization in Japan, the Packet Radio User's Group (PRUG).

Much of what we have in mind can be accomplished today with existing Part 15 radios. One of the author's of this article has such a system currently up and operational in the San Francisco Bay Area. The system uses two mountain top sites and can currently cover all of the South Bay Area, providing voice and data services to users at ranges up to 20 miles. Here are the characteristics of the **system**:

- Operates on 2.4 GHz.
- Radios use FHSS half duplex. Output power is 1W. EIRP is within FCC limits of 4 W EIRP.
- TCP/IP protocols are used.
- Accepted Internet protocols are used to handle voice and data traffic.
- **System** can be accessed by any device that uses the TCP/IP protocols and a similar dataradio.

Here are some of the things that this POC radio system can accomplish:

- o Can handle several separate voice conversations, bulletins, and data streams simultaneously?

**Yes**, using standard Internet protocols. Uses the H.32x standards.

At the core of the H.323 standard is a method for managing network latency, or the time it takes to send and acknowledge a packet. High-latency networks such as the Internet, where data packets must jump through many routers and subnets, have a tendency to wreak havoc on audio and video synchronization. To address this shortcoming, H.323's Real-Time Transport Protocol (RTP) time-stamps and sequences packets and reduces delays.

H.323 also specifies the coding and decoding of video and audio signals, optimizing data for lower bit rates and low-bandwidth connections. H.323-compliant products are now quite common on the market with Microsoft's **NetMeeting** being a good example. More information on H.323 can be found at: <http://gw.databeam.com/h323/h323primer.html>.

- o Supports duplex (just **like a** telephone) and conferencing (just like a teleconference)?

**Yes**, again using standard Internet protocols, even though the actual radio link is half duplex.

- o Lets you know who else is monitoring and lets you contact them without interrupting anyone else?

**Yes.**

- o Is resistant to deliberate interference, and allows the control operator to "lock out" stations that are not following the rules?

Yes. We have full control to lock out users as required by a number of different methods.

o Can share its operating frequencies with several similar repeaters nearby, with little degradation in the performance of any of them?

Yes. We are able to add new mountain top sites without the need for coordination.

o Lets you use one radio to access all of these functions, and others such as PacketCluster and APRS, simultaneously?

Yes.

o Puts the amateur allocations above 1 GHz to more intensive use?

Yes. In this case, 2.4 GHz is used.

So it would seem from TAPR's work and experiences to date that we are really not too far from demonstrating a system to the amateur radio community that is quite similar to that proposed by the League. To get things moving to the next step, TAPR would like to propose the following to the amateur radio community in general:

o Setup a meeting as soon as possible between TAPR and the other amateur radio organization to discuss this effort in more detail. The end result of that meeting would be a working paper and a set of recommendations to both organizations as to what next steps would have to be taken to make this concept a reality.

o Install and play with one of these Part 15 systems in different part of the country. Such a system could be procured and deployed for a total cost of less than \$10K. TAPR

would be happy to provide all of the necessary specifications.

## Conclusion

We believe that amateur radio has been at a crossroads for the last several years and continues to wait for the "light to change" to indicate what the future **will** really hold in store for the service. The ARRL, TAPR, AMSAT, and other technology-oriented groups must take the initiative and forge ahead into the future on our own. We need to be proactive to change and challenges, and not take a position of "wait and see" for attitudes to change. There will be those members in all of our organizations that will hate what the future will bring, but past history and experience shows us that adopting a position of limited or no change only means that the change and growth will occur elsewhere. Change does not mean the total abandonment of the past traditions that we believe have made the amateur radio service what it is today. We can either bring about increased growth in our ranks or see that growth occur on the Internet and other areas that many of our members will perceive as much more fun and enjoyable ways to spend their time. Not following the course of change might be the wise political approach to adopt for now -- but is it unlikely to be the most productive one.

The issues and actions the we have raised are just some thoughts about where amateur radio is today and where it might be going. These are just first steps towards a new future and many more will be required to effect any real change. Long range planning is certainly important, but with the increased pace of change in society and the technology sector, amateur radio needs to take a fresh look at where it has been and just where it would like to go.