Why we should retain a Morse code requirement for the unrestricted amateur license

By Andrew Roos, ZS1AN[1]

Introduction

The ITU WRC-03 conference has amended Article 25, removing the mandatory Morse requirement for unrestricted amateur licenses. The revised wording allows each administration to determine for itself whether Morse proficiency should be a requirement for an amateur license.

National amateur radio societies around the world must now recommend to their administrations whether the Morse requirement should be retained. This position paper was prepared for the Council of the South African Radio League to provide reasons why, in my opinion, we should retain a Morse code requirement for the unrestricted amateur license.

It is important to note that this is not the same as arguing that licensees who have not passed a Morse code should be denied all access to the HF bands. I am in favour of granting some access to the HF bands to those holding restricted licenses. However I believe that this should be done by amending the privileges of the restricted license, rather than removing the Morse code requirement of the unrestricted license.

The principle argument will run along the following lines: CW is a useful and popular mode of operation; the education and examination syllabus should include the basic abilities needed to use useful and popular modes; the ability to send and receive Morse code is necessary to operate CW; and therefore the education and examination syllabus should include the ability to send and receive Morse code.

CW is a Useful Mode

In this section I shall establish that CW is a useful mode. I do not claim that it is the "best" or "most useful" mode (whatever that might mean), or that it is more useful than other modes like SSB or the various digital modes. Indeed, I believe that all these modes have their rightful place in amateur radio.

Traffic Volume

I think those who doubt whether CW is useful do so because they fail to look at CW in terms of our objectives as amateurs. Some of the opponents of Morse code testing note that most commercial and some military services no longer use CW, and provide that as "evidence" that the mode is no longer useful, or at least not "best of class". However commercial and military requirements and constraints are very different from those facing amateurs. For these services, traffic volume is often the most important consideration; there are rarely any power or equipment limitations; bandwidth limitations are less severe than in the amateur bands; good signals can often be assured by the use of very high power transmitters or satellite communications; and skilled operators are considered an unnecessary expense.

However the requirements and constraints facing amateurs are very different, which means that the optimum mode of communication is also different, and in many cases it is CW.

For example, consider the fallacy of comparing modes by traffic volume. When I listen to amateur stations operating in all modes, the thing that strikes me most is how little information is being communicated by most of them. Not because they are hamstrung by inefficient modes, but because they don't actually have very much to say to each other. There are exceptions of course, but the

[1] Email: zs1an@qsl.net.

majority of QSOs consist simply of an exchange of signal reports, name and QTH, station and weather information. Even though I always welcome a rag-chew, and often attempt to encourage the other station to go a bit further than the "standard" items, in many cases my attempts are politely rebuffed. In any case, rag-chews certainly don't stretch the traffic handling capabilities of CW.

I am not denying that there are times when amateur stations efficiently handle large volumes of traffic. The very efficient traffic nets in the USA are a good example of this (and by the way many of the best use CW). However for many, perhaps most, amateur activities, traffic volume is not a significant consideration, so one cannot argue that CW is an unimportant mode for the amateur service simply because commercial services, for which traffic volume is the key requirement, no longer make widespread use of it.

By the way, the military does still make use of Morse code for specialized requirements. For example, Naval Gunfire Forward Observers of the British Army are "trained in advanced communications, Morse code, adjusting both naval gunfire and artillery, forward air control techniques, and helicopter operations, including helicopter rappels"[2]. Morse code is also a requirement for Special Forces units including the SAS and SBS.

QSO Rate

So what is important? Well for the DXer, DX-pedition operator and contester, the primary consideration is *rate* – that is, the number of QSOs per hour. For the DXer rate matters because the greater the rate, the greater their chance of making a QSO and getting into the DX station's log. For the DX-pedition operator rate matters because the success of an expedition is often judged by the number of QSOs. And for the contester rate is (almost) everything. When it comes to QSO rate, CW and phone are about equally matched. For example in last year's IARU HF World Championships, where the phone and CW contests take place during the same 24 hour period and under the same propagation conditions, the top single-operator phone station was KH6ND with 2,451 QSOs, while the top single-operator CW station was P3F with 2,816 QSOs. Digital modes trail slightly – although the IARU HF contest does not include digital modes, a comparative figure is the 1,912 QSOs made by KI1G, the top entrant in the ARRL RTTY roundup. Although this contest runs for 30 hours, contesters may only operate for a maximum of 24, so the comparison is a reasonable one.

To avoid upsetting anyone, let's just agree that CW, phone and digital modes all achieve similar QSO rates. That is sufficient for my argument.

Bandwidth Efficiency

One of the areas where CW is clearly superior to most other modes is bandwidth efficiency. CW can achieve a similar QSO rate to phone while accepting a channel spacing of 250 Hz or less, compared with the 2 500 Hz minimum required by phone. This means that the QSO rate per Hertz of bandwidth occupied is at least ten times greater for CW than it is for phone. The only other mode that can compete with this remarkable efficiency is PSK-31. Bandwidth efficiency is especially important in the amateur service given our limited amateur allocations. (Anyone who claims that our HF allocations are underutilized has never operated during a major contest!)

Readability under Poor Signal Conditions

When it comes to weak-signal performance, CW is a clear leader on the HF bands. Listening tests have shown that SSB operator-to-operator grade service with 90% intelligibility of related words by trained operators requires a signal to noise ratio of 48 dB-Hz for a bandwidth of 3 KHz[3]. A similar level of intelligibility can be obtained with a CW signal to noise ratio of 27 dB-Hz in a 500 Hz

---

[2] Dominique Sumner, "148 Commando Forward Observation Battery", http://www.specwarnet.com/europe/148fob.htm.

[3] Akima et al, "Required Signal-to-Noise Ratios for HF Communication Systems", Institute for Telecommunications Sciences ESSA Technical Report, ERL 131-ITS 92, August 1969.

bandwidth, while RTTY requires a signal to noise ratio of 55 dB-Hz. This means that for the same level of intelligibility, a phone signal requires 11 dB more power than a CW signal; and an RTTY signal requires 28 dB more power. For CW signals in a 250 Hz bandwidth the advantage over SSB is about 13 dB. In other words, to achieve the same intelligibility under poor conditions as a 100 W CW signal you would require a 2 KW SSB signal!

I notice this effect regularly when band conditions are poor and I hear SSB operators whom I know to run high power into large beams complain that conditions are "impossible", while I still manage CW QSOs with 100 W and a dipole.

Admittedly some of the newer digital modes like WSJT also provide excellent weak-signal performance. However these modes are designed specifically for VHF operation. The best HF digital modes, like PSK-31, still fall short of CW in weak signal ability.

The relative power efficiency of CW is of particular benefit to operators who use simple low-powered stations, which is likely to be the case for operators from previously disadvantaged communities. It will become ever more important as we move deeper into the trough of the solar cycle over the next few years.

Simplicity and Home Construction

One of the objectives of amateur radio is to encourage home construction. Here CW has a distinct advantage, since CW transceivers are inherently less complex, and hence less expensive and easier to construct than, phone transceivers. For example, the Small Wonder Labs[4] "Rock Mite" QRP CW transceiver kit retails for US $30. I do not know of any comparably priced SSB equivalent.

Low Power Requirements

CW transceivers also often have significantly lower power drain than multi-mode designs. For example, my Elecraft K1 draws only 55 mA on receive. This makes CW transceivers ideal for battery-powered "adventure radio" operations, for example for operations from mountain summits. Commonly used portable SSB transceivers like the Yaesu FT-817 draw as much as 450 mA, making them much less suited to sustained battery-powered operation.

The CW "Lingua Franca"

The abbreviations and pro-signs used in CW communications make it possible for operators who do not speak the same language to communicate at least basic information. This means that proficiency in English is not a requirement for successfully communicating worldwide using CW, which is an obvious benefit in our attempts to facilitate amateur radio amongst previously disadvantaged communities.

Emergency Communications

One of the roles of the amateur service is to provide emergency communications in the event of a national disaster. Many different modes might be utilized, depending on the circumstances. If the emergency is localized, then FM repeater communications are likely to play the leading role. For more widespread emergencies, HF communications are important. If the emergency leaves our computer systems operational, and if propagation is fairly good, then digital modes might be most effective. If computers are unavailable but we can rely on high power transmitters and fair propagation, then SSB might be the mode of choice. If we lose our computers and have to operate with limited power (for example from backup batteries or solar power) or under poor propagation conditions, then CW might be the best (and only) way to get through.

[4] http://www.smallwonderlabs.com

Summary

If you want to operate on DXpeditions or in contests, CW satisfies the key requirement for a high QSO rate. CW also makes better use of limited amateur spectrum than most other modes. If you have a limited budget or power or antenna restrictions, then CW provides you with better intelligibility under poor signal conditions than any other common HF mode. If you want to construct your own equipment, then CW allows simpler and less expensive transceiver projects. If you want to operate from remote places using battery or other alternative power, then CW is the most power-efficient mode. And under certain emergency conditions, CW may be the only mode possible.

For these reasons I believe that no-one can honestly claim that CW is no longer a useful, or even an important, mode of communications.

CW is a Popular Mode

It may surprise you to discover just how popular a mode CW is. A recent multiple-choice survey on the ARRL web site, which was open to all amateurs (not just ARRL members), asked the question "what percentage of your operating time is spent using CW?". The results were as follows[5]:

Answer	**Percentage of Respondents**	**Number of Respondents**
I do not operate CW at all	32.6%	1002
Less than 25%	17.1%	525
26-50 %	6.2%	192
51 – 75%	8.6%	265
76 – 100%	35.4%	1089

So if this survey is accurate then it would appear that 44% of amateurs spend more time on CW than on all other modes put together.

CW is also a popular contesting mode. A quick check showed that 3645 CW logs were submitted for the CQ Worldwide 2002 contest, compared to 4050 SSB logs.

Admittedly, in South Africa the contest statistics are tilted somewhat more towards SSB. The 2002 HF CW contest received 15 entries as compared to the phone contest's 40 entries. However the CW contest still received more entries that the VHF Contest (14 entries), 40m Simulated Emergency contest (10 entries) or the 80m QSO Party (3 entries)[6].

Again, I am not arguing that CW is the most popular mode. Only that it is one of several popular modes. Or, to misquote Oscar Wilde, "reports of its death are greatly exaggerated".

The Education and Examination Syllabus

Having established that CW is both a useful and a popular mode of amateur communication, it is easy to show that our education and examination syllabus should include at least the basic abilities required to operate in this mode. After all, one of the main purposes of the syllabus and examination is to equip new amateurs to operate efficiently, legally and safely using the most common and useful modes.

I am not suggesting that CW should receive any special treatment here compared with other useful and popular modes like FM, SSB and some of the digital modes. I think it is important for the education syllabus to include the basic abilities needed to operate in all these modes.

---

[5] http://www.arrl.org/survey.php3?pollnr=176.

[6] http://www.sarl.org.za/public/contest_results/contestresults.asp

Why not just allow candidates to select the modes they intend to operate in, and only learn the skills necessary for those particular modes? Well I can think of a couple of good reasons not to do that:

- A new amateur generally does not know enough about the different modes to make informed decisions until he or she has had a chance to use them in practice. So if we do not provide candidates with at least the basic abilities needed to try out each of the modes, then we are not equipping them to make an informed decision about which modes to use.
- It would be a nightmare to administer. Would we create a separate license class for someone who wanted to operate CW, RTTY and PSK-31, but not AM, SSB or FM? They of course should not be required to learn the phonetic alphabet, as it is not relevant to any of their preferred modes – but how would we administer or enforce such an unwieldy set of options?

So I think there are sound reasons to give a basic grounding in all the popular and useful modes to all candidates, and allow them to make their own choices once they have had the opportunity to try out the different modes.

Now I admit that this does not happen very well today. Although SSB and FM operating procedures are included in the examination syllabus, we have lagged behind the development of digital modes. We do not, for example, examine either the theory or the practice of PSK-31, which is becoming increasingly popular and which is certainly also a useful mode.

But the fact that our syllabus has lagged behind the development of digital modes should be seen as a reason to include more about digital modes in the syllabus, so we can properly equip new amateurs to make the most of them. It does not make sense that because we have lagged in this area we should stop preparing our candidates properly for other modes like SSB, FM and CW.

The Morse Requirement

So what does it take to have basic operating ability in CW? Well clearly the ability to send and receive Morse code. Someone with no Morse code ability cannot be considered basically competent in CW, just as someone who did not know the phonetic alphabet could not be considered basically competent in any of the phone modes.

Of course some may argue that since computers can send and receive Morse code, competence in using computers and soundcard interfaces (which will in any case be needed for the digital modes) could also suffice for CW. However if you look back at the attributes that make CW such a useful mode, you will see immediately that this is not the case as many of these advantages fall away if computers are used to generate and receive Morse. Computers cannot read Morse correctly under poor conditions; it is not simple to construct a CW transceiver that includes a computer to interpret the Morse; and however power-efficient you manage to make your transceiver, you're not going to have much joy off batteries if you have to run a computer as well! Reliance on computer would also make it less likely that CW communications would be available during a disaster.

So for these reasons I suggest that the key abilities required for a basic level of competence in CW are the ability to send Morse code by hand, and the ability to receive it by ear. And this is why I believe that we should retain a Morse code requirement for an unrestricted amateur license.

The No-Code Arguments

As well as explaining why I believe that the Morse requirement should be retained, I think it worthwhile to take a brief look at the arguments advanced by those who oppose the Morse requirement, in order to show that their arguments are unsound. As a representative of the "no-code" camp I have chosen the No-Code International lobby group, the best-known opponents of the Morse code requirement. Their home page[7] gives the following reasons as to why Morse code testing should be abolished.

[7] http://www.nocode.org

1. NCI is not opposed to manual Morse code operation. But CW is just another mode and should not be afforded any special priority over others. It is available to those who wish to use it. Morse proficiency should not be required for those who do not wish to use the mode.

I agree that CW is "just another mode and should not be afforded any special priority over others". However I have argued that it is the role of the syllabus and examination to equip new amateurs with the abilities they need for basic competence in all popular and useful modes. That ability for CW is Morse code. If the argument advanced by No-Code International is correct, then similarly those who do not wish to use phone should not be required to demonstrate proficiency in phone operating procedures or the phonetic alphabet. And generalizing from modes to other aspects of amateur radio, those who do not wish to build or maintain their own equipment should not be required to demonstrate proficiency in basic electronics. Those who do not wish to operate DX should not be required to demonstrate proficiency in the theory of propagation. And so on. If taken seriously this position would result in a syllabus where all components were optional, which would be ridiculous and impossible to administer.

2. Manual radiotelegraphy communications has been superceded by more modern, reliable, accurate, faster and efficient means of communication.

I agree that this is largely true in the commercial services where traffic volume is the primary consideration, where good signal strength can be assured and where there are few restrictions on equipment, bandwidth, antennas and power levels. However this is not true of the amateur service, where CW remains one of the best modes of communication given the cost, power and bandwidth limitations we operate under, and given that traffic volume is not usually the primary concern.

3. Requiring manual telegraphy proficiency is not compatible with the radio amateur's mandated objective of contributing to the advancement of the radio art.

Agreed, but neither is requiring knowledge of AM modulation, or of discrete electronics, or of ionospheric propagation when much greater efficiency can be achieved using satellites or fiber-optic cables. Certainly a knowledge of dipoles and quarter-wave verticals cannot be considered a contribution to the advancement of the art in antennas. However this does not invalidate the Morse component, as contributing to the advancement of the art is only one of the radio amateur's objectives, not the only one.

4. No evidence exists that Morse proficiency is an indicator of a desirable, motivated or better qualified operator.

Anecdotally I can report that I have never, ever heard profanity or personal insults on CW. This is in stark contrast with the bad language and worse manners of some of the operators on FM repeaters. But this is purely anecdotal and does not count as evidence, and I have not relied upon it as a reason for retaining Morse. I must also add that the great majority of operators on the FM repeaters are also courteous and professional, and the bad behavior mentioned is confined to just a few, many of whom remain anonymous.

5. The Morse code requirement serves as an advancement barrier to many otherwise qualified individuals.

Electronics theory also serves as a barrier to many people who would otherwise make good operators. But in my view that is not a good reason to ditch electronic theory from the syllabus. I have yet to see a good argument from anyone as to why they really cannot manage the Morse component. I hear many people saying they "don't have time" or "aren't interested" – well tough. If you don't have the time or interest to pass any other component of the syllabus, then you won't get a license. Why should Morse code be any different? And if you have a real physical or mental problem that makes it unreasonably hard for you to pass the Morse test, then you can apply for an exemption.

6. The value of Morse code communications in the Amateur Service is primarily recreational in nature and manual telegraphy proficiency should no longer be a compulsory licensing requirement for any class of Amateur Radio license.

I agree that the value of Morse code communications is primarily recreational. However this misses the point that the Amateur Service as a whole is primarily recreational in nature, as are all the modes used. So if this was a good reason not to teach CW competence, then it is an equally good reason not to teach competence in SSB, FM, RTTY, PSK-31 and Packet as the use of all these modes in the Amateur Service is "primarily recreational in nature".

What will happen if Morse testing is removed?

Well fairly obviously there will be a reduction in the number of new amateur operators who become proficient in CW. There will still be some who still learn Morse code, but they will be fewer than at present. The older operators who are already proficient in CW will eventually die or leave the hobby, resulting in a smaller proportion of CW operators on the bands.

The use of CW may stabilise at a lower number than at present, or it may loose critical mass and eventually die out altogether. After all, in order to become proficient in CW usually requires some sort of encouragement or tuition, so if there aren't sufficient CW operators around there won't be anyone to train those newcomers who would like to learn. And many new amateurs who would have enjoyed CW and become skilful operators if introduced to Morse code during their training will lose the opportunity to discover it for themselves.

Some new operators who would have spent much of their time operating CW in a 250 Hz bandwidth will instead operate SSB with a 2.5 KHz bandwidth. They will find that 100 W just does not cut it under poor conditions, and purchase linear amplifiers. The reduced number of CW operators may result in some or all of the current CW allocations being reallocated to phone; but this will not reduce congestion. On the contrary, even with additional allocations the bands will be more congested due to the higher proportion of 2.5 KHz bandwidth signals.

The resulting perception that expensive linear amplifiers and antenna systems are required to communicate effectively when conditions are poor is likely to be a much more serious barrier to entry amongst previously disadvantaged communities than any Morse test. After all, people from these communities are generally willing to invest their time to acquire new skills, while significant financial investments are simply not possible.

Eventually many amateurs will lose the ability to maintain a high QSO rate, or to rag-chew, while making best use of our scarce spectrum resources. QRP and adventure radio operations will become less popular, due to the difficulty of being heard on QRP phone and the dearth of CW activity. We won't have any good alternative to offer newcomers who can't afford linear amplifiers and large antenna arrays – we'll just have to tell them to wait until propagation gets better, or for the next upturn in the solar cycle. Government will target us as a "rich man's hobby". And should a disaster not conveniently leave our computers unscathed, we may not be able to perform the emergency communications role we so proudly proclaim.

To me, this is a fairly bleak picture of the future of amateur radio.

Of course some will argue that even if the Morse code requirement is abolished, those who want to learn it will still do so, and that if this is insufficient to keep the mode alive well, then, it was a dying mode anyway and best left to its fate. However this argument is fundamentally flawed, as can be seen if it is applied to any other aspect of amateur radio.

Suppose, for example, that we decided to do away with the electronics component of the syllabus. This could easily be justified by "No-Tech International" on the grounds that electronics is irrelevant since surface mounted devices prevent us from constructing or maintaining state of the art equipment; and that it serves as an unfair barrier to entry to those who do not have the time or inclination to master this difficult subject. In any case, knowledge of electronics clearly is not required to operate modern black-box rigs.

Without an electronics component in the syllabus, most amateurs would probably never bother to learn it. Some who would have found it interesting had it been a requirement will never know, since they won't have the opportunity to be introduced to it in the first place. Others may be interested, but

will find it too much of a struggle to learn as there won't be anyone to teach them – after all, most of the local amateurs will have "no-tech" licenses.

Slowly the amateur community will lose its ability to construct and maintain equipment, and even its understanding of how the equipment works. We will become simply a community of operators. And that would also be a sad day for amateur radio.

What this analogy illustrates is that although doing away with the Morse code requirement may result in the eventual demise of CW as a mode of operation, it does not follow that CW had outlived its usefulness. Similarly, even though the abolition of the electronics component of our syllabus might result in the demise of home construction, this does not mean that home construction and technical ability have outlived their usefulness. All that these examples show is that which aspects of our hobby survive and prosper, and which struggle or even die, to some extent depends on what we choose to teach newcomers to the hobby. This is hardly a surprising observation! And having shown why I believe CW to be an important component of our hobby, I believe we need to ensure that we continue to teach Morse code to future generations.

Conclusion

This paper has shown that CW is both a useful and a popular mode of communication amongst amateurs. I have argued that a key purpose of our training and examination syllabus is to equip new amateurs with the basic abilities they need to make use of all useful and popular modes, and that in the case of CW this means training and examining candidates in Morse code. I have also examined the arguments given by No-Code International and shown them to be without substance.

Doing away with the Morse code requirement may result in the decline or even the eventual demise of an important mode that offers many advantages for today's amateurs. It would compromise our ability to provide emergency communications. Doing away with Morse means accepting the need for higher power and more complex and expensive antenna systems in order to communicate effectively under poor propagation conditions which will reduce the appeal of amateur radio in previously disadvantaged communities.

I therefore recommend that the Council of the South African Radio League should support the retention of a Morse code requirement for the issuing of unrestricted amateur licenses. This does not exclude the possibility that some HF access could be given to other license classes that do not include a Morse code requirement.