19 July, 2004

RECOMMENDATIONS

from

RADIO AMATEURS OF CANADA

to

INDUSTRY CANADA

concerning

MORSE CODE AND RELATED MATTERS

July 2004

CONTENTS

1. LIST OF RECOMMENDATIONS

Recommendation 1

Radio Amateurs of Canada recommends to Industry Canada that the current Morse code Qualification be dropped as a requirement for operation in the bands below 30 MHz.

Recommendation 2

RAC recommends to Industry Canada that, at the same time as Recommendation 1 comes into force, the achievement of a grade of at least 80% on the Basic examination will be required in order to be permitted to operate in the bands below 30 MHz. Achievement of at least 80% will lead to a new qualification to be called the Intermediate Qualification. Holders of the present Basic plus Morse Qualification will be deemed to hold the Intermediate Qualification.

Recommendation 3

RAC recommends to Industry Canada that current holders of the Basic Qualification who have not also obtained the Morse Qualification should continue to have their existing operating privileges. That is, they will be permitted only to operate on the bands above 30 MHz.

Recommendation 4

RAC recommends to Industry Canada that any current holder of the Basic Qualification who does not also have the Morse Qualification should have the option of re-taking the Basic examination with a view to obtaining a grade of at least 80%. Those who are successful will receive the Intermediate Qualification.

Recommendation 5

RAC recommends to Industry Canada that the pass mark for the examination leading to the Basic Qualification be raised to 70% at the same time as the Morse code requirement is eliminated.

Recommendation 6

RAC recommends to Industry Canada that all persons who currently hold both the Basic and Advanced Qualifications be given operating privileges on the HF bands. In future, persons who wish to obtain the Advanced Qualification should already hold the Intermediate Qualification, or the current Basic plus Morse Qualifications, and will need to obtain a grade of at least 70% on the Advanced examination.

Recommendation 7

RAC recommends to Industry Canada that the present Morse code examination continue to be available to those Canadian radio amateurs who wish to have that qualification specified on their certificate.

Recommendation 8

RAC recommends to Industry Canada that holders of the Intermediate Qualification be permitted to construct and use commercial transmitting equipment kits.

Recommendation 9

RAC recommends to Industry Canada that holders of the Intermediate Qualification be permitted to construct and use their own transmitting equipment in the bands at 2.3 GHz and above.

Recommendation 10

RAC recommends that a new entry-level qualification be introduced, designed to ensure good operating practices and requiring only an introductory level of theory.

Recommendation 11

RAC recommends that all examinations on the new syllabus be divided into several elements, as appropriate, and a pass mark be required on every element.

Recommendation 12

RAC recommends to Industry Canada that the pass mark on all elements of all examinations be set at 75 percent at the same time as the new syllabi are introduced.

2. INTRODUCTION

The Past President of Radio Amateurs of Canada, Bill Gillis, VE1WG, established an Ad Hoc Committee on Radio Amateur Qualifications in the light of the decision of WRC-03 concerning Morse code as a qualification for certain radio amateur licences.

That committee has submitted a report to the RAC Board of Directors. The Board has approved the report and now wishes to make recommendations to Industry Canada based upon the proposals contained in the committee's report.

In the preparation of this report the committee digested a considerable amount of information from many sources. It noted the decision taken at WRC-03 and the subsequent actions of some national administrations including those of the United Kingdom, Switzerland, Belgium, The Netherlands and Germany. The committee monitored the limited action which has, to date, occurred in the United States. A discussion paper "A Review of Amateur Service Regulation" published by the Australian Communications Authority has been very useful.

The committee reviewed the existing arrangements which promote reciprocal operation of radio amateurs in other countries including the CEPT Radio Amateur Licence, the International Amateur Radio Permit, and the Convention between Canada and the United States of America concerning Operation of Certain Radio Equipment or Stations.

The discussion paper (The Morse Code Decision - some factors worth considering) by Ken Pulfer, Vice-President (Government and International Affairs), VE3PU, was found to be very helpful. The results of various surveys of the opinions of Canadian radio amateurs, the most important and comprehensive being that taken by RAC through its website, have been taken into account.

The nature of the present examinations for the Basic and Advanced Qualifications have entered into the picture. For this reason the committee reviewed the syllabi (and in some cases, question banks) of some other administrations including CEPT, the FCC in the US, and the UK Radiocommunications Agency.

Based upon the work of the committee, RAC's recommendations to Industry Canada comprise two main parts. Sections 3 and 4 deal with the immediate issue at hand - Morse code as well as regulations relating to construction of equipment. RAC believes that these recommendations could be implemented rather quickly should they be acceptable to Industry Canada. It is considered that these recommendations could be put in place with minimal revision of Industry Canada's current procedures and documentation. No changes would be required, for example, in the existing question banks and the examination generator.

The second part (Section 5) identifies some opportunities for improvement to the Canadian examination structure. Revisions to this structure could provide an opportunity to encourage more young persons to become radio amateurs. Further study and consideration of the Canadian system, taking into account developments in other countries, will be necessary before implementation of the recommendations.

It is RAC's considered opinion that the recommendations described in this document, if implemented, would be to the benefit of the Canadian radio amateur service as a whole and also be consistent with the policy objectives of Industry Canada.

3. THE ROLE OF MORSE CODE

One can ask, "Why do we have a Morse test?". The short answer is that there are historical reasons. Morse code has been used by radio amateurs ever since the beginning of radio experimentation. Indeed, Morse code was for many years the only communication technique used by radio experimenters. Therefore it was essential to have Morse skills, and a test for these skills was a logical requirement when licensing was introduced.

However, as technology progressed, other communication techniques were developed: amplitude modulation, single sideband modulation, frequency modulation etc. and, later, various digital methods. As these other technologies were introduced, many amateur radio enthusiasts adopted them and Morse code changed from being the sole technique to just one of many communication methods which they used. But even when radiotelephony became practical, there was still substantial use of Morse code. The commercial and military services continued to use Morse. The radio amateur community was considered by governments to be a pool of trained operators and knowledgeable technicians for war service and other times of emergency. So Morse skills were valuable and the Morse test persisted. But, by the nineteen-nineties, commercial and military use of Morse was a thing of the past. Radio amateurs were the only service continuing to use Morse code. It is now the case that many radio amateurs do not know Morse code and that many others, who have passed a code examination, do not use code.

Many radio amateurs, and would-be radio amateurs, now regard Morse code as being irrelevant and uninteresting. The fact that, until now, the passing of a Morse code examination has been an internationally accepted pre-requisite to obtaining certain operating privileges is widely regarded as an anachronism. It is likely that many potential amateur radio operators are dissuaded from seeking operating qualifications because of the Morse code requirement. Even some keen Morse code users admit that the use of Morse code will largely disappear in the long term, except for certain specialized applications and for those who enjoy its use.

Morse is a skill. It requires a certain aptitude. Not all individuals have this aptitude. Therefore to retain the Morse test discriminates unfairly against many people. Furthermore, it does a disservice to amateur radio in Canada by excluding many who are highly qualified technically and who could make experimental contributions to amateur radio

There are clear signs that the decision taken at WRC-03 to allow individual country administrations to

> *"determine whether or not a person seeking a licence to operate an amateur station shall demonstrate the ability to send and receive texts in Morse code signals"*

will result in many countries dropping the code requirement. The European Radiocommunications Office (ERO), even before WRC-03 took place, was on record as favouring the dropping of the Morse code requirement. This implies that the CEPT

Recommendation for the harmonization of amateur radio certificates in most European countries will, in due course, omit the present Morse code requirement. At the time of writing, Australia, Austria, Belgium, Germany, Ireland, Luxemburg, The Netherlands, New Zealand, Norway, Papua New Guinea, Singapore, Switzerland, and the United Kingdom have already dropped the requirement for code or are expected to do so. Others are likely to follow suit.

Several surveys of the opinions of current Canadian radio amateurs, regarding the question of whether or not to drop the code requirement, have been made. These indicate that the majority of respondents are in favour of dropping code. The RAC survey, in particular, has received over 1300 valid responses. The number of respondents is probably large enough to reflect the views of most radio amateurs in Canada. About 66% of Canadian radio amateurs do not want, or will accept the dropping of, the Morse code. This opinion is most strongly held by holders of the Basic Qualification (81% in favour) but even 51% of holders of the Morse Qualification hold that opinion. About 69% of the respondents to the RAC survey also believe that the Basic examination should be more rigorous. This opinion arises from the fact that the Morse code examination is considered by some to be a filter which limits operation on the HF bands to those who have exhibited a high level of dedication and competence.

There are advantages to the use of Morse code in communication as compared with other techniques. A code signal occupies much less bandwidth than do other techniques. Therefore, many more code signals can be accommodated in a given range of frequencies than is the case for single sideband signals, for example. Reception of very weak signals in the presence of high noise levels is possible using Morse code when most other techniques fail. These advantages mean that code will continue to be important to those radio amateurs who are interested in such activities as propagation studies and long-distance weak-signal communication.

The bandwidth factor would come into play, as well, if the Morse code requirement is dropped. It is likely that an increased number of radio amateurs will commence to make use of the HF bands for single sideband communication. This will add pressure to the sub-bands now recommended by RAC for such transmissions. There will be an increased probability that single sideband transmissions take place in the sub-bands now set aside for use only for Morse code communication. This possibility is a matter of concern to radio amateurs who make significant use of Morse code transmission.

All of the above considerations lead to the conclusion that the present Morse code requirement for Canadian radio amateurs should be dropped, but only with certain important provisos. In planning for the dropping of the code examination. RAC believes that Industry Canada should take into account the following factors:

1. There must be an awareness of the impact of this action upon existing reciprocal agreements and other arrangements which permit Canadian radio amateurs to operate in other countries and foreign radio amateurs to operate in Canada.

2. The Morse code examination must continue to be available in Canada for the benefit of radio amateurs who may require such a qualification for operation in another country, and for those who wish to acquire skill in the use of Morse code.

3. Operation on the HF bands requires special knowledge and skills not necessary for most operations on the bands above 30 MHz. This difference should be reflected in the examination arrangements.

4. RECOMMENDATIONS CONCERNING MORSE CODE AND RELATED MATTERS

Taking into account the views of many Canadian radio amateurs and also the actions taken and likely to be taken in other countries, RAC believes that Morse code as a requirement for operation in the HF bands is no longer appropriate. Accordingly,

Recommendation 1

Radio Amateurs of Canada recommends to Industry Canada that the current Morse code Qualification be dropped as a requirement for operation in the bands below 30 MHz.

The High Frequency bands (1.8 MHz to 30 MHz) offer the opportunity to communicate with radio amateurs in other countries on all continents. Improper operation of equipment, or improper procedural practices, can result in the transmission of signals which may adversely affect radio amateurs (or even radio users in other services) in other countries as well as Canada. Operation in the HF bands requires technical competence on the part of radio amateurs, as well as a good knowledge of international regulations and operating practices. Accordingly,

Recommendation 2

RAC recommends to Industry Canada that, at the same time as Recommendation 1 comes into force, the achievement of a grade of at least 80% on the Basic examination will be required in order to be permitted to operate in the bands below 30 MHz. Achievement of at least 80% will lead to a new qualification to be called the Intermediate Qualification. Holders of the present Basic plus Morse Qualification will be deemed to hold the Intermediate Qualification.

The holder of the Intermediate Qualification will have the same privileges as those currently granted to the holder of the present Basic Qualification (without Morse) plus the freedom to operate on all bands.

Most existing holders of the Basic Qualification (without the Morse code Qualification) will not have real experience of the technical, regulatory and operating requirements referred to above. In most cases, they will not be well-prepared to operate in the HF bands. Therefore,

Recommendation 3

RAC recommends to Industry Canada that current holders of the Basic Qualification who have not also obtained the Morse Qualification should continue to have their existing operating privileges. That is, they will be permitted only to operate on the bands above 30 MHz.

Holders of the Basic Qualification (without Morse) should be encouraged to improve their qualifications such that they may operate on the bands below 30 MHz. Therefore, RAC believes that the following recommendation would be an essential complement to Recommendation 3:

Recommendation 4

RAC recommends to Industry Canada that any current holder of the Basic Qualification who does not also have the Morse Qualification should have the option of re-taking the Basic examination with a view to obtaining a grade of at least 80%. Those who are successful will receive the Intermediate Qualification.

Based upon the experience of two members of the Committee as amateur radio course instructors (and one as an Accredited Examiner), and taking into account statistics relating to grades obtained on the Basic examination, as well as a mathematical analysis of the examination process (see Appendix 2), it has been concluded that the current Basic examination with a pass mark of 60% allows some persons to obtain that qualification without having an adequate knowledge of regulations, operating practices and radio theory. For this reason RAC believes that a change in the Basic examination pass mark should be implemented at the same time as the proposed elimination of the code requirement. Accordingly,

Recommendation 5

RAC recommends to Industry Canada that the pass mark for the examination leading to the Basic Qualification be raised to 70% at the same time as the Morse code requirement is eliminated.

RAC is aware of the fact that the Federal Government wishes to increase the number of Canadians who have scientific and engineering knowledge and qualifications. In particular, Industry Canada has many programs which have that aim. The amateur radio service is supportive of these programs. It is noted that the proposed pass mark change would make only a small reduction in the number of persons acquiring amateur qualifications and this would probably be more than compensated for by the effect of the removal of the code requirement. But the higher pass mark would ensure that those who do obtain these qualifications will have a higher level of knowledge. RAC believes that this is desirable from a Federal Government policy point of view.

Radio amateurs who now hold the Advanced Qualification, but not the Morse Qualification, are not permitted to operate on the HF bands. In fact, such persons are likely to have passed the Basic examination with a high grade and should have reasonable technical competence. In view of Recommendation 2 it seems acceptable and fair to allow such persons to have access to the HF bands. However, in order to increase the level of technical competence of holders of the Advanced Qualification RAC believes that an increase in the passing grade should be implemented, as in the case of the Basic examination. (It is noted that in the US and the UK the passing grade is 72% or 74%.) Therefore,

Recommendation 6

RAC recommends to Industry Canada that all persons who currently hold both the Basic and Advanced Qualifications be given operating privileges on the HF bands. In future, persons who wish to obtain the Advanced Qualification should already hold the Intermediate Qualification, or the current Basic plus Morse Qualifications, and will need to obtain a grade of at least 70% on the Advanced examination.

While some administrations have now dropped the Morse code requirement for operation below 30 MHz, it is clear that it may be some time, a matter of years perhaps, before all administrations make a decision about this matter. Meanwhile, their code requirements remain in force. An example of particular interest to Canadian radio amateurs is the situation in the United States. Although the National Conference of Volunteer Examiner Coordinators in the USA has filed a Petition for Rulemaking to the Federal Communications Commission advocating an immediate end of Morse code testing, the FCC has not scheduled the process to begin until fourth quarter of 2004 with a Notice of Proposed Rulemaking.

Because of the situation in the USA, and because it may be some time before existing international arrangements for reciprocal operating (e.g. the Convention between Canada and the USA, CEPT, IARP) are modified, some Canadian radio amateurs will continue to need a Morse code qualification in order to operate in certain other countries. If the Canadian code requirement is dropped, as recommended, radio amateurs without a Morse qualification would be unable to operate on the HF bands in those other countries which retain a code requirement. It is worth noting that Russia and other Eastern European countries are expected to retain the code requirement.

It is noted that the German telecommunications authority is to retain the possibility to pass an official Morse code examinations for "some years to come". While in future Morse code examinations to access the HF bands may / will not be required as such, anyone who either needs or wants official proof of his/her Morse code capabilities will then be given the benefit of taking an official examination in Morse code for at least some time to come.

RAC believes that Canadians should also have the opportunity to take an official examination in Morse code. Therefore,

Recommendation 7

RAC recommends to Industry Canada that the present Morse code examination continue to be available to those Canadian radio amateurs who wish to have that qualification specified on their certificate.

The examination should continue to be given as now constituted in order to preserve its compatibility with existing reciprocal arrangements. However, when the Morse policies of other administrations become known, the Morse examination should be reviewed to ensure that it qualifies adequately for foreign privileges

.

(RAC notes that, in future, only those Accredited Examiners possessing a code qualification should be authorized to administer the Morse code examination.)

RAC reminds Industry Canada that, in all IARU Regions, the maximum bandwidth for amateur radio transmissions in the frequency band 10.100 to 10.150 MHz is 1 kHz. This means that, should the above recommendations be implemented, that band will continue to be limited to users of narrow band transmissions.

The introduction of the proposed Intermediate Qualification, with its requirement for an enhanced knowledge of technical, regulatory and operational matters, presents an opportunity to make an amendment to the current regulations concerning construction of equipment.

There are now available many high quality commercial kits for the construction of HF transceivers. Under current regulations only those radio amateurs with the Advanced Qualification are permitted to use such equipment. RAC believes that this regulation is unnecessarily restrictive. It is noted that the UK's entry level licence (the Foundation Licence) allows the use of "properly designed commercial kits".

The construction of a kit is an educational process. It leads to an understanding of components, the architecture of equipment, and proper adjustment of controls, and also provides sufficient knowledge to make repairs. Kit construction encourages radio amateurs to learn more about radio equipment and how it works. In short, those who have constructed commercial kits become better qualified radio amateurs. Kits cost significantly less than regular commercially manufactured transmitters. Therefore, the ability to construct and use kits would enable more persons with limited financial resources (for example, young persons) to become active on all bands.

There exists the possibilty of improper transmissions caused by faulty construction or adjustment. Modern kits make this unlikely.

The holder of the Intermediate Qualification will have demonstrated a reasonable technical knowledge, Therefore,

Recommendation 8

RAC recommends to Industry Canada that holders of the Intermediate Qualification be permitted to construct and use commercial transmitting equipment kits.

Further to the matter of construction of equipment, RAC believes that a similar relaxation of the regulations for the bands at 2.3 GHz and above would be appropriate. At these frequencies, much equipment is constructed by radio amateurs. Current Basic holders are permitted to transmit in any mode at these frequencies but are not allowed to construct their transmitters. This discourages such persons from operating at the microwave frequencies. The range of signals at those frequencies is very limited and most antennas are very directional. The likelihood of improper transmissions causing problems is very small indeed. RAC believes that holders of the new Intermediate Qualification should be able to construct their own equipment in the microwave bands. Accordingly,

Recommendation 9

RAC recommends to Industry Canada that holders of the Intermediate Qualification be permitted to construct and use their own transmitting equipment in the bands at 2.3 GHz and above.

The proposed system of qualifications is summarized in Table 1. The Table shows the privileges, required examination, and certificate notations for each qualification. The present system is summarized in Table 2 for purposes of comparison.

The recommended equivalences between the present and future qualifications (i.e. the grandfathering arrangements) are shown in Table 3.

Table 1. Proposed System of Qualifications

Qualification	Basic	Intermediate	Advanced
Privileges	Operation above 30 MHz	Operation on all bands Build and use commercial kits Build and use any equipment for use above 2.3 GHz	Operation on all bands Build and use any equipment High power Repeaters and club stations Remote control
Requirement	Basic examination with 70% pass level	Prerequisite: none or Basic Basic examination with 80% pass level	Prerequisite: Intermediate Advanced examination with 70% pass level
Certificate	"Basic"	"Intermediate"	"Advanced"

Note: the certificate for the holder of any of these qualifications may be endorsed with the Morse notation as appropriate.

Table 2. Present System of Qualifications

Qualification	Basic	Basic + Morse	Advanced	Advanced + Morse
Privileges	Operation above 30 MHz	Operation on all bands	Operation above 30 MHz Build and use any equipment High power Repeaters and club stations Remote control	Operation on all bands Build and use any equipment High power Repeaters and club stations Remote control
Requirement	Basic examination with 60% pass level	Basic examination with 60% pass level + Morse examination	Advanced examination with 60% pass level	Advanced examination with 60% pass level + Morse examination
Certificate	"Basic"	"Basic" "Morse"	"Basic" "Advanced"	"Basic" "Advanced" "Morse"

Table 3. Equivalences

(equivalences, i.e. grandfathering arrangements, are shown by the shaded rectangles)

	New Basic	Intermediate	New Advanced
Present Basic			
Present Basic + Morse			
Present Advanced			
Present Advanced + Morse			

5. RECOMMENDATIONS CONCERNING CURRICULUM AND EXAMINATIONS

Curriculum, Present and Future

The present curriculum comprises three elements: Two written examinations (Basic and Advanced) and a Morse test. These elements can be combined in different ways to obtain four different combinations of privileges: Basic, Basic+Morse, Advanced and Advanced+Morse. The scheme is progressive, in a sense, but not sequential.

The removal of the mandatory Morse test results in only two written examinations for three levels of privilege. There is only one examination (Basic) to qualify for two different levels. In our recommendations we have made the distinction between the two levels by a difference in pass mark. This is a temporary solution only and ultimately the curriculum should comprise three distinct syllabi, which we have called Entry, Intermediate and Advanced. The Entry and

Intermediate syllabi would be derived from the present Basic syllabus and the Advanced syllabus would be substantially unchanged. The scheme is progressive in that a higher level has additional privileges and the pre-requisite is certification at the next lower level. The proposed scheme is comparable to the three-tier, progressive schemes used now in the US and the UK. This alignment internationally will facilitate the negotiation of reciprocal operating and licensing agreements.

Entry level

"The Department of Industry believes that amateur radio should be readily accessible to Canadians, so that those who are interested in the science and art of radiocommunication may avail themselves of every reasonable opportunity to learn, enjoy, contribute or participate in that service." (From RIC-3). In the spirit of this statement, we propose that a new entry level of qualification be created which would attract new people --- especially young people --- into the hobby without compromising the quality of the successful candidates.

The idea of an entry level was introduced at the nineteenth meeting of CARAB. At the twentieth meeting of CARAB, RAC undertook to make a proposal regarding an entry level. The present proposal is a fulfillment of that commitment.

In the UK, the Radiocommunications Agency already offers a Foundation licence for this purpose. The Wireless Institute of Australia (WIA), RAC's counterpart, "has proposed the introduction of arrangements similar to the UK Foundation licence." The Australian Communication Authority has initiated a Review of Amateur Service Regulations which includes a consideration of this proposal. In the US, the National Council of Volunteer Examiner Coordinators (NCVEC) has formed a committee to develop an FCC rule-making proposal for a new entry-level Amateur Service licence.

The examination for the entry level qualification should demand an adequate knowledge of a selected range of topics of the most basic nature in regulations, operating and theory. The Intermediate and Advanced syllabi can then build upon knowledge in these three areas. Australia already has two levels of theory examinations, Novice Theory and Amateur Theory. Both the US and the UK have three licence classes and both regulations and theory are examined at different levels for all three licences.

The topics and questions needed for the revised examination could be drawn largely from the present Basic syllabus and question bank with some simplified theory questions substituted.

Such a level will put amateur radio within reach of the participants in RAC's Youth Education Program. The syllabus should be designed so that it, or parts of it, could be incorporated into a school curriculum.

Recommendation 10

We recommend that a new entry-level qualification be introduced, designed to ensure good operating practices and requiring only an introductory level of theory

Intermediate syllabus

Industry Canada published a revised Basic syllabus in RIC-3 in 2001, replacing the previous syllabus appearing in RIC-24, last issued in 1997. Inspection of this revised syllabus will reveal that it is quite comprehensive of the topics relevant to HF operation, although some topics, such as modern digital modes, should be added. It is closely equivalent to the US General syllabus and the UK Intermediate syllabus which carry HF privileges. An examination based on this syllabus, taken in conjunction with our recommended increase in pass mark discussed below, is therefore an adequate test for the proposed new Intermediate Qualification.

A number of respondents to the RAC survey called for increased coverage of regulations and operating in particular. It would appear that the amateur community is not generally aware of the RIC-3 expansion of the syllabus. In fact, some courses are still teaching from study guides based on the narrower syllabus in RIC-24. (And still graduating students, perhaps a testimonial to the lack of effectiveness of the low pass mark as we have already noted.)

Advanced syllabus

The Advanced syllabus would be largely unchanged except for the addition of a few new topics. There was a perception in the survey that the presence of the topic of vacuum tubes in the curriculum indicated that the curriculum is out of date. There is some justification for this except for candidates for the Advanced Qualification who would be allowed to construct and use high-power amplifiers. Therefore, we propose that the topic of vacuum tubes be transferred from the Basic syllabus to the Advanced syllabus and expanded. At present, topics on regulations are presumed to have been covered in a previous examination and are not included in the Advanced syllabus. It is advisable to include some topics pertaining to advanced operation and regulations.

Multi-part examination

A complaint that arose in the survey is that it is possible to pass the Basic examination with minimal knowledge of regulations. Only 25 percent of the examination is based on regulations and a mastery of the other areas only - operating and theory - will produce a pass. In fact, it is quite possible for a candidate who is technically trained to pass the examination without studying regulations at all.

The solution to this problem is to separate all examinations into two or three parts - Regulations, Operating and Theory - and require a pass on all parts. This would ensure that the successful candidate is not weak in any area. The table further below presents some instances where multi-part examinations are used. In Australia, candidates are examined separately on theory and regulations and required to pass both for any grade of licence.

It is not feasible to administer the record-keeping for part-credits on a two- or three-part examination; it would be necessary, from a practical standpoint, to require the candidate to pass all parts at one sitting.

<u>Recommendation 11</u>

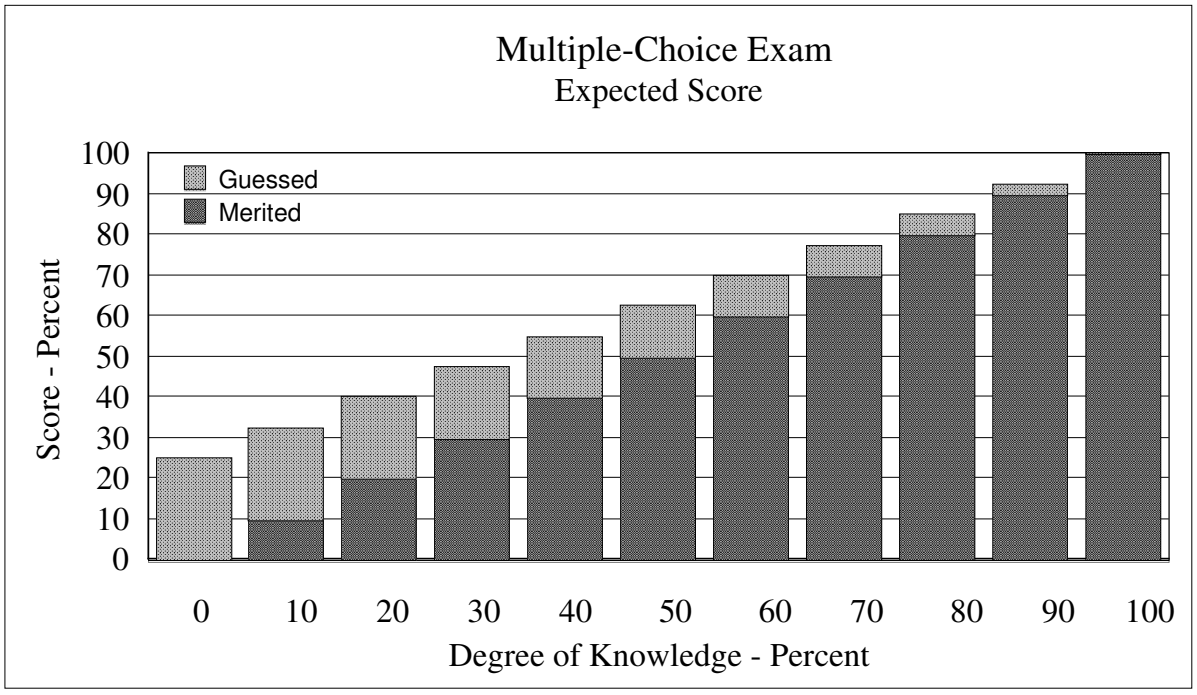
We recommend that all examinations on the new syllabus be divided into several elements,

as appropriate, and a pass mark be required on every element.

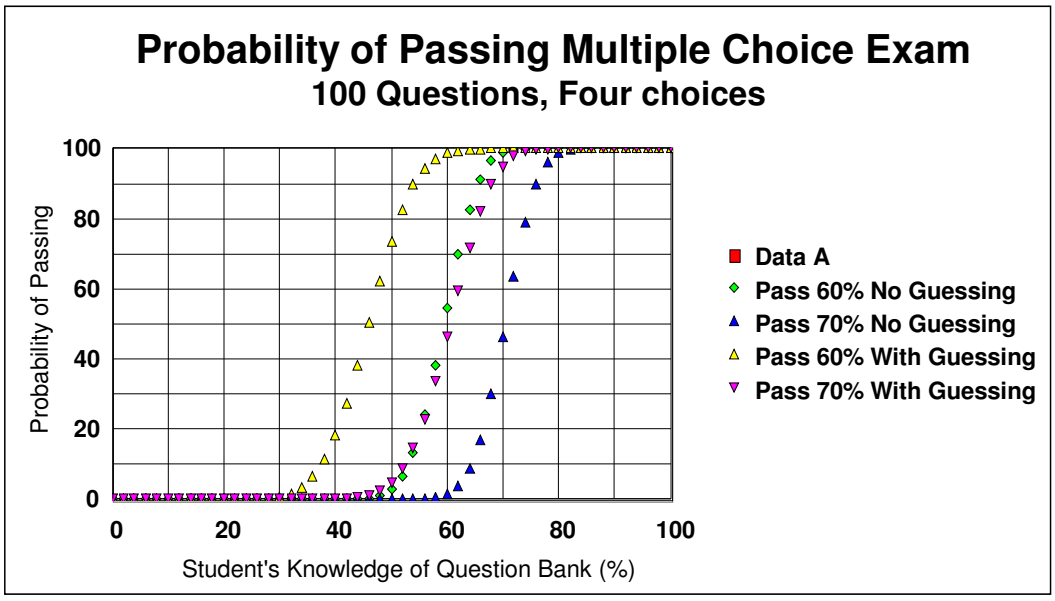
Multiple-choice examinations

The multiple-choice examination is very easy to generate and administer and provides an objective means of scoring. However, because guessing is allowed, the score is, in part, a measure of the candidate's luck and not just his or her knowledge. The histogram below shows that the guessing factor favours the poorer candidates and is greater the lower the pass mark.

For example, consider a candidate who has mastered only half the syllabus - that is, he/she can answer half the questions in the question bank and must guess at the remainder with a probabilty of 1 in 4 of guessing right. This proportion will be carried over, on average, into any examination that is generated from this question bank. Therefore, on average, this candidate can be expected to score 50 percent on answers he/she knows and 12.5 percent on answers he/she does not know for a total of 62.5 percent - a pass!



A closer examination of the probabilities [see figure below] shows that this half-knowledge candidate will pass an examination 73 percent of the time. Furthermore, he/she is not limited to one attempt at the examination. There is a 92 percent probability that the candidate will pass on two attempts and is almost certain to pass if he/she persists in re-taking the examination.



One solution to the guessing problem is to penalise the candidate one point, or even two points, for a wrong answer. However, this discriminates against the candidate who has a very good, but not perfect, knowledge of the syllabus. The candidate is torn between demonstrating his/her part knowledge, which could be done with impunity on an essay-type examination, or gambling away his/her merited score

The figure above shows that the effect of guessing is to lower the pass mark, in this case by about ten percent. The only countermeasure to the guessing effect is to raise the pass mark.

Pass mark

The foregoing analysis demonstrates the inadequacy of the present pass mark of 60 percent. In our interim proposal, we have recommended marks which are higher but differ from one qualification to another. We suggest that at such time as the three separate syllabi are introduced, all the examinations should have the same pass mark. The table below shows that, for multiple choice examinations, it is common practice to use a pass mark in the range of 70 to 80 percent.

PASS MARKS			
EXAMINATION		**QUESTIONS**	**%**
Amateur Radio Licences	**UK**	**-**	**75**
	US	**26 /35 or 37/50**	**74**
	Australia (*)	**-**	**70 & 70**
Other	**Ontario Driver's Licence (*)**	**16/20 & 16/20**	**80 & 80**
	Pleasure Craft Operator's Card	**27/36**	**75**

(*) Two parts. Must pass both parts.

Recommendation 12

RAC recommends to Industry Canada that the pass mark on all elements of all examinations be set at 75 percent at the same time as the new syllabi are introduced.

Waiting period

Several respondents in the RAC survey suggested a waiting period or a probationary period or a period of supervision by a qualified amateur before a person would be given HF privileges. Although, similar arrangements have been used in Canada in the past, this type of requirement is no longer feasible to administer and so we do not recommend it.

Question banks

Although we have recommended three different syllabi, whereas there are only two at present, this does not in itself imply a much greater pool of questions. It is likely that the necessary topics for the Entry level and Intermediate syllabi could be drawn largely from the present Basic syllabus. This implies a separation of the present Basic question bank into two banks according to the selection of the topics for the syllabi. Some additional questions may be required; the question banks of English- and French-speaking administrations are a good source for new questions.

A criticism of the present examination system is that a public pool of multiple-choice questions lends itself to rote memorization, an abuse of the examination in its intended purpose. The only safeguard against this is to ensure that the ratio of the number of pool questions to the number of examination questions be very high. In the US and New Zealand, this ratio is specified to be 10:1. In Canada, the ratio happens to be about the same but for certain topics it is as low as 4:1. Any changes to the question banks should ensure an adequate ratio exists for every topic.

Examination generator

All these changes in syllabi would entail additional function in the examination generator software. The present generator is designed to generate a fixed number of questions from one of two question banks. This functionality is not adequate for the qualification system we are recommending. Furthermore, there may be future demands for examination changes as a result of changes in international regulations or reciprocity agreements, or advances in radio technology. A new generator, much more flexible than the present one, would be required.

Implementation and maintenance of the new system would be facilitated if the question bank and the examination generator were to be based on any one of a number of commercially available database systems.