

Operating Patterns Among Canadian Amateurs



**Radio Amateurs
of
du Canada**

**Radio Amateurs of Canada
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Operating Patterns Among Canadian Amateurs: Results from the RAC Survey 2021

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The Radio Amateurs of Canada (RAC) periodically conducts surveys to obtain objective information on the current status of amateur radio in Canada. The RAC Survey of 2021 focuses on operating patterns among radio amateurs, including how active they are in various specific aspects of the hobby, the frequencies utilized, antennas used, and some key demographics. This technical report is a full analysis of those survey data. Other studies will likely come from these data.

This report is organized around the demographics of Canada and survey participants, hobby activities, and the use of band allocations by Canadian amateurs. To my knowledge, these are the most detailed behavioral data on ham operator activity at a national level in existence. A summary of key findings is located at the end of the report. The Appendix contains technical aspects of the survey as well as supplemental analytical results from the survey. We encourage the reader to study the survey deployment information prior to digesting the findings.

Canadian Amateur Radio Operations: Demographics of Survey Participants

It is difficult to fully understand surveys of individual amateur operators without first gaining a good appreciation of where all operators reside and some other pertinent characteristics of the universe from which they originate. The RAC Survey 2021 results are placed within the demographic context of all amateur operators in Canada. These include the geographical locations by Province, age group, projected age-specific population of the nation, residential size-of-place, and the length (tenure) of license-holders and self-reported active status.

Geographical distribution by Province

The figure below (Figure 1) contains a map where each license address in the Canadian amateur radio operator database has been georeferenced to a point location using their reported license address. These are plotted with each Province outlined and Metropolitan areas shown in a darker polygon. This allows the reader to see where individual licensees are located with respect to population centers in Canada. In the lower panel, a bar chart of the number of licensees by Province complements the map distribution of precise locations of all amateurs in the nation.

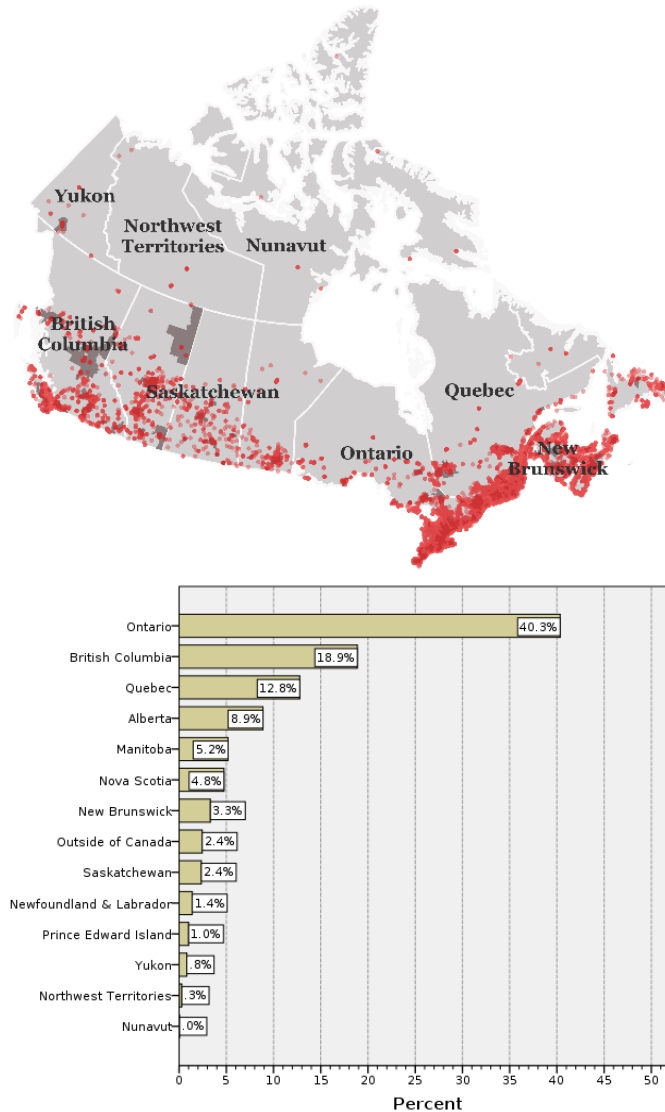
There is ample evidence demonstrating how spatially concentrated hams in Canada are in terms of their residence. Almost three-fourths are in three Provinces, led prominently by Ontario (40%). A bicoastal concentration pattern is shown by British Columbia being a distant second home (19%), followed by Quebec (13%). But the map of each ham licensee demonstrates a clearer aspect of this spatial concentration. It is the southeastern region of Canada that hosts a dominate portion of amateur radio operators. Moreover, amateurs reside along the southern border of Canada from the East to the West. There are small numbers of ham operators residing in low population density areas within these broader regions.

Using data not shown, the license database has about one-fifth (18.9%) of all licensees residing outside of any type of Metropolitan area. Almost seventy percent do (69%). Thus, amateur radio operators, whether active or not, are highly located in medium to large urban centers in Canada. These results are shown in Figure 2.

In the RAC Survey 2021, respondents are slightly more decentralized than the full license database itself. When asked to identify the local environment of their station, survey respondents say that they were in rural areas (22%) or small towns (31%), more than where the full license database members are actually located.

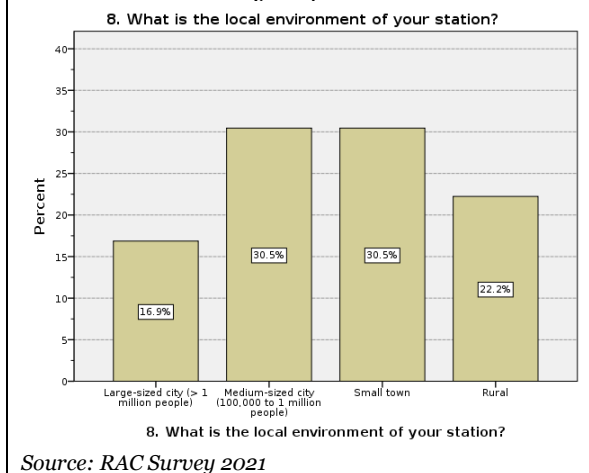
In fact, there is the same percentage saying they live in small towns as in medium-sized cities of 100,000 to one million residents (31%). The larger (metropolitan) cities of more than one million population lay claim to a smaller share of RAC Survey respondents (17%).

Figure 1. Licensed Amateur Radio Operators in Canada, 2021



Note: data taken from the Amateur Radio Service Centre, georeferenced by the author, and used to construct the point map (top) and bar chart by Provinces (bottom).

Figure 2. Local Size-of-Place Environment for RAC Survey Respondents



Shown in the Appendix regarding the survey methodology, Table A1 compares license numbers to survey respondents by Province through a comparison of respective percentage distributions by Province. The ratio in the table illustrates the “over or under” representation of the RAC Survey versus the license data representing the amateur radio population. If the survey response was perfectly random, higher than expected responses came from the Provinces of Northwest Territory (ratio of 2.54), Manitoba (1.76), Prince Edward Island (1.71), and so forth. Under-represented Provinces include Nunavut (0.42 with only

47 licensees) with several (e.g., Newfoundland and Labrador at 0.78) being only a bit so. In all, this is not surprising for a non-random sampling design that is triggered by a social media call to “opt in” to an online survey.

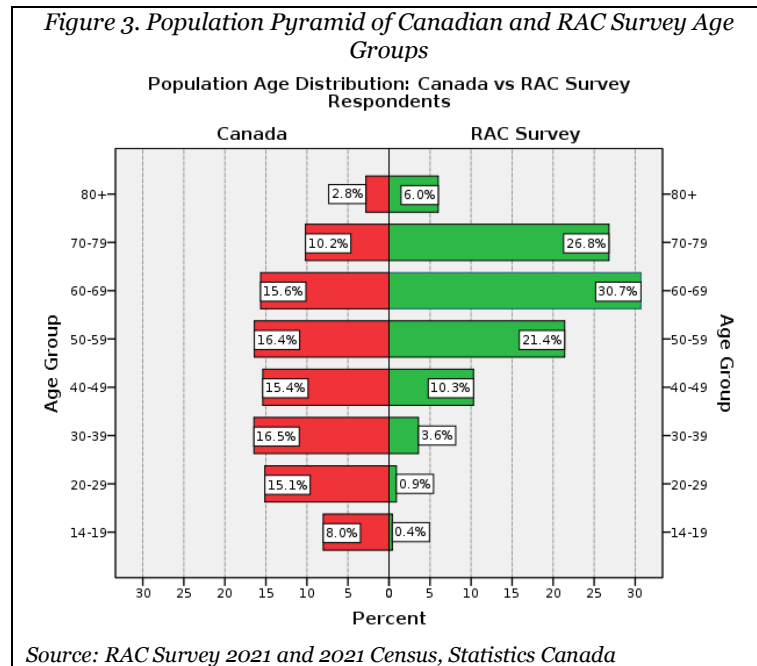
Age distribution of participants and Canada

One of the pressing issues facing all amateur radio organizations in the modern world is what appears to be a rapidly aging set of participants. We base this belief on various observations at mostly in-person amateur radio activities since licensing bodies rarely ever collect or release birth dates with their license data. (Not all release actual license records themselves.) The issue is whether we are seeing ham operators who participate in these venue events or is the ham population actually aging as much as our eyes tell us?

From every data source that the author has seen or analyzed, the population of amateur radio licensees worldwide is substantially graying.¹ RAC Survey 2021 respondents were asked what is your age group and given a choice of mostly decade-length age ranges. The 2021 Census of Canada age-by-year data were extracted from Statistics Canada and collapsed to fit the same age ranges. These data are presented in a population pyramid graphic in Figure 3. The Canadian population (left) and RAC Survey (right) do add a further confirmation of this aging amateur radio population. Ham operators in the survey are less than the population below the age groups less than age fifty but increasingly over the population distribution after the half-century mark. In the sixties and above, amateur operator percentages are over double that of the population at large.

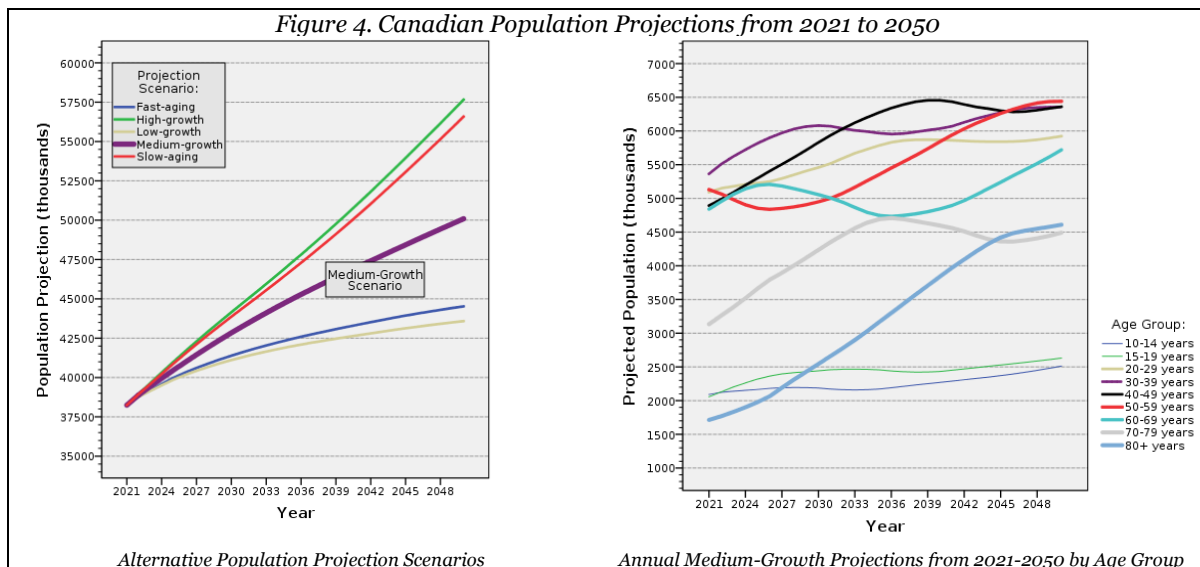
What does this population distribution mean for amateur radio in Canada? There are at least two elements to the demographic equation here. If we think of amateur radio as a behavior, a hobby or a pastime, that occurs over the *life course* of individuals, then the behavior may be age-related regardless of historical period.² Or, alternatively, it could be an *historical period* behavior that is prominent during an age range of one or more adjacent periods in history. We have many behaviors that do largely fade away as the participants age through other stages of life. Some, however, begin at later stages

without younger groups joining the activity. This life course perspective recognizes the effects that are frequently revealed by hams themselves: work, marriage, family formation, competing interests, and others. Other investigations with relevant data are required to answer these questions. But one aspect that is critical involves the future Canadian population itself. *How is it scheduled to age over the next several decades?*



Statistics Canada has published age-specific population projections for the nation. These have been taken to prepare Figure 4 with various projection scenarios (left) and age-specific projections from 2021 to 2050 (right). As is common, the “medium growth” scenario was selected to present the scheduled growth of age groups. Shown in the purple line (left), this set of assumptions for population growth fall in the middle of those with high-growth or slow-aging models versus low-growth or fast-aging parameters. They are generally the most reliable to use for analyses such as this report.

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The results in the right panel for each age group that was configured to match the RAC Survey age groups tell us that the population in Canada will grow in the middle-age categories and in the most senior ones. Those in the twenties through fifties will top the age pyramid by 2050, followed by those most senior residents in their seventies and

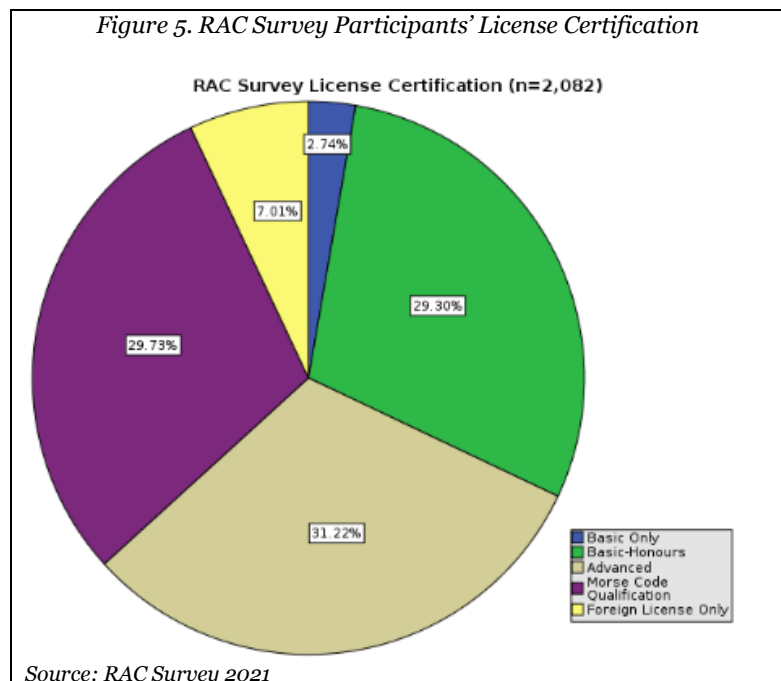
over. The youngest population of teens (10 through 19) *will be far smaller*. This is a significant signal to policy-makers in Canada.

This pattern has two clear implications for amateur radio in Canada. One is that the age groups of 60-80 years of age, now dominating amateur radio as the RAC Survey suggests, will simply disappear as they age-out to infirmity or becoming Silent Keys. Yet, their non-ham radio peers are scheduled to grow in number. (A recruitment focus on *late-in-life* hams is a clear policy for RAC to consider.) A second implication is that teens will be a relatively scarce recruitment commodity in terms of the age pyramid. There will simply not be enough of them to replace those Baby Boomers now dominating the hobby, regardless of the recruitment resources directed toward them. Demography can be destiny. But it does not have to be so.

This should not be misconstrued to suggest that it would be a waste of time to expose young people to amateur radio as a recruitment method. It encourages strategic and efficient methods for RAC and its membership clubs and associated organizations to reach *both* the youth population as well as later-in-life adults. More will be said about this in the final section of the report.

License tenure and activity over the amateur radio career

While the population demography reflects a challenge for the future of amateur radio in Canada, it is important to more fully understand how the hobby is pursued over the ham's "career" as a licensed amateur operator. RAC Survey participants were asked both about their license certifications as well as how many years they had held a license and been active in the hobby. The dominant license is the Advanced certification (70.1%). In the RAC Survey, the chart (Figure 5) below

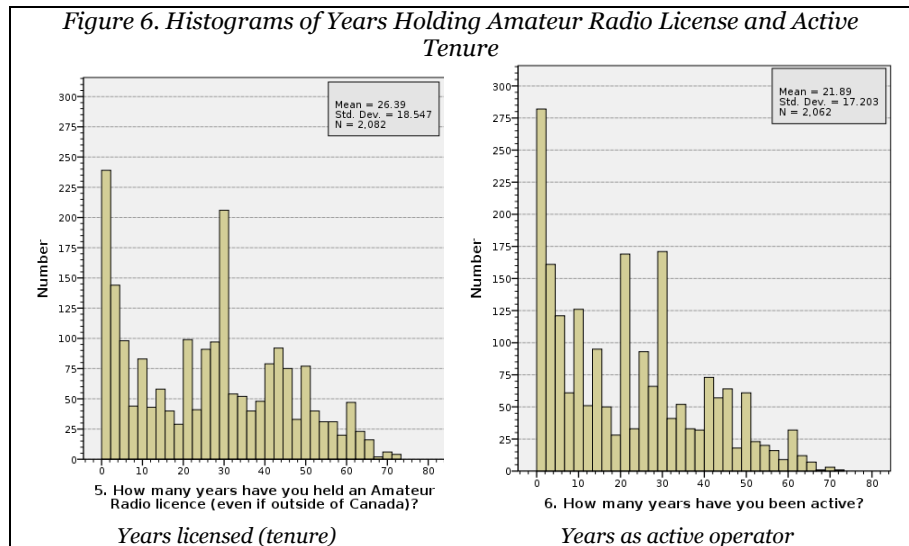


illustrates that their license certifications are about equally split across Basic with Honours (29.3%), Advanced (31.2%) and the Morse Code Qualification (29.7%). Those with a Basic Only certification are a small portion of the survey respondents (2.7%). These breakdowns may become important as we analyze the activities of these responding amateurs, especially for band use.

The graphic in Figure 6 displays histograms of the frequency of hams in each year bin. On the left is length of holding a license (tenure). The right panel is the same display except for years of activity. The average years of license tenure is about 26 while 22 is the average of years active. The variation in each measure is about the same, a standard deviation of around 17-18 years. The experience levels among Canadian amateurs are lengthy but it is also *quite variable*.

There is a notion, perhaps rooted in the Baby Boomer and preceding generations, harkening back to the emergence of amateur radio, that young people get exposed to amateur radio, get licensed and continue their amateur radio careers in a continuous fashion. This would make the teen years the prime period in the life course for recruitment into the hobby. In the survey, there is some modest evidence of this pattern. Hams who are in the most senior age groups report years of license tenure suggesting that the teen years were when they became licensed. Moreover, a large number of them say they have been “active” all of their licensed years. This question wording leaves the definition of *activity* up to the respondent. This notion, however, does not fit many respondents in the RAC Survey. The latter are large enough to beg the question of how valid is this traditional idea with which we often characterize all amateurs. Like many stereotypes, there are significant examples that fit it but it also mischaracterizes a large share of ham operators.

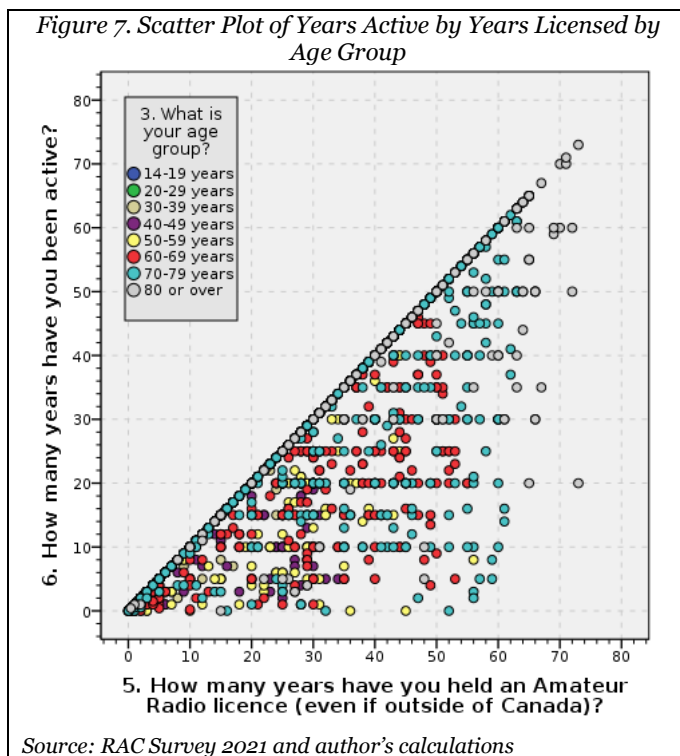
There are two things to hold out as important from this graphic. One is that survey responses bunch around newcomers (or zero to 4 years) or 25-30 years of holding a license. Activity is about the same pattern except the bunching of respondents is not as pronounced as license tenure. The “careers” of activity in amateur radio tend to vary quite a bit. A second is that these two variables are not linked to the *same amateur*. How many have activity periods that last for most of their license tenure? What lengths of active periods characterize Canadian hams?



We have visualized this linkage through a scatterplot of ham radio activity by license tenure with age groups identified. Figure 7 contains this visualization. A scatter plot is an X-Y plotting of individual data points along the data values of each variable. The age group for each survey respondent is shown by a distinct color.

There are no respondents above the line in this plot since activity is predicated in this survey upon holding a license. *The diagonal line of hams reflects those who have been active their entire careers in ham radio.* Among those in the most senior age groups

(e.g., 70 and over), this suggests the commonly held pattern of getting licensed at a teen or young adult and staying the course. There are many of these amateurs but they are *far from being the dominant group*.



The large number of data points moving *away* from this diagonal (toward the lower right) reflect hams who got licensed and have not been “active” nearly as long as those of similar license tenure on the straight diagonal line. Those among the most senior groups have had enough experience to reflect the inactive periods that vary, sometimes widely. Thus, these data illustrate that our conventional image of the amateur who gets licensed early in life and maintains that hobby activity throughout is largely a stereotype. Although it is one based upon real-world examples who fit it ideally. These patterns of activity period are directly pertinent to policies for recruitment into the hobby. They illustrate clearly the significant

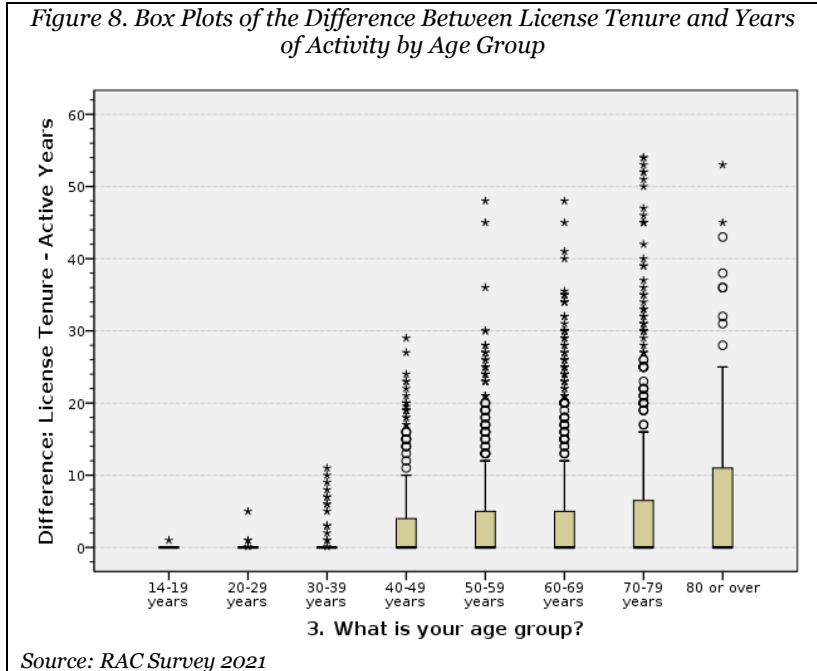
market among *late-in-life* hams. See Howell (2013) for another U.S. survey with data on *late-in-life* ham operators.

To further illustrate how much of a deviation from this ideal type exists, Figure 8 uses box plots of the simple difference between years licensed and years of activity (i.e., years licensed – years active). It’s broken out by age group. Box plots show the data emanating from the center point of the median at the middle of the box. In this case, zero provides a bounding so that there is only one end of the distribution of survey respondents. These data are highly skewed toward higher periods of less activity (“inactivity”). The median lines in the boxes are barely visible. There is a trail of hams who report a *growing gap of inactivity* as age increases. Some get licensed but drop out of the hobby, at least for some periods of time. For example, for the most senior group, some have been licensed-*but-inactive* for 40 or more years. Over their license tenure, a significant group of hams fall away from practicing the hobby.³ This licensed but inactive segment represents a ripe market for recruitment back into amateur radio activities. I will note in passing that we do not have any consensus for what “active” in the hobby means.

Summary of Demographic Patterns

As I complete this section, it’s important to bear in mind several of the key findings as they place the following analysis of hobby activities and use of band allocations into a geographical and demographic context in Canada.

Canadian hams are spatially clustered into the southeastern corridor and along the southernmost regions of the nation. A very small portion are situated in the northern hinterlands. While all licensees are mostly metropolitan-centered, RAC Survey 2021 respondents are spread more evenly across less populated locales, including small towns and rural areas. These respondents are dominated by amateurs in their sixth decade and over. Government population



projections show that their senior age peers are likely to grow over the coming decades as are the middle-age segments of the population. But the teen population in relative proportions are not likely to grow. There appears no real basis to ignore the aging ham population as something that will take care of itself with some emphasis on recruiting teens as replacements in the hobby. There simply will not be enough of them for this to be an effective and sole strategy.

Age-related hobby activities, therefore, *could well be at risk of diminishing in the coming decades*. Many hams are long-tenured but a noticeable portion of those say they have been inactive during that period. In fact, we demonstrated that there are many who have been active for not very long at all. They likely got lost in the shuffle of competing interests during the life course, perhaps leaving the hobby altogether or for just a few years. The mix of amateur radio operators' careers in terms of tenure of licensure and active participation replaces the life-long ham activity vision held by many today.

I analyze age differences in hobby activities and band usage throughout the report. However, to reduce the volume of reported analyses, we make note of only those that appear significant to the report's focus. Marginal results are included in the Appendix and noted in the narrative (see Table B3 for additional summaries).

Hobby Activities: The Pattern, Extent and Mix of Participation

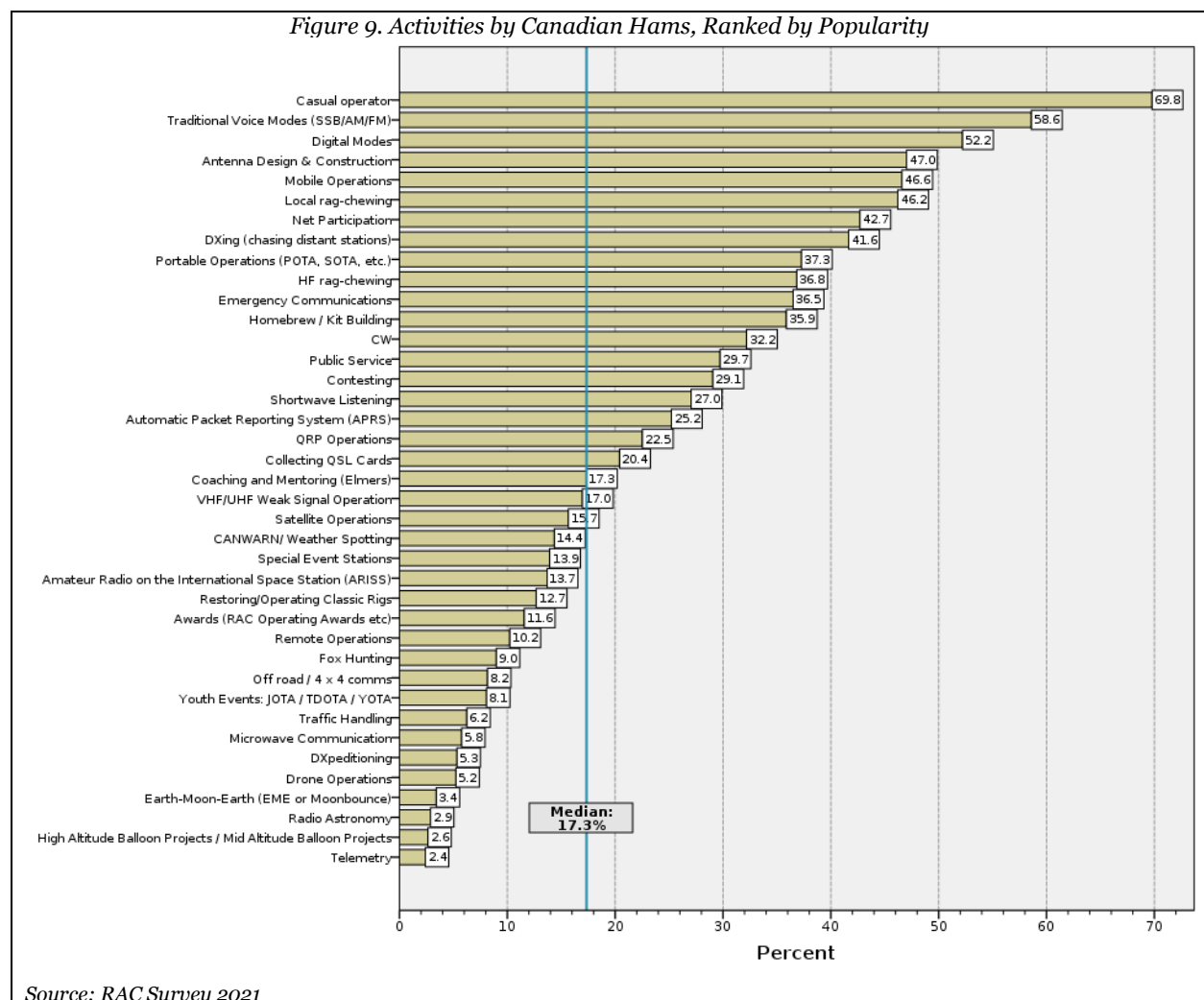
The RAC Survey 2021 included a significant set of questions about participating in specific hobby activities. The author has not seen any national survey of amateur operators that compares to the breadth of this one. Therefore, on the whole, it may be

the only objective source to date speaking to the often-used term, “active” hams. The results reveal patterns of behavior and time in activities and on which bands.

Descriptions of the range of activities

A primary focus of the RAC Survey was to measure participation in specific activities within the hobby (see Appendix A). A total of 38 activities were presented during the survey, asking the respondent for a declaration of their involvement. We sorted these responses into a chart from highest to lowest participation (Figure 9). (A table in the Appendix also contains these same results.)

Dominant Operating Activities. It should be little surprise that casual operating and voice modes are the top activities. While the median percent participation in all these activities is about 17 percent, the activities with the highest engagement are clear relative to this baseline. Three activities reach a majority level of participation: casual operations, using traditional voice transmissions, and digital modes. This is both not shocking but the level of use in digital transmission might be a surprise to most readers.



Over two-thirds (70%) operate in what they consider a *casual style*. Traditional voice modes, like SSB, AM or FM, are second (59%). What may be a surprise is where digital modes rank: in third place (52%). Fully one-half of Canadian amateurs now operate digital modes. This considerably out-ranks the venerable and original mode of CW (32%) where only a third say they now use Morse Code for communication. With local (46%) and HF rag-chewing (37%) registering at double the median participation rate, it is clear that hams in Canada, at times, enjoy just chatting with others. A more formal style, Net participation, is engaged in by some 43 percent.

Contesting and Chasing DX. Contesting as a pursuit is popular among a smaller group of less than one-third in size (29%). But new forms of “contesting” have emerged through portable operations such as POTA, SOTA and related activities outside the usual shack (37%).⁴ Fox-hunting is followed by almost one-in-ten (9%) Canadian hams. Low power QRP operations, regardless of location, is popular in about one-fifth (23%). Mobile operation is on par with local rag-chewing in popularity (47%). Operating Special Event Stations gets about 15 percent (14.9%) engaged. Thus, the emergence of portable operating, especially in combination with formal log-submissions via Parks or Summits on the Air, has surpassed in numbers of practitioners in the traditional contesting operations. This may be a shock to some in the contesting community who have been part of the establishment of amateur radio activities for decades. These objective survey results document evidence to the contrary.⁵

The related activity of pursuing distant contacts (DXing) is as popular as, for instance, checking into various Nets. Some 42 percent identify as DXers. The related activity of collecting QSL cards per se falls in at only a 20 percent level of engagement. (The electronic QSL records, such as LoTW, eQSL, etc., may have supplanted paper cards for many hams.) As could be expected with the investment in money and time commitment, being involved in DXpeditions themselves is rare (5%).

Public Service. Public service in emergency communications engages about a third (37%) and more general similar activities (30%). Related to this includes weather and storm monitoring (14%). Formal traffic handling (6.2%) maintains a small but dedicated group. Drone operations might be considered in the public service arena. While it’s a new technology for amateur radio, there is a nominal set of hams in the survey (5%) who say they use it. The venerable APRS network is used by a quarter of operators (25.2%).⁶ Taken together, there is a significant share of Canadian amateurs engaged in emergency and related public service activities.

Building. Designing and building amateur radio equipment, especially antennas, capture a surprising share of activity. Antenna construction is the third most popular activity result at 47 percent. Homebrewing and kit-building is an activity of over a third of these respondents (36%). The restoration of classic rigs and putting them on the air attract a small group (13%) but one more highly attractive to hams than a dozen other aspects of the hobby. The homebrewing roots of the hobby appear to remain live and well.

Elmering and Coaching. The mentoring and coaching of other hams, especially newly licensed ones, is a practice that takes time. It may not be for every amateur operator.

Only 17 percent (17.3%) report engaging in this activity. Related engagement for youth involves several activities, such as JOTA, TDOTA and YOTA, and garners about 8 percent of hams in Canada into their support.

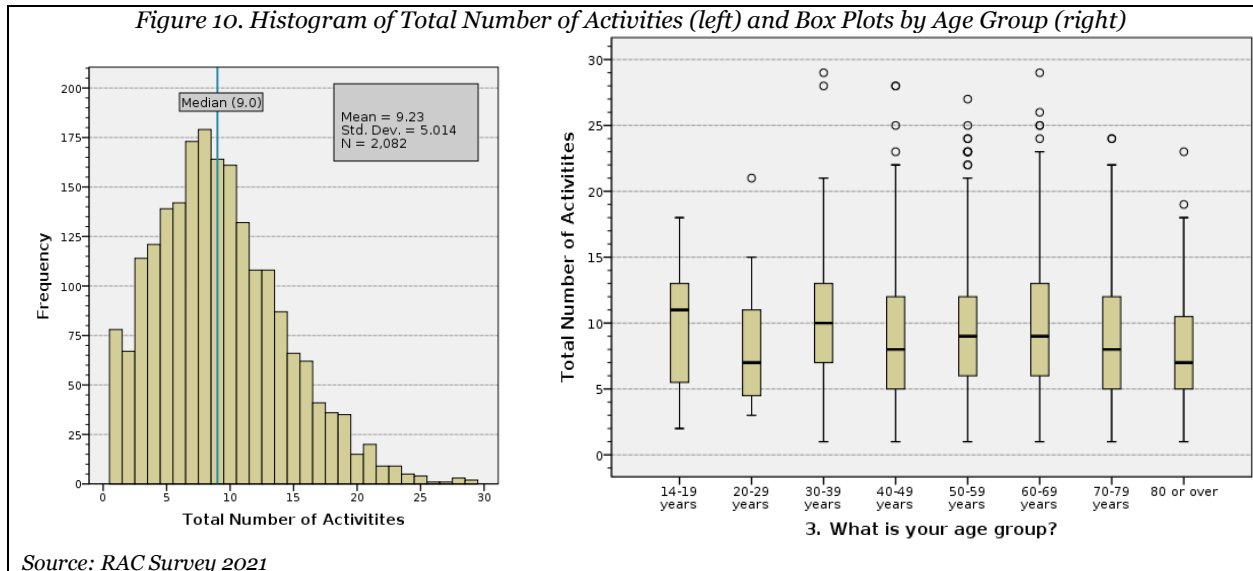
Space and Satellites. Various aspects of amateur radio in space are popular. Contacting the International Space Station (ARISS) is now an attraction for many (14%). Satellite operations in general are comparable in their share of practitioners (16%). Bouncing signals off of the moon (EME) is a specialty of some 5 percent of these hams. Using amateur radio for radio astronomy, a crossover field for astronomy proper, has a small contingent (3%) of followers.

Shortwave Listening. Many amateur operators began as shortwave listeners. Over a quarter (27%) in this survey report being engaged in SWL activities. This is on par, by comparison, with formal contesting or QRP operations. Perhaps the reader is somewhat surprised by this result. SWLing is nonetheless as or more popular than contesting, public service or QRP operating.

Niche Activities. A number of miscellaneous activities may not fit into these broader sets of activities. These include: remote operations (10.2%), VHF/UHF weak signal operations (17%), off-road communications (8.2%), high altitude ballooning (2.6%) and telemetry (2.4%). Each of these may fit into other larger activities but stand on their own in this survey. These results serve as a baseline for future surveys repeating these activity questions so that their growth may be objectively determined.

Total Number of Activities. The total number of activities that RAC Survey 2021 participants reported reflects just *how* active each ham operator is regardless of the activity's specific focus. A sum of all activities by age group is shown in the accompanying chart as a histogram and by age group in a bar chart (Figure 10). Since we have no data with which to compare the total portfolio of an amateur operator's activities, it's important to examine how Canadian hams vary in them.⁷

Survey respondents say they participate in as few as one and as many as 29 *different* activities. The median number is nine. The left panel shows that there is a skew to the right side of the distribution where the most active hams are located. The right panel shows that the medians (dark bar in the box) do not vary much across each age group. There is some change from the teens to the thirty-year-old group but the pattern smooths out from there. These hams are not followed as they "age," so we cannot truly speak about more specialization occurring from the teen years into middle age. It could be the historical period in which each ham got licensed and socialized into the hobby, perhaps by an Elmer coach, that shapes these specific activities. The results here, however, show little change in the overall portfolio of activities by hams of all age groups. The top group (at 10) is only three higher than the bottom group (at 7). This is a good sign for continuing engagement regardless of age as measured in 2021.



These results show that amateur radio activities in Canada are more than alive and well. The well-entrenched activities of casual QSOs with fellow hams is clearly a common pastime. These are predominately using voice or digital modes but CW operation is practiced by one-third. Building, especially antennas, is a very popular activity. EmComm and contesting tend to round-out the traditional areas but is also seems clear that Canadian hams may be a diverse lot in terms of how they spend their time in the hobby. Moreover, their activity levels are not lower among older age groups than younger ones. Age does not appear to impact the simple number of reported activities. Amateurs in Canada get involved in varying activities without much regard to their ages. I now turn to the diversity in specific activity behaviors in our analysis, in which age will be shown to play a prominent role.

Putting Activities into a Demographic and Geographical Context

The key differences in activity participation by age, RAC membership, rural-urban residence, and Province are summarized in this section.

I examined variations in these patterns by age group, license class, RAC membership, Province and residential size-of-place. This involved voluminous statistical tabulations and significance tests, too much to include directly in this report. A summary table (Table B3) is shown in the Appendix of supplementary results is included for the interested reader. It shows if each activity varies significantly by each of the above control variables. Those that appeared to be most informative are presented here in the report's text.

Age Group Patterns. A pattern of age differences occurs in the adoption of some of the newest technologies emerging in the hobby. It is not surprising to the reader that this was by younger hams. Conversely, some long-standing activities with traditional appeal hold lower levels of engagement by younger amateurs. The line charts in Figure 11 compare a set of traditional activities with ones, like digital modes, that have become much talked about in the hobby. *These represent some key age patterns in the RAC Survey of 2021.*

Using traditional voice modes, whether SSB, AM or FM, has been a staple of ham radio for decades as has the original transmission mode, CW. Both are used at lower rates among young Canadian hams while they reach their respective zenith

among the most senior group. Comparing this top panel with that on the bottom, there is a corollary with digital modes and mobile or portable operations. Younger hams say they do these activities at higher rates than older hams and the trend, like the comparable ones in the top panel, are mostly continuous and downward.

Chasing DX becomes more appealing during middle age and continues until senior status. The same is true for HF rag-chewing. These two activities may well typify many senior hams to the extent that these survey results reflect the country's population of

Figure 11. Comparison of Traditional (top) versus New (bottom) Activities by Age Group

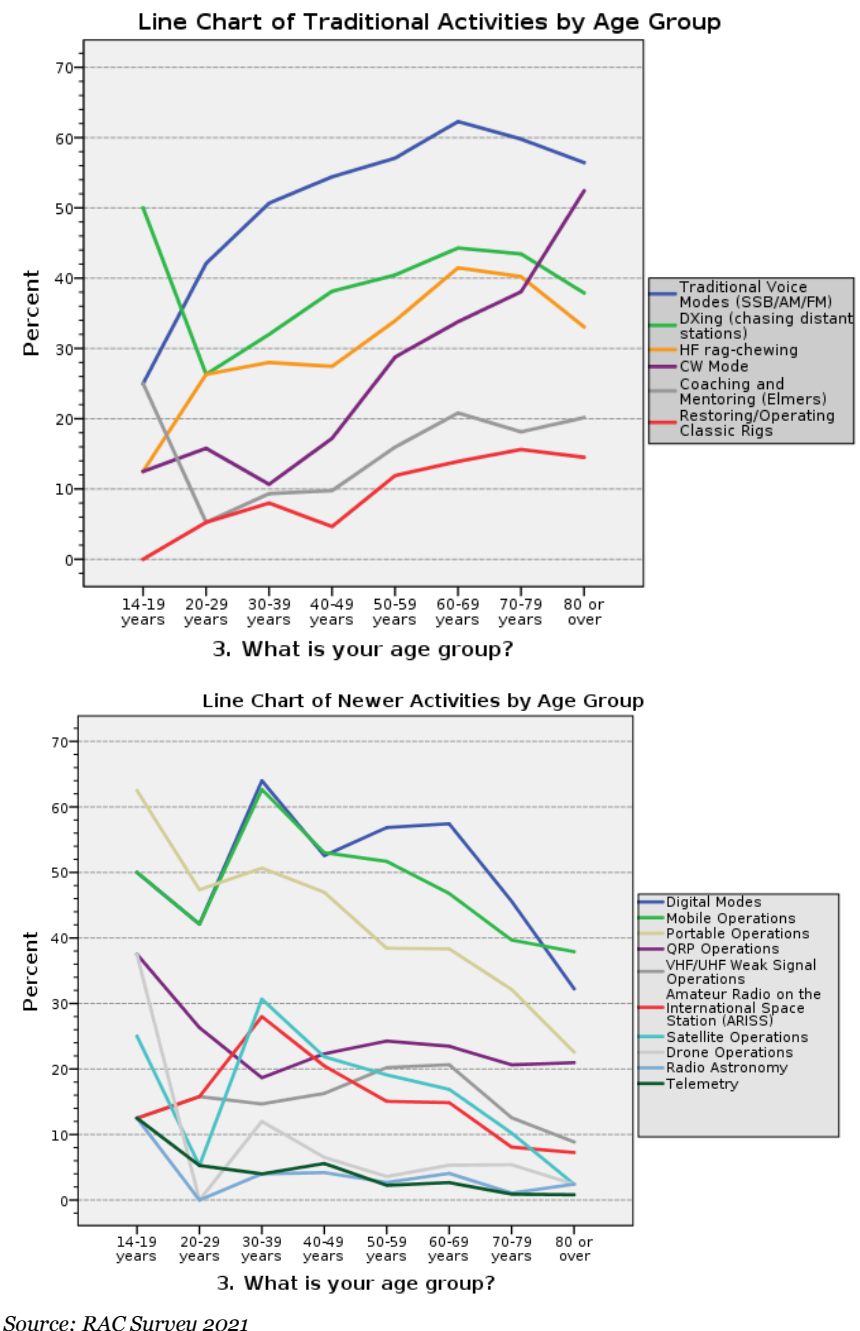
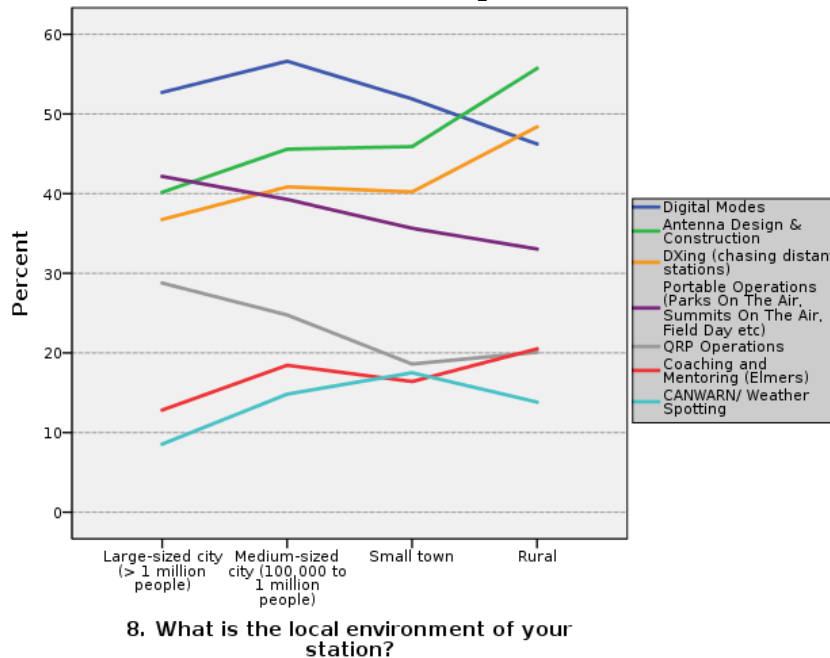


Figure 12. Newer Activity Participation by Size of Place for Canadian Ham Operators



Source: RAC Survey 2021

amateurs. By sharp contrast, it's the data modes of all stripes, including satellites (including ARISS), drone operations, and telemetry that have higher participation rates among younger age groups. *If it's portable and digital, these younger hams are more likely to report that they are doing it.*

This begs the question of Elmering activity. There is a higher percentage of teens that report this activity of coaching other hams

than any other single group. But this age group is a small sample size (n=8) so it's not a reliable estimate. The more conservative interpretation is that Elmering is mostly for those successively older in age. Peer teaching by young hams, however, is a clearly desirable goal.⁸ This survey just did not capture it due to the lower response rate among younger hams.

A strikingly age-graded activity is CW operating. Up to the age of 49, CW use is lower than 20 percent, or one-fifth of the full survey respondents. This increase to almost one-third for those in their fifties, and increases to a majority among those eighty or over. While there is anecdotal evidence that CW interest and practice is growing among younger groups in Canada and the U.S., this new data on activity participation casts a pall on any broad generalizations from those "feel-good" media stories. CW operation does appear at-risk of becoming more of a niche activity over the next couple of decades based on these demographic patterns.⁹

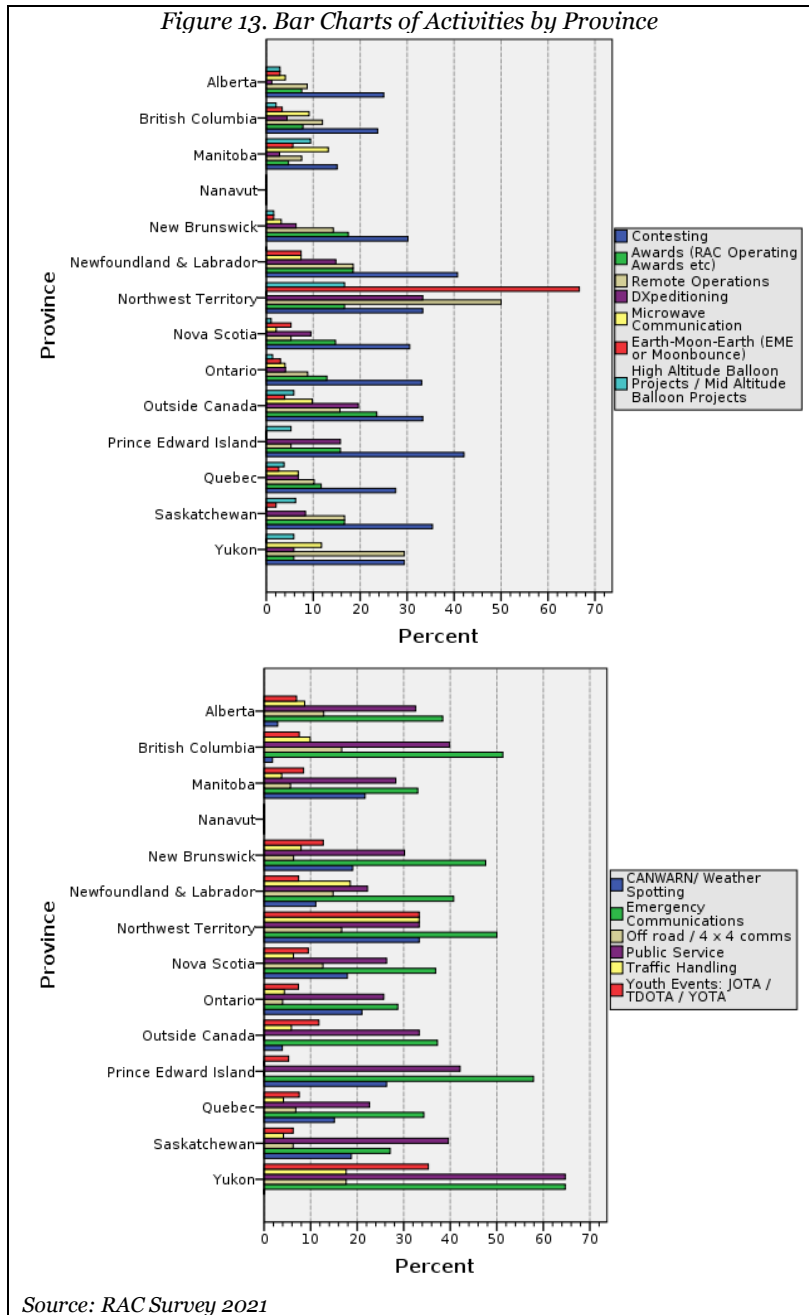
A final traditional activity, the restoration of classic radios, seems very fitting to be something that connects a younger period in life with an older one. This trend is found in the top panel but just not as dramatic as one could expect. It rises past ten percent during the fifties, increasing until the seventies among survey respondents.

Age-graded activities identify sectors of the hobby that may grow or decline in the future. Advocacy and Elmering can change those patterns but these baseline data are important to benchmark such impacts. Comparisons of the 2021 survey with another in the future will tell the tale of such potential change.

Geography Patterns. In this survey, there is a notable spread of ham operators across cities, towns and rural areas in Canada. But do hams in those local environments participate in the hobby in different forms of activity? Figure 12 compares some strategic activities by size-of-place. Several of these activities may reflect land availability and the amount of RF noise. Antenna design and construction as well as DXing, for instance, are higher in rural locales than in urban ones. But digital modes and portable operations are higher in urban centers. This may be because of the converse: inadequate space for desired HF antennas and digital modes may compensate for those limitations. There is also more coaching activity in smaller places to perhaps facilitate such activity.

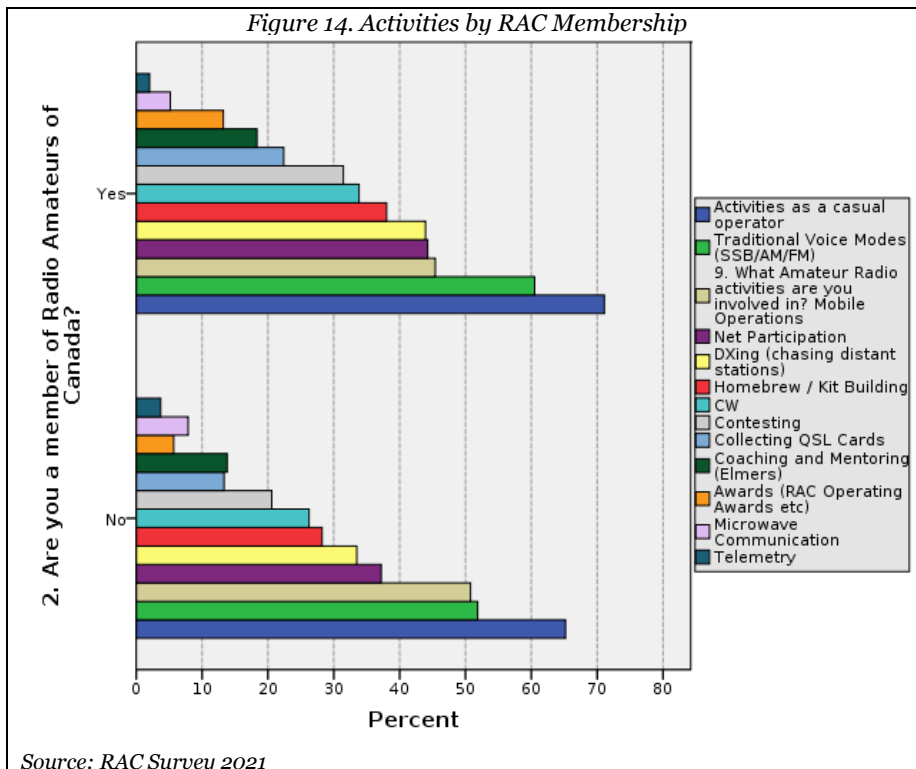
Turning to patterns of activities by Province, Figure 13 (top panel) makes similar comparisons. While there is indeed significant variation among individual amateurs within each Province, some Provinces stand out as having higher participation in specific aspects of the hobby. For instance, the Northwest Territory has much higher EME or Moon bounce activity than any other Province. Not surprisingly considering the overall participation rate in EME, it is very low in most regions. Another example is that contesting is lower in Alberta and Quebec Provinces. Ballooning projects tend to happen more in a few areas, such as the Northwest Territory and Manitoba. Remote operations are located in NWT and the Yukon.

For public service and related activities, along with youth-oriented events, the bottom panel in Figure 13 contains these comparisons of participation. EmComm is generally



the more frequent activity in this chart, reaching a majority in several (Yukon, Prince Edward Island, British Columbia and the Northwest Territory). It is lower in Provinces with large urban centers. Weather spotting tends to follow suit somewhat. It's higher in the Northwest territory and Manitoba but not so much in Quebec, Alberta or British Columbia. A similar non-urban center pattern occurs for off-roading communications. Traffic handling activities are also more likely in provinces with non-urban centers, like the Northwest Territory or Newfoundland and Labrador.

Youth events, involving JOTA, TDOTA and YOTA, also follow the less population dense regions. The Yukon and Northwest Territory lead in this activity category. Several are below ten percent participation levels (e.g., Alberta).



RAC Membership. One might conjecture that membership in a national amateur radio association would be related to greater participation in the hobby. Reading *The Canadian Amateur* magazine, participating in other RAC members-only organized activities might well foster higher levels of hobby activities, net of other influences.

Figure 14 shows where this is valid and where it is not as much the case. Casual operating, participation in nets, homebrewing, operating CW, contesting and award chasing are those where this is so. But telemetry use and mobile operations are counter examples. Thus, engagement through RAC is linked to slightly higher participation in certain hobby activities but the relationship is not universal. The distinctions between survey respondents who are versus are not RAC members are not dramatic but worth noting. These results may lead to policy choices to emphasize coverage of certain elements of the hobby not now covered as much as these data would reflect amateurs' interests.

A Composite Profile of Canadian Amateur Operators in Action

The set of activities measured in the RAC Survey 2021 are detailed. This is a clear virtue for I have found no other national survey with such detailed data on ham operator activators. This also raises the question as to whether actual behavior patterns by Canadian hams coalesce into activity themes. For instance, is there a set of common activities that can be distinguished in this large group from more specialized ones? I examined this question by using a common statistical procedure called principal components analysis which estimates how many relatively homogeneous activity groups exist in the data. These results are fully presented in the Appendix and summarized in Tables B4 and B5 and Figure B1.

Table 1. Relatively Homogeneous Groups of Activities Reported by Canadian Ham Operators

Group 1: EmComm	Group 2: Competition	Group 3: Super HF	Group 4: Traditional Building-Ops	Group 5: QRP Portable	Group 6: Digital	Group 7: Satellites	Group 8: Remote Control	Group 9: Casual Operations	Group 10: Mentoring	Group 11: Balloons
Emergency Communications	Awards (RAC Operating Awards etc)	Earth-Moon-Earth (EME or Moonbounce)	Homebrew / Kit Building	Portable Operations (POPA, SOTA, Field Day, etc.)	Digital Modes	Amateur Radio on the International Space Station (ARISS)	Remote Operations	Local rag-chewing	Fox Hunting	High Altitude Balloon Projects / Mid Altitude Balloon Projects
Public Service	Contesting	Microwave Communication	Antenna Design & Construction	QRP Operations	Automatic Packet Reporting System (APRS)	Satellite Operations	Telemetry	HF rag-chewing	Coaching and Mentoring (Elmers)	[NOT] DXpeditioning
CANWARN/ Weather Spotting	DXing (chasing distant stations)	VHF/UHF Weak Signal Operation	Restoring / Operating Classic Rigs		[NOT] Youth Events: JOTA / TDOTA / YOTA		Drone Operations	Net Participation	[NOT] Shortwave Listening	
Traffic Handling	Collecting QSL Cards	Radio Astronomy	CW				Off road / 4 x 4 comms	Casual operator		
Mobile Operations	Special Event Stations									

Source: RAC Survey 2021

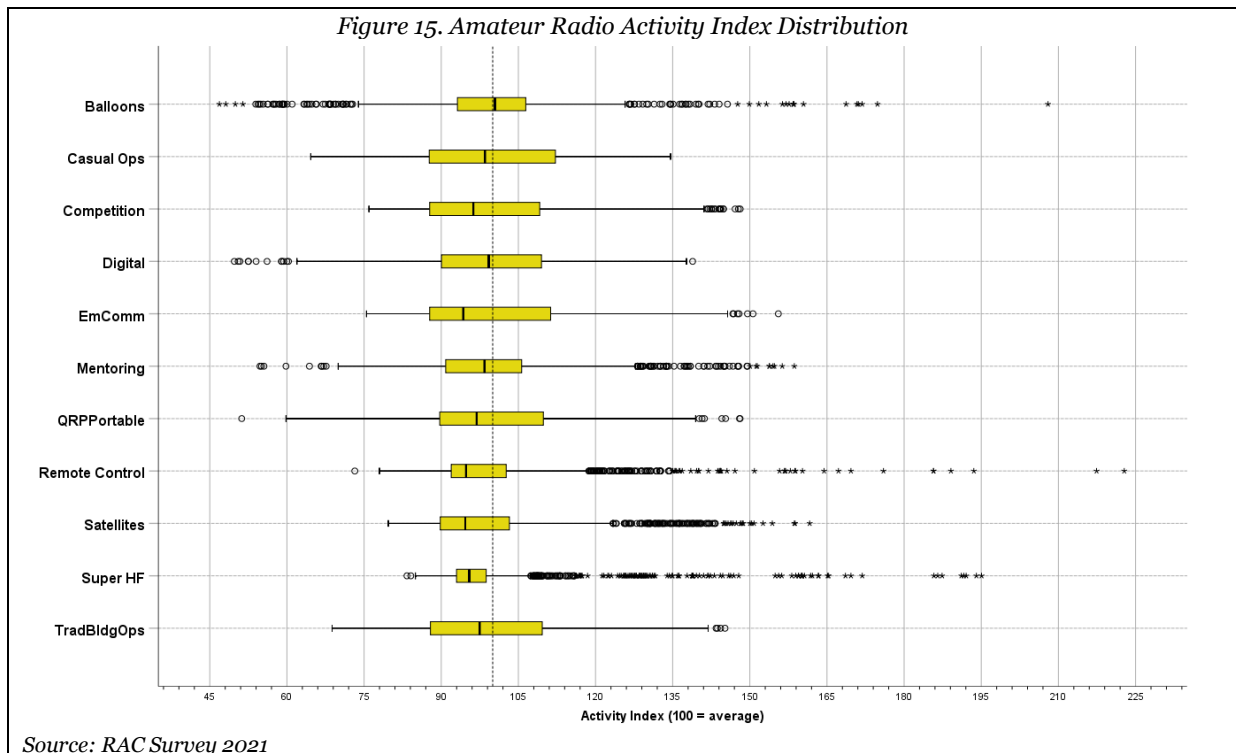
Note: [NOT] means that the activity is negatively related to the grouping (i.e., hams engage less in that specific activity relative to the other activities in that category. This negative relationship is significant.

The individual activities and their named group are in Table 1. There are 11 relatively homogeneous groups, appearing in order of the strength of their similarity as measured by percent of common variance. (See Table B4 and Figure B1). Group 1 is most homogeneous while Group 11 is the least. A few items are homogeneous but have an inverse pattern. These are labeled with “Not” next to their name as in Group 6, Digital, where the *lack* of participation in youth events is consistently related with digital and APRS activity. The same can be observed in Group 11 where ballooning is associated with not participating in DXpeditioning. I note that this may not make sense to the reader but Group 11 is the least homogeneous set of items and DXpeditioning does not relate to any of the other activities as strongly as it does balloon operations.

I have summarized the set of specific activities into these 11 groupings. EmComm, for instance, is comprised of emergency communications, public service events, weather spotting, traffic handling, and mobile operations. These are easily observable by the reader in common amateur radio operations. Group 2 is labeled Competition since it consists of competing for awards, contesting, DXing, QSL card collecting and special event station operations. The remaining groupings follow a similar set of patterns.

The individual activities comprising each group were added together using the results of the principal components analysis and converted into a T-Score format with an average of 100 and a standard deviation of 15 points. Thus, an average activity score on any of the groups is 100 with scores lower than that reflecting lower activity and higher ones

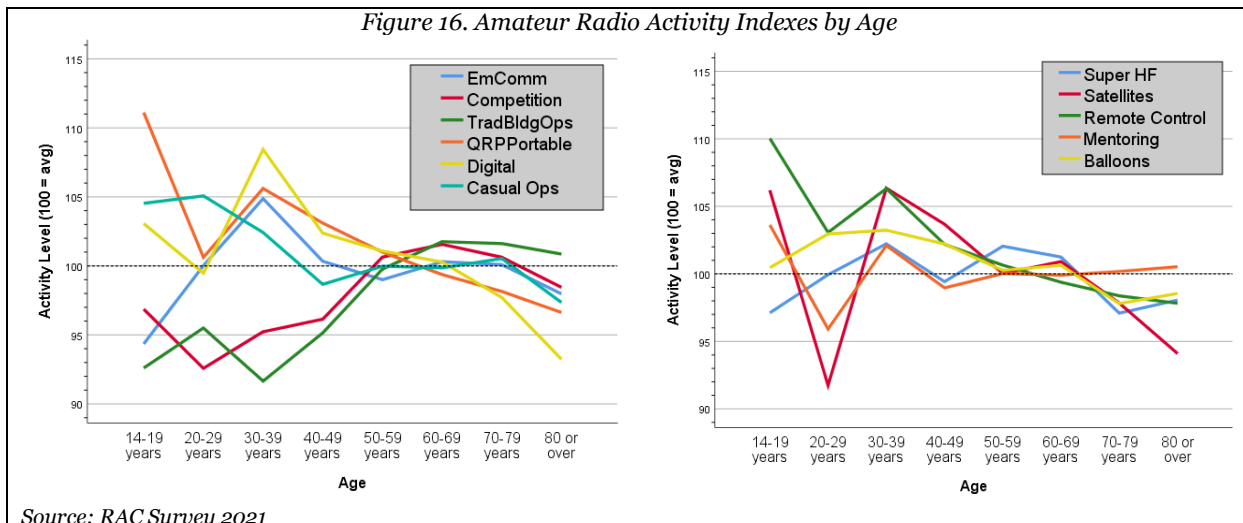
indicating higher activity levels. The distribution of these activity patterns in terms of those indexes are shown in Figure 15. The vertical lines are placed one standard deviation apart with a dashed vertical line set at the overall average of 100. This allows the reader to quickly determine how the box-and-whisker plot for each index varies since the black line inside the blue box is the median score for the index. (The median will differ from the mean of 100 due to the asymmetry of the data above or below the 100 score.)



It is clear in this visualization of the activity index results that Canadian ham operators vary widely in what themes of activity they do. There are small numbers of operators that engage highly in an activity space. This includes Balloons, Competition, Mentoring, Remote Control, Satellites, and Super HF activities. In contrast, Traditional Building and Operations, Emergency Communication, and Casual Operating tend to have a less variable set of aficionados. The latter constitute the mainline activities engaged in by hams in Canada. The specialization activities are those with extremely active hams even with some other operators participating at lower levels. This is the main take-away result for the overall picture of Canadian amateurs in action.

Because of the concern about age in the amateur radio space, I have constructed line charts by age group in Figure 16. I separated more conventional activities into the left panel and newer activities in the right (except for Mentoring). There are clear age patterns in these graphs. They tend to confirm the age patterns in the individual activities.

Figure 16. Amateur Radio Activity Indexes by Age

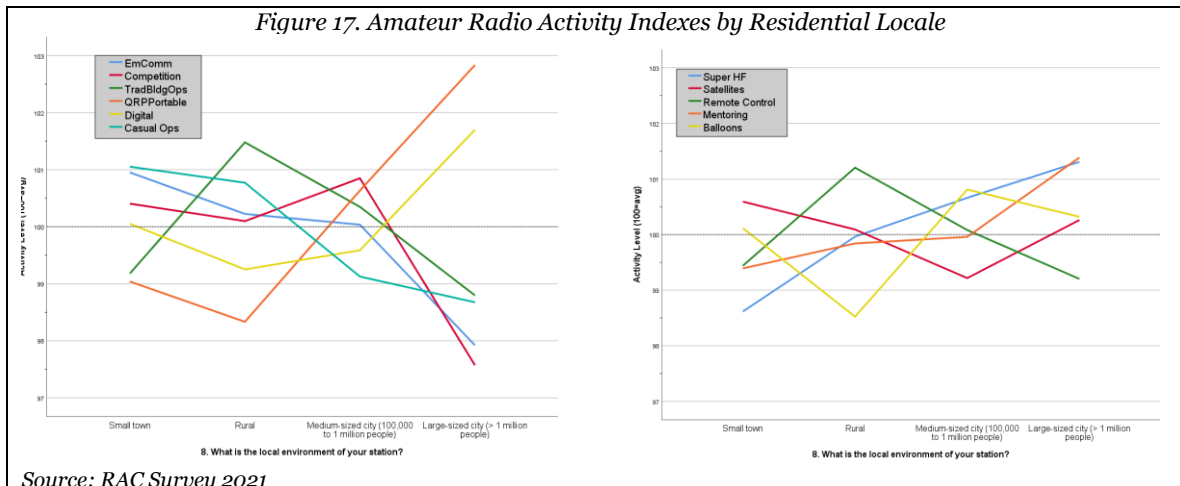


Source: RAC Survey 2021

Younger hams tend to be engaged in QRP portable activities as well as digital modes more than older operators. They tend to not get involved in competition, in contrast to much social media to the contrary. In addition, younger hams do not report traditional building activities or operations (CW) nearly as much as middle-aged or more senior amateurs. These are important findings for they fly in the face of some contemporary thinking by many in amateur radio.

The activities of competing against other hams as well as traditional experimental work and operations do not go above average activity levels until these hams reach age 50 and above. Traditional activities remain at these levels by age group. Competition tends to trail off after age 80, a result also observed in twenty years of U.S. ARRL Sweepstakes Contest data (Howell and Wright, 2021). They tend to be average or below in QRP portable activities and digital mode operations.

Figure 17. Amateur Radio Activity Indexes by Residential Locale



Source: RAC Survey 2021

In the right panel of Figure 16, mentoring is something engaged in by all age groups above the average score with the exception of the twenty-year-olds. Younger operators report much higher participation in remote control operations as well as satellite work.

Balloon operations are the third above average activity for younger operators. Super HF band work is above average for those from the twenties until the seventies. For the most senior hams, no activity reaches an average score except mentoring.

I also found some important patterns in these activity data based upon residential location. In Figure 17, a similar line graph is presented. Large, urban locales face different challenges for amateur radio activities. There are more land-use regulations, residential lot sizes may be significantly smaller, but there are likely a higher concentration of amateur radio operators in the area. The results tend to illustrate these constraints.

In the large-size cities of over a million population, greater QRP Portable activities are reported and more digital operations. These tend to be responses to greater challenges for antenna systems being permanently installed at residences in these large cities. Fewer Competition-style activities are pursued as a result. Few casual or traditional building operations are, too. On the other hand, the line chart in the right panel shows that more Mentoring occurs in these large cities. This may well be due to the higher concentrations of amateurs there. At the same time, Super HF operations are engaged in where hams live in these cities of a million or more. I suspect that this is due to the dramatically smaller antenna systems necessary so the activity space is more welcoming for this specialization in the hobby.

A couple of other patterns are worthy of note. Remote control elements of the hobby tend to take place in rural areas but less so in any type of municipalities. Balloon activity is lowest in rural areas but above average in any type of town or city.

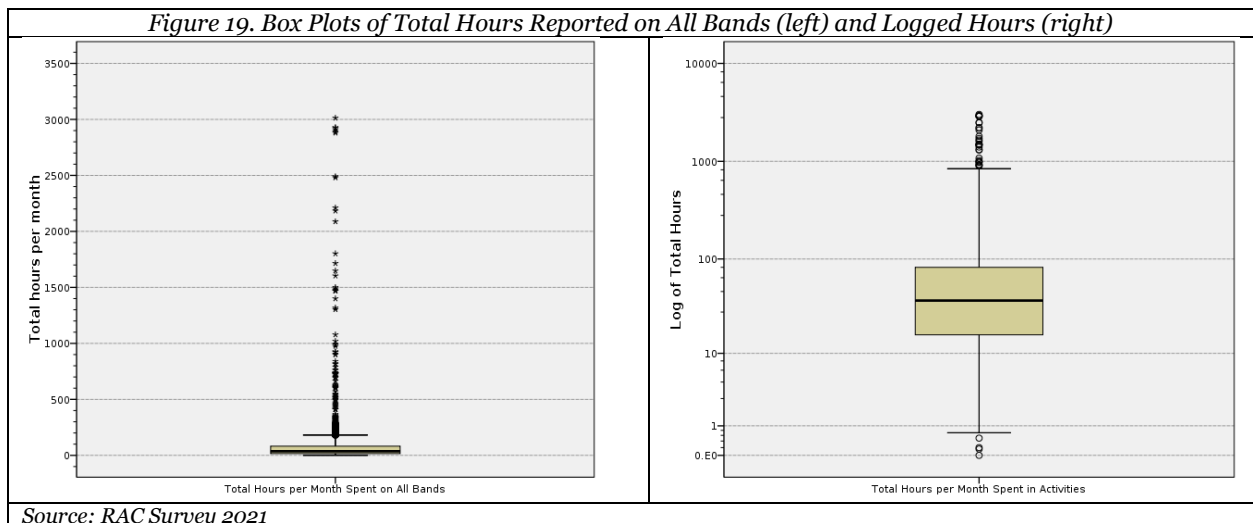
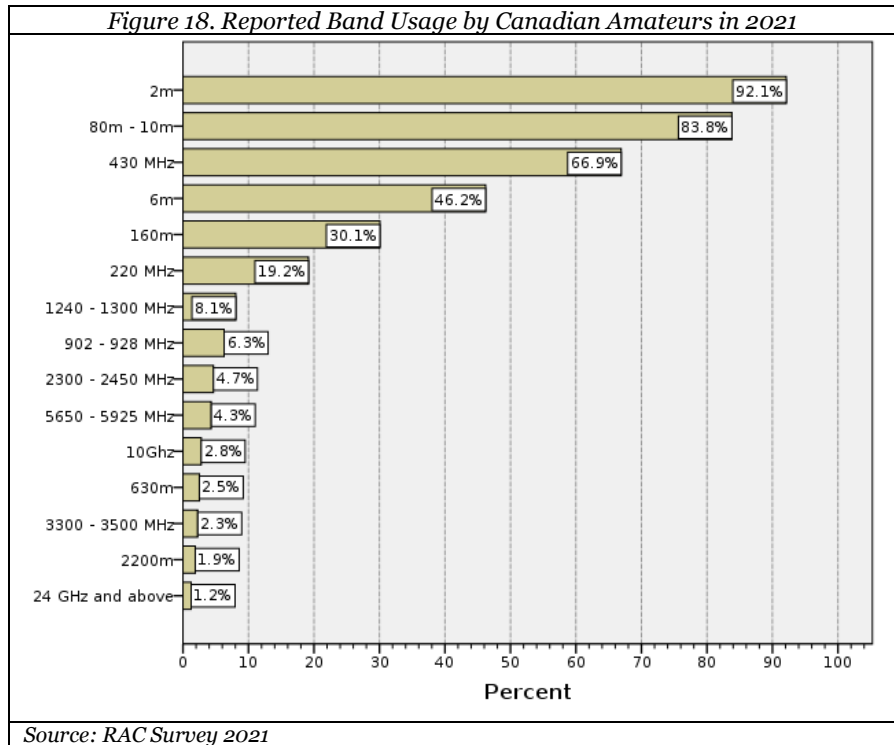
Use of Band Allocations by Canadian Amateurs

Band use by frequency range: VLF, HF, VHF, UHF, Microwave

The 2021 survey also asked about the usage of band segments and hours per month devoted to each one. This part of the study identifies *where* Canadian amateur operators transmit to complement what *type* of communications they reported in the previous section. The bands used and the amount of time per month reported by survey participants provide the contours of these behaviors in Canada (see Figure 18).

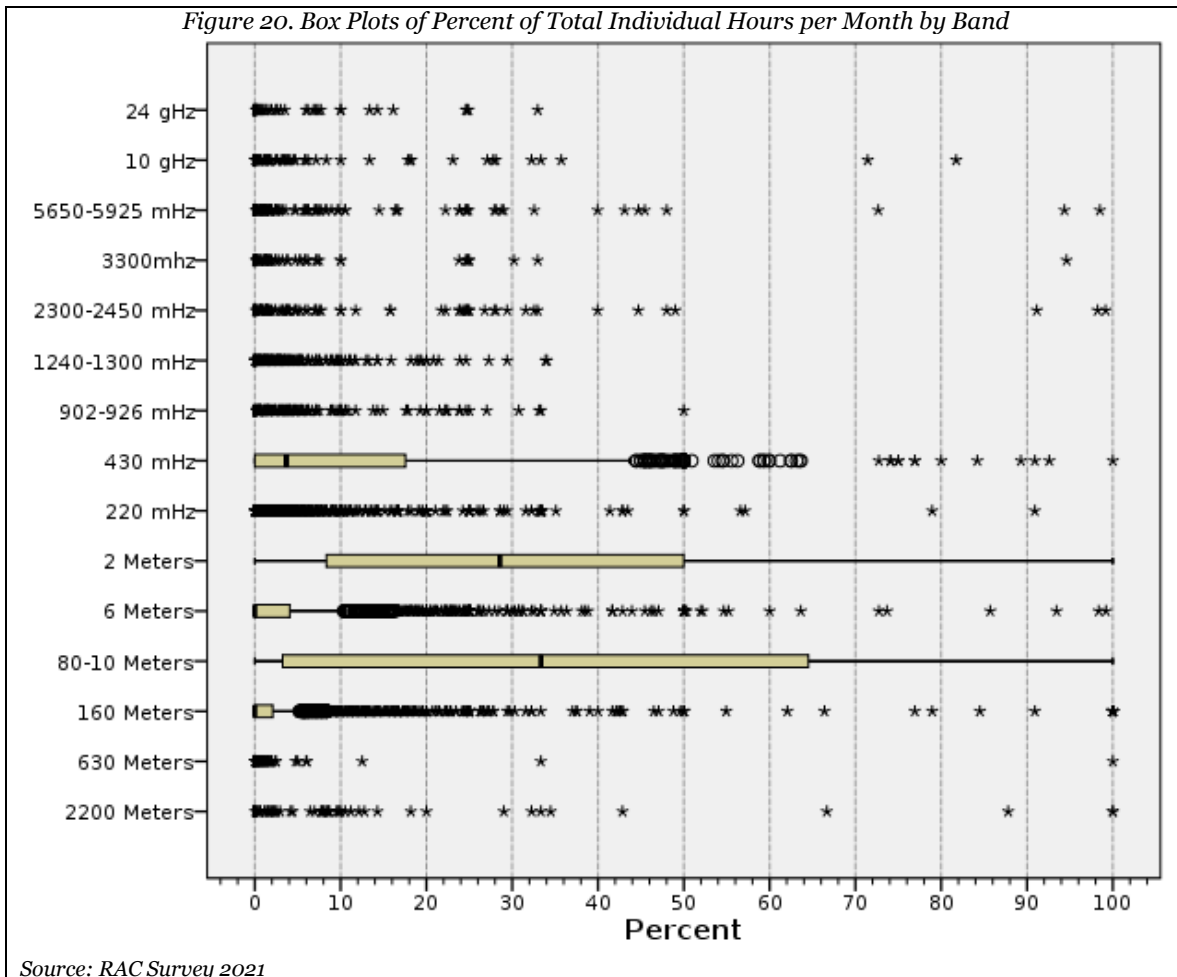
This chart shows that two-meters is the common band for over 90 percent of Canadian amateurs. The HF bands, from 80-10 meters, are second at over 80 percent. The UHF band of 430 MHz is used by two-thirds (67%), followed by the Magic Band of six-meters (46%). The Top Band, 160 meters, is used by almost a third (30%) of these hams. The 220 MHz band captures about one-fifth of Canada's operators. Above this frequency, are the microwave allocations, or Super HF. None reach a tenth in reported usage and systematically decline as the frequency goes higher.

A total of 194,174 hours per month were reported by Canadian amateurs to have been used over 15 bands during 2021. The average is 93 with an estimated standard error 5.4, assuming that the realized sample was random. The variation in these reported hours is large, with a standard deviation of 249! The median is 34 hours per month. These statistics are only for hams reporting *any* hours of usage per month (a total of 121 respondents reported zero hours). This demonstrates that many operators are active, perhaps one hour per day or so (34 hours per month) while a smaller segment report spending vast amounts of time on one or more of these bands.



These summaries should be qualified with an anomaly. One element of modern amateur operations is “always-on” monitoring receivers or beacons. These could be APRS on 2-meters, transmit beacons on other bands, scanning VHF bands or above, and a host of others. The survey asked an open-ended question about hours of use on a given band. Some respondents added text statements when they replied with 720 hours per month

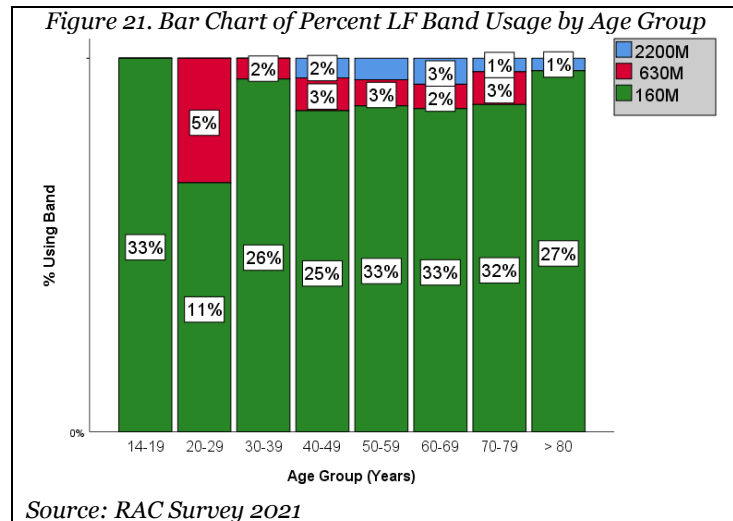
(24 hours x 30 days) to the effect that beacons or other “always-on” transmitters or (scanning) receivers were used in their shack on that band segment.



These patterns can be seen in Figure 19, containing two box plots of total hours reported. On the left, the number of hours is concentrated around the median (represented by the dark line in the middle of the “box”) of about 34 but a share of respondents responded to the question with increasingly larger totals. The 3,000-hour total clearly reflects multiple radios in operation at the same time by a given operator in the survey. Many of those reporting less than this highest value also fit into this operating style. The complementary box plot (right) illustrates how the bulk of hams vary in hours of operation on all bands. This is expressed in a log transformation of total hours. This graph of the log (LN) of hours reported shows the distribution in a way that is not dominated by the extreme high values reported in the survey.

Thus, there is a small portion of Canadian amateurs who report large numbers of hours on multiple band segments. However, the more representative pattern of behavior is a spread of hours that varies by band. We might consider the “time portfolio” that a ham might allocate to the hobby. The median would suggest about an hour a day (which may

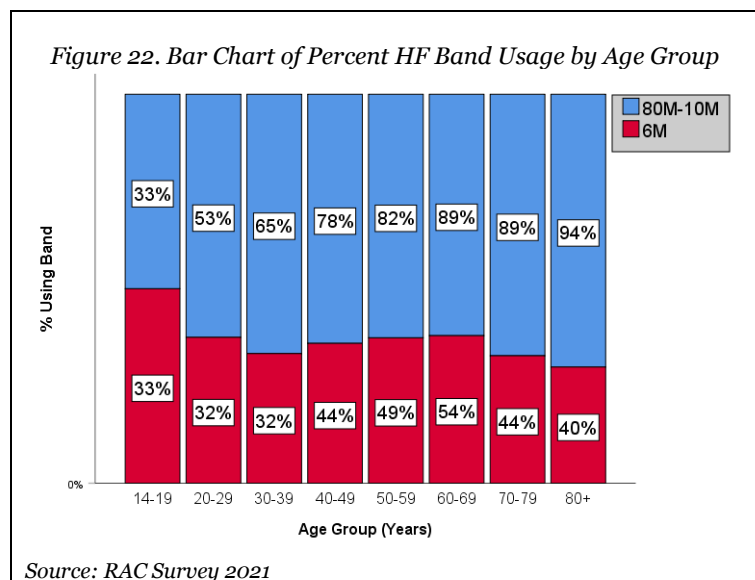
be bundled to several on a weekend). But what share of time in the varying total number of hours that all amateurs report spending is allocated to each of these band segments?



I computed the total time as shown above. The reported hours on each band were converted into a percent of the total time per month by band. These percentages, which total up to 100 percent for an individual respondent, are shown in Figure 20 as a box plot of the distribution by band. This represents more of a *time portfolio* characterizing each amateur in the survey.

Two patterns jump out in Figure 20. Some hams spend most of their time on 2 meters and 430 mHz while others are mostly HF operators. There are small numbers of hams who are effectively “band specialists.” Note those near the 100 percent mark on various microwave bands or 160 meters or the lowest bands, 630 and 2200 meters. Some operate mostly on six meters. It is important to note the dominant patterns of frequency usage while also recognizing that not all hams follow suit and choose to be *band specialists* in the time they spend participating on these frequency allocations.

Two patterns jump out in Figure

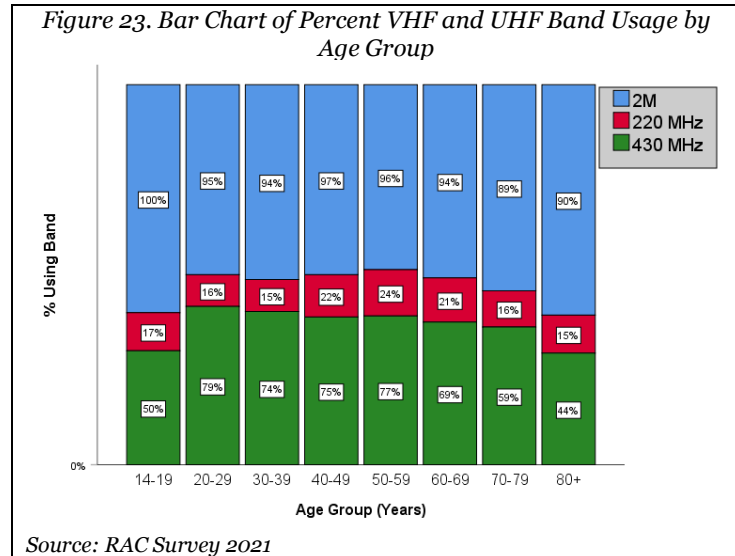


Modes by Frequency Range: Age Patterns

I have organized comparisons by age group for each prominent frequency band: Low Frequency, HF, Very and Ultra High Frequency, and Super High Frequency. These results can tell us about how hams of various age cohorts are making use of each band allocation.

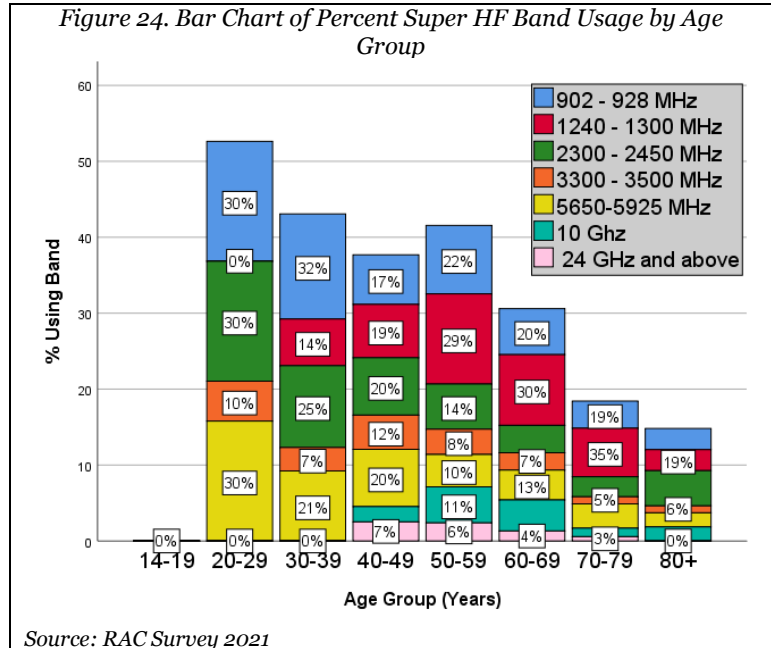
Figure 21 begins with low frequency (LF) bands, including 2200, 630 and 160 meters. As a long-standing band allocation, the Top Band of 160-meters is used by every age

group. This is particularly for those over age 30. But the newer allocations of 630- and 2200-meters are sparingly used among all ages. Likely because of the required antenna lengths and land-use restrictions, the lowest frequency band (2200-meters) has at most 3 percent participation in any age groups. The 630-meter band has at most a 5 percent usage rate, this among twenty-year-olds.



The results for HF include the Magic Band of six-meters as shown in Figure 22. There are few surprises in this graph. The 80 through 10-meter bands are enjoyed by over half of the hams in Canada for those over age 20. (This is likely due to licensing patterns.) These are the most long-standing allocations where the widest variety of commercially available equipment is available to the amateur radio market. Use of 80-10 meters slightly increases with age (e.g., 20-year-olds at 53% vs 80-year-olds at 94%).

For six meters, use is fairly constant at just less than one-half of Canadian ham operators play in the periodically open Magic Band. This really does not change much with age. The attraction to this low-opening, high-reward band is the ability to work DX during band openings. A minor attraction is local and regional communications, often using repeaters operational on the band.



The result of the highest reported usage (33%) among the small number of teens in the survey should be taken cautiously since the actual use in the population could be more different than the other age groups with higher numbers of respondents.

In short, the results for use in the high frequency to six-meter bands is largely what would be expected by most amateur operators. But knowing the age patterns does empirically illustrate how young hams get into HF at those ages, too.

Turning to VHF and UHF bands, Figure 23 also shows no surprises: *two meters is king!* About 90 percent of every age group says they work two meters, hands-down the universal frequency band for Canadian amateurs. This is followed by the 430 MHz band which is a bit more popular among younger hams than older ones who tend to favor 2 meters. The 220 MHz band universally holds a slice of about one-fifth (15-24%) of the survey respondent's reported usage.

Moving into the Super High Frequency ranges involving the highest band allocations, Figure 24 shows these results of band usage by age. The barriers to getting into SHF operations differ markedly from other bands. There are fewer off-the-shelf commercial radios and associated equipment so homebrewing is almost a requisite. The equipment and space for homebrewing, for instance, a transverter for an HF or VHF/UHF radio or a horn antenna is not available to every ham operator.

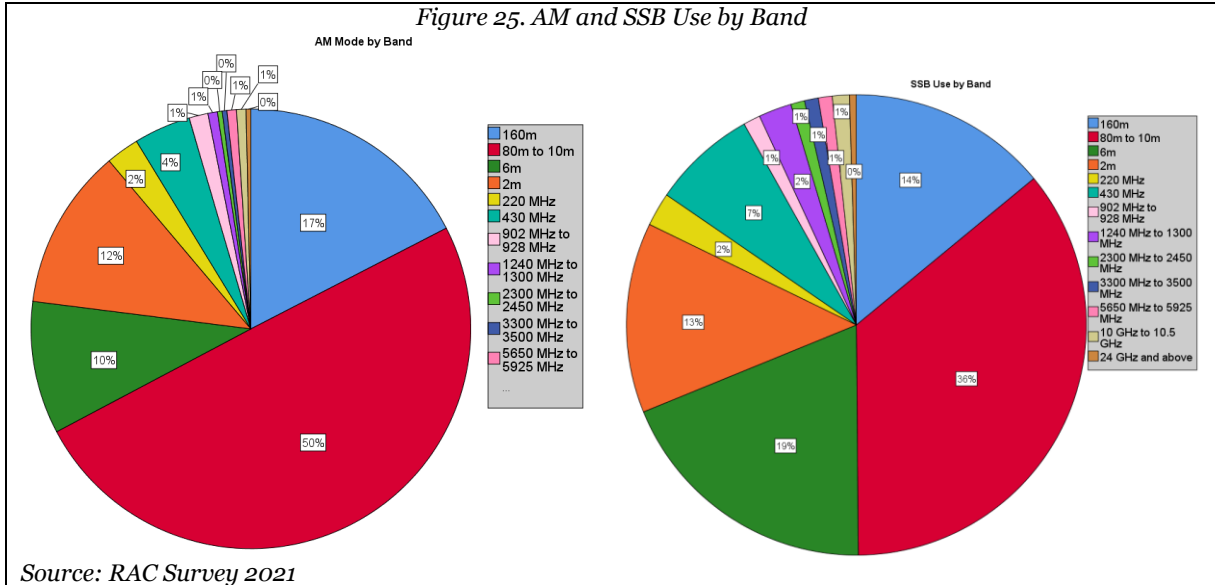
With this preface, there are age-graded patterns of usage in this allocation region. Figure 24 displays a stacked bar chart by age group of Super HF band use. This region of band allocation is sparsely used at the highest band of 24 GHz. The users are exclusively in the 40- to 70-year-old groups. On the other end, the 900 MHz region is used by all age groups, especially younger hams. The 1.2 GHz band has a significant group of users, between a fifth and a third of those from age 40 to 80 or more. This compares well with the 5 GHz (t650-5925 MHz) band. The 2 GHz region is close behind. With these relatively new allocations as compared to HF, for instance, there is likely to be increased use. The concentration of use in large urban centers may foster increased adoption since there are more operators and Elmers available in those cities.

Mode Use by Band Allocation

In this section, I present the reported modulation modes used in specific bands for Canadian amateur operators. The mode is shown in a pie chart with the percent reported usage for each band. This allows the reader to quickly identify where a specific mode is used and how diverse modes are for a given band allocation. This depiction does not show how much a mode is used within each band, only how the mode is distributed across bands. In the next section, I will present results for each band by age of the operator to illustrate the dominate mode within each band and how age is associated with these transmission modes. The reader is cautioned in their interpretation of these two distinctive sets of results.

In Figure 25, AM and SSB modulation find their traditional bands. One half of the AM use resides in the 80- to 10-meter band. It is significantly used in 160-meters, 2-meters and 6-meters with sparse usage in the remaining band allocations.

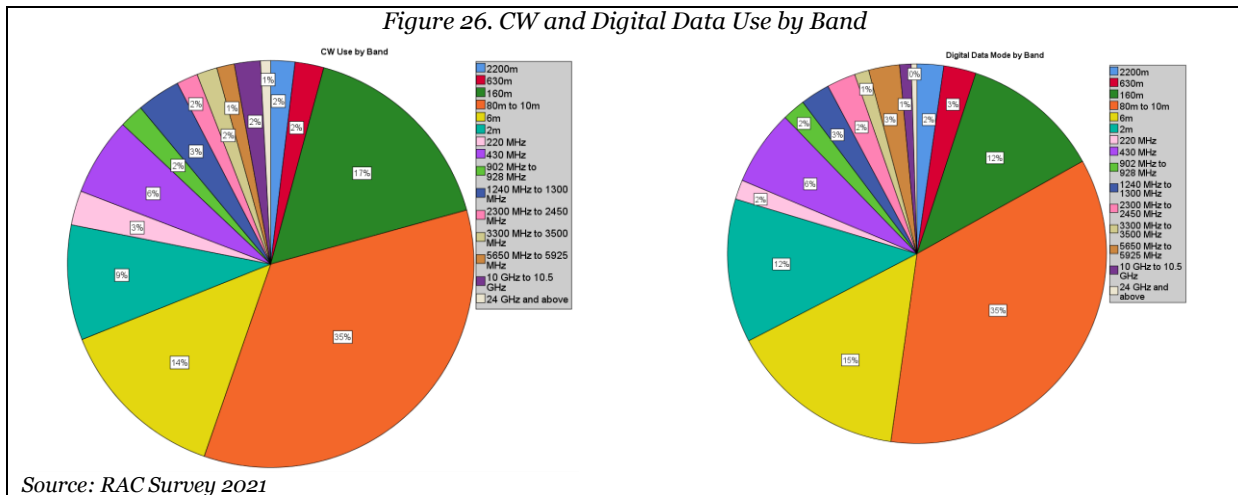
Figure 25. AM and SSB Use by Band



The stalwart SSB phone mode dominates HF as the modal transmission type with 160-meters and 6 meters coming next along with 2-meters. The 70cm band is the next frequency for SSB use. The Super HF bands each have some SSB transmissions reported by these hams. It's mostly a 160-meter to 70cm world for single sideband.

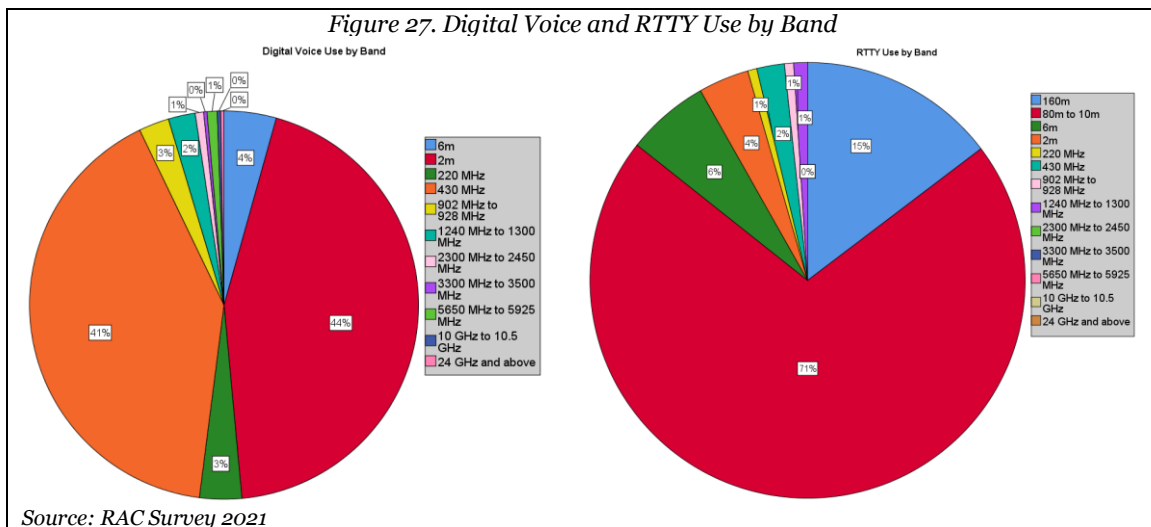
As shown in Figure 26, CW is used in several bands, dominated by HF (80-10 meters). Two bands bookending HF finds CW a common mode in 160- and 6-meters. The 700cm band, 900 MHz, and 10 GHz have some notable CW operation. These are followed by the 1.2 GHz band with the rest having nominal CW activity reported in this survey.

Figure 26. CW and Digital Data Use by Band

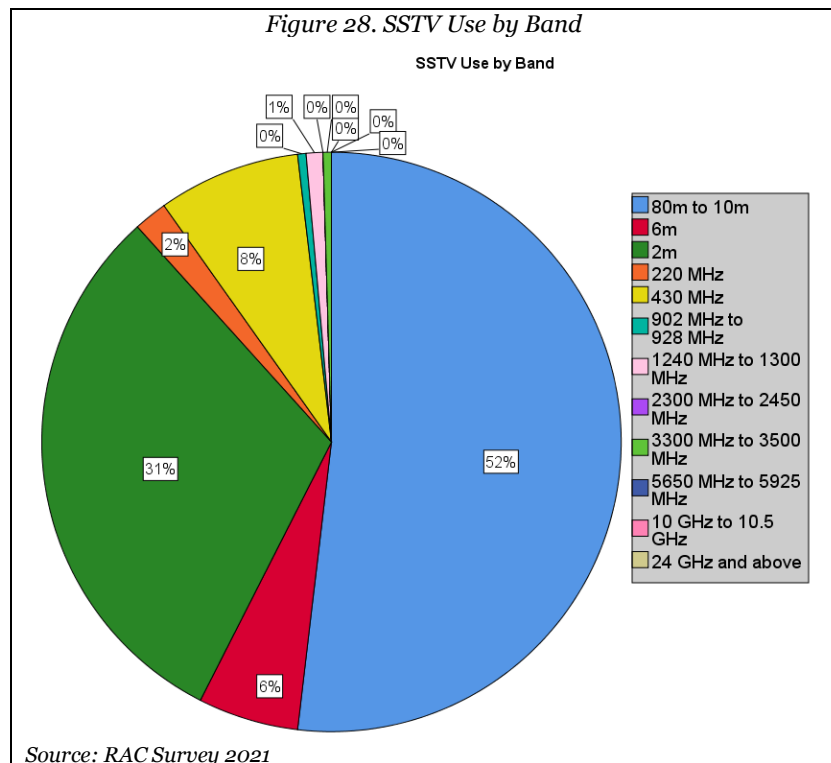


The rise of digital data modes (especially the wildly popular FT8) is confirmed in this national survey of hams. Some inferences can be made using signal spots (like PSKreporter) but they do not represent the broad population of all ham operators, only signals over a transient period. The HF bands, from 80 to 10-meters, are used with

digital data modes by over one-third (35%). This is followed by 6 meters (15%) and 160-meters (12%) as well as 2-meters (12%). There is nominal to significant digital data mode use on the rest of these band allocations as well. The 70cm band has, for instance, 6 percent of these amateurs using digital data modes there. Thus, digital data modes are an important means of communicating in most all of the amateur band allocations for Canada. While HF and nearby frequencies are the mode areas, it is only 24 GHz that show no reported activity as of 2021.



The use of a modern digital voice mode as well as a traditional data mode, RTTY, is shown in Figure 27. It is no surprise to the reader who is active on 2 meter and 70cm repeaters that some 85 percent of the relative digital voice usage by band is concentrated here. The 2-meter band has 44% while the 70cm band has 41% of the reported operations in digital voice in Canada. The rest reflect nominal patterns, such as the 4 percent with digital voice operations in the 6-meter segment.



The traditional data mode of RTTY remains largely an HF-centered transmission style. The 80- to 10-meter bands garner almost three-fourths (71%) with the 160-meter band

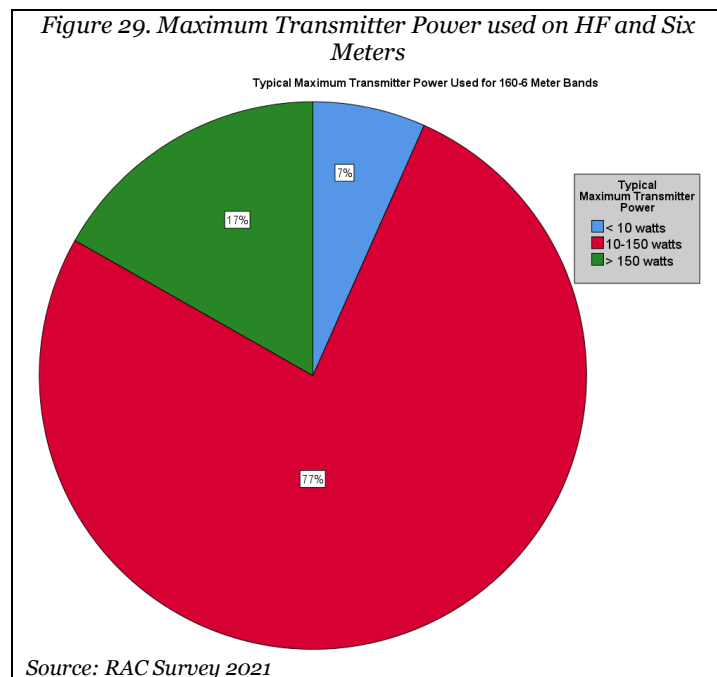
trailing far behind in second place at 15 percent. The remainder trail off as the frequency goes up the spectrum.

The final transmission mode is slow-scan television (SSTV). Figure 28 contains these results. Like RTTY, it's largely an HF use pattern (52%). However, for SSTV, two meters has almost a third (31%) of the traffic in this mode. The 70cm band follows (8%) with six-meters right behind (6%). The 1.2 GHz band, gaining in popularity due to more commercial equipment being available, is used by 1 percent. The other slivers in this pie chart round down to zero percent but it does reflect small numbers of microwave-oriented ham operators making use of the spectrum. *Will that grow?* It will take another replication of this survey a few years in the future to determine if that prospective growth is measurable in such a broad survey like this.

This SSTV mode has a niche following. It is largely concentrated both in HF as well as VHF regions of the band allocations. SSTV is another niche mode of transmission that is mostly on HF or VHF/UHF frequencies at present.

Power on HF and Microwave Frequencies

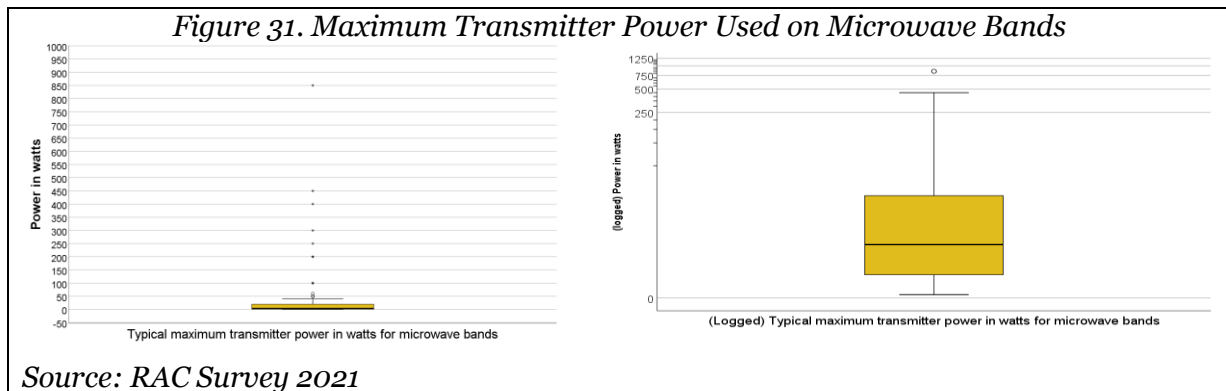
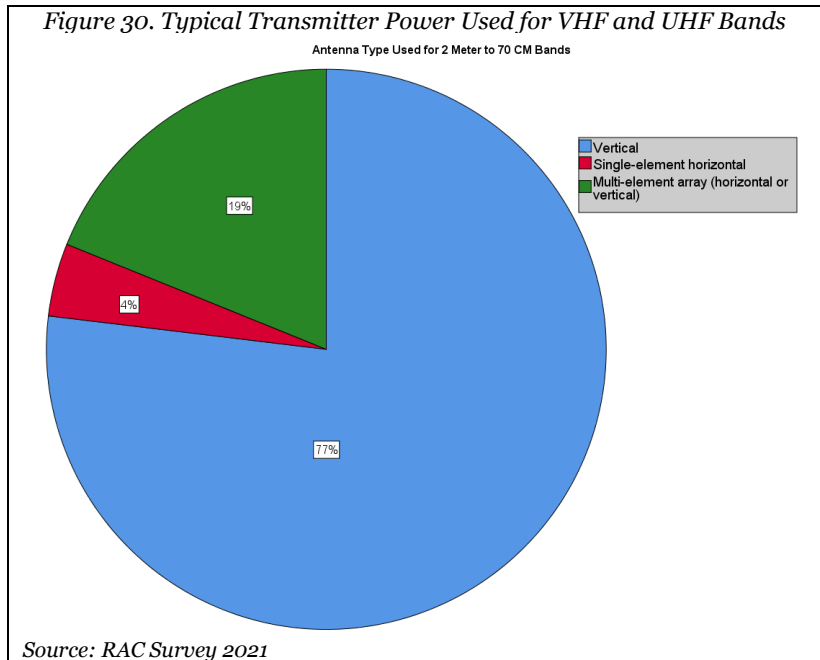
In this section, I focus on how much transmit power is typically used on the HF and microwave bands. Survey respondents were asked about what they consider “typical” usage although these settings can certainly be different at any given operation.



In Figure 29, the maximum power used to transmit on 160-6 meters is displayed in a pie chart. Although many may not agree that 10 watts is QRP power, we are using that convention here. About three-fourths of the survey respondents say they use between 10 and 150 watts in a typical transmission. Some 17 percent use over 150 watts, perhaps up to their license limit. Only 7 percent report that they use QRP levels at less than 10 watts. These responses are not contingent on the mode of transmission.

Turning to the VHF and UHF bands, Figure 30 summarizes the typical power used. A similar pattern occurs as in HF and six-meter operation. Just under three-fourths (71%) use between 10-150 watts on a regular basis. A small slice, some 2 percent, report over 150 watts. About one-fourth (27%) say that less than 10 watts is what they typically use in these bands.

The power utilized in the microwave bands reflects a very different picture. Figure 31 displays two box plots to illustrate. As shown above, microwave band usage is a niche activity within Canadian ham radio. Fewer than 10 percent report any activity but these spent quite a bit of time on these frequencies. Likewise, the boxplot in the left panel of Figure 31 illustrates the small number of microwave aficionados who use very much power. (This is power in watts without consideration of antenna gain which I examine below.)

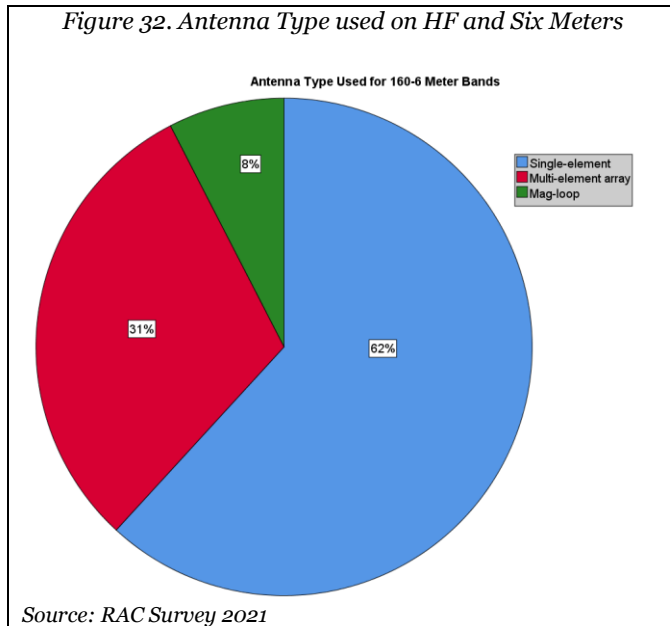


In the right panel, I've reproduced the left-hand panel's data in watts into a logged form to allow readers to more closely see the lower power portion of the distribution. The log of the power in watts places less emphasis in the smaller frequencies at the extreme power levels. The average power usage is 40 watts with a majority under 100 watts of power. This is not the power level emitted from the antenna with is buoyed by the relative gain of the antenna, as I discuss below on the results for antennas.

I examined these transmitter power reports by province, age group and license class. There was not much meaningful variation in those data apart from the differences in reported activities on microwave bands. In part, this is the limitation I mentioned of the small number of extreme values in the upper power range. The specialization of using high power in the microwave frequencies is a small number of Canadian hams, at least in this survey. It would take a new sampling design to "over sample" hams who are microwave users to get a more reliable estimate of the higher power ranges in use.

Antenna Use by Frequency Band

The other shoe on power use is the prospect of gain residing in the antenna use for transmitting. I begin with the HF through six-meter results for basic antenna structure used by Canadian hams. Figure 32 contains these results.

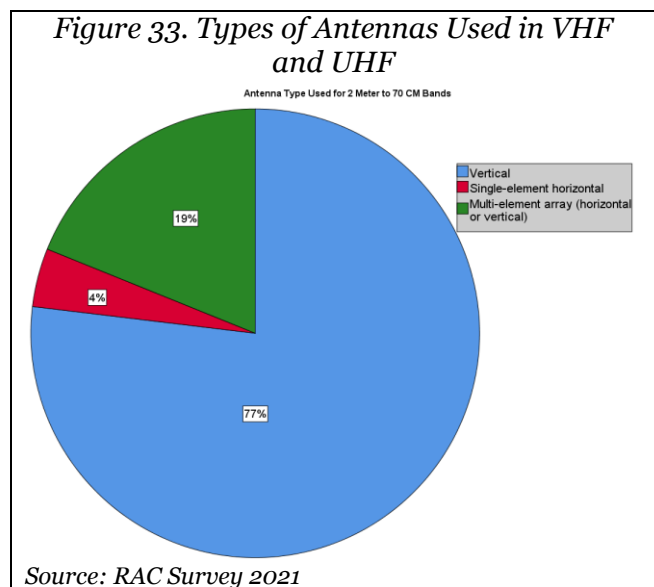


Just shy of two-thirds (62%) report a single-element antenna. The common dipole is an example of such an antenna. This is not a surprising result per se. The dipole antenna is often the first antenna described in license examination material. It is also the most frequent first-time build antenna for most new ham licensees. These results illustrate how the single element antenna serves the HF and six-meter frequencies well even today.

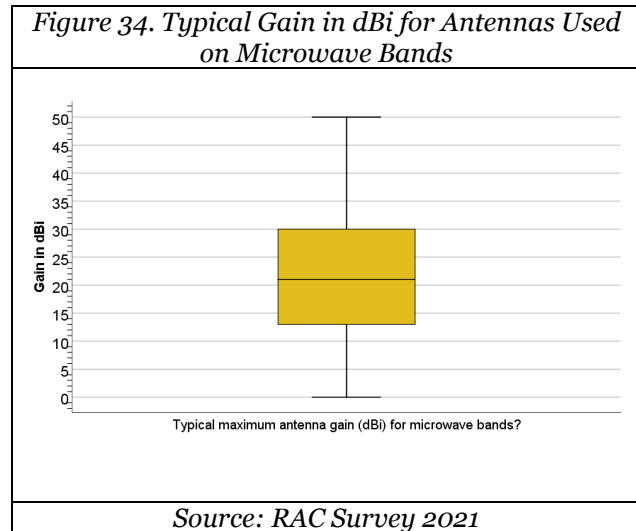
Multi-element arrays, most always having both gain and direction, are used by almost one-third (31%). For this frequency region, most are of the Yagi-Uda type, although there are wire

beams as well as phased verticals, too. In results not shown, I examined whether multi-element array antennas on these bands are related to DXing or Contesting activities. They are in both. DXers and contest operators about about twice as likely to report typical use of multiple-element arrays than those who do not participate in these activities.

The magnetic loop is reported in use on HF by about 8 percent in this survey. This antenna design for the HF and six-meter bands is available for homebrew construction with many plans available. But it is readily available from several commercial manufacturers. Putting a number on the share of hams reporting they use it for transmitting and receiving on HF tells us something about this type of design, which is known to have a high Q coefficient as well as lower noise than the single wire antenna. I examined the results by province, age group, and whether DXers or contest ops were more or less likely to use magnetic loops but do not present the results here. There were no appreciable differences regarding magnetic loop use in those groups of respondents.



Turning now to antennas used in the VHF and UHF bands, Figure 33 shows why the vertical antenna is almost ubiquitous. Three-fourths (77%) use a vertical antenna. About one-fifth (19%) use a multi-element array, with in horizontal or vertical polarization. This is likely a Yagi beam design but others are possible. Only a handful say they use a single-element horizontal antenna on these bands.



It is reasonable to assume that most of the multi-element array designs are used for DXing or Contesting or both. As was the case with the HF bands, the use of multi-element arrays for the VHF and UHF bands were about twice as high (40% or so vs 20% or so) as for hams who say they do not do those activities.

Only a small fraction of hams operating in the VHF or UHF frequencies say they use a horizontal single-element antenna. It is likely that the mobile use of these bands may deter an alternative polarization if the operator is at a fixed

location.

Turning now to the microwave bands, we noted a small group using higher power levels for transmission. But power in watts is not readily necessary on these bands due to the higher gain often realized in the antennas used. Figure 34 illustrates the distribution of antenna gain (dBi) reported by amateur operators. While a small portion use antennas with less than 5 dBi gain, the median figure is about 22 dBi. Some say they have very high gain of over 40 dBi which makes even small power in watts effectively “high power” on the bands.

These antennas are typically designed to be much physically smaller than those used on lower frequencies. This provides a potential for more accessible use. However, the dangers of a very high effective power rating (power in watts plus antenna gain) can actually work against this flexibility. As manufacturers release more commercial equipment for these varying microwave frequency bands, it is likely that the numbers of amateur operators will dip their toes into the microwave bands. This survey only captures a small number of them because their relative share of the population is small.

Summary and Conclusions on Amateur Radio Activities in Canada

Key Findings Summary

Most Canadian ham operators are on the Eastern seaboard with a significant presence on the Western coast. Nationwide, they concentrate along the Southern border in medium-to-large urban areas. A comparison of the RAC Survey 2021 with Statistics Canada Census data confirms that amateur operators are over-represented in the 50

and over age range by at least a 2-to-1 margin. Hams are grossly under-represented in the 14 to 39 age group.

Population projections by Statistics Canada have two clear warnings for RAC. One is that as the 60- to 80-year-old hams move to become Silent Keys or too infirm to operate, the recruitment of younger and *late-in-life* individuals to the hobby becomes critical. This is very consequential because the second warning is that there will simply not be enough teens to replace members of the Baby Boomer generation who expire from operating. The upside to this second warning is that, as I point out below, this process of “late-in-life” hams is already happening in larger numbers than one might guess without data from a national survey such as this one.

Licenses in the survey are almost evenly split among Advanced (31%), Morse Code Qualification (30%), and Basic-Honours (29%) with Basic-Only (2.4%) and Foreign licenses (7%) rounding out the mix. This provides an ample mix of radio amateur operations.

Asking Canadian hams how long they have been “active” (self-defined) reveals that a highly variable pattern, regardless of the years they have held a license (license tenure). The dominant group of hams are **not** those licensed early in life who then *stay the course*. This conventional image of the “amateur career” is a stereotype based on a vocal minority of hams but is not born out by these national survey data. Instead, what is observed in a comparison of license tenure and years of active participation is a small pattern of career amateurs, licensed as a youth, but a majority becoming licensed *all along the age span!*

The detailed 38 radio activities measured in the survey illustrate a common yet wide-ranging set of operating patterns. These are the first national data on such a large set of specific operating behaviors that I have seen to date. The clear core activity is casual operating (70%) using traditional voice modes of modulation (59%). A surprise is that digital data modes (52%) are the third most frequent operating activity, just behind traditional voice modes. This outpaces the traditional CW activity by a wide margin (32%). Traffic handling, one of the earliest uses for wireless radio, has only a small following today (6%).

The high-profile activity of radio contesting is pursued by less than a third (29%) while chasing DX is favored by almost half (42%), on par with casual rag-chewing (46%). The public service (30%) and emergency communications (37%) activities fall into somewhat similar categories of participation. While this might seem low for emergency or public service activities, it begs the question of *how many hams and where are they needed in public service?*

The original prime activity in amateur radio was building a radio set. About one-third say they homebrew or build kits of electronic devices (37%). The increased complexity of amateur radio technology has precluded many ham operators from designing or building a transceiver, for instance, that meets high-end standards so this result should

not be surprising. Nonetheless, the one-third share of hams who design or build devices maintain a significant homebrew culture in Canadian amateur radio.

Coaching and mentoring others into the hobby was identified as an activity by less than a fifth in the survey (17%). There are age-graded patterns in this amount of Elmering as more senior hams are more engaged in teaching others. An important aspect of older hams being more engaged in Elmering is that they participate less in activities that younger hams enjoy. We do not yet know what impact this may have in effective coaching of younger hams.

Do hams engage in shortwave listening (SWL)? *They do in Canada!* Over a fourth report they listen to the shortwave bands (27%). More of them do this in remote areas, perhaps for practical reasons, than in urban locales.

The overall behavioral pattern of activities ranges widely among Canadian hams. The average number is about 9 out of the 38 identified in the survey instrument (9.23; standard deviation is 5). Graphic displays show that there are a number of amateur operators who report participating in over 20 specific activities. Most say they engage in 5 or less. These activity themes only vary modestly by age. The top age group's median score is 10, only 3 activities higher than the bottom group, with a median of 7 activities. These results are for the overall levels of behavioral engagement in the hobby.

The specific activity participation *does* vary importantly by age. *These represent some key age patterns in the RAC Survey 2021.* Younger hams spend more time in “newer” activities than more established traditional ones. Older hams are more engaged in the traditional set of activities identified in this survey. *If it's portable and digital, these younger hams are more likely to report that they are doing it. For more senior hams, not nearly as much.* This bodes strongly for a social change that may happen over the next few decades. Newly developed activities may become the traditional ones, relegating many of the current stalwart activities to be practices by only a small minority.

A strikingly age-graded activity is CW operating. Up to the age of 49, CW use is lower than 20 percent, or one-fifth of the full survey respondents. This increase to almost one-third for those in their fifties, and increases to a majority among those eighty or over.

Residential environment shapes activities, likely due to land use restrictions. Low power QRP, digital, and POTA are more prone to be practiced by hams in larger urban cities. Bear in mind that the geographical concentration of Canadian ham operators are in the Southern border and in or near medium-to-large cities.

RAC membership is not related to the dominant activity of a casual operating style. It is linked, however, to the use of traditional voice modes, DXing, homebrewing and microwave band usage. RAC members report higher participation in those activities than non-members.

These 38 activities were summarized into statistically similar groups of activities, some 11 in all. These were labeled as: *EmComm, Competition, Super HF, Traditional Building & Ops, QRP Portable, Digital, Satellites, Remote Control, Casual Operations, Mentoring, and Balloons*. This larger picture underscores the fact that Canadian amateurs vary widely in the avenues they pursue in the hobby. But some are extremely active in specific themes. These include balloon launches, remote control of equipment, mentoring, and microwave operations.

In the use of frequency band allocations, Canadian amateurs make substantial use of them. One clear finding: *two-meters is King!* Over 92 percent use the two-meter band. It appears to be the common crossroads for the Canadian amateur. HF is second with over 80 percent in the survey reporting usage of 80- to 10-meters. The adjacent bands, including 70cm, 6-meters, and 160-meters, follow in descending order of use.

A total of 194,174 hours per month were reported by Canadian amateurs to have been used over 15 bands during 2021. A small portion of hams in Canada report large numbers of hours each month operating on multiple band segments. The median time is about an hour per day. The “portfolio” of time as a percent spent on each band illustrated the presence of “band specialists.” There are also distinct age patterns in the use of each band region. These include low frequency (LF), HF, VHF and UHF, as well as Super HF.

The modes of modulation used in transmitting find themselves segregated by band. They do, however, vary in predictable ways. The use of AM, for example, is largely in the broad HF and adjacent bands. Single-sideband follows a similar pattern but does extend to much higher frequencies (e.g., 2-meters).

CW is reported on the HF and 6-meter bands but also 70cm, 900 MHz, and 10 GHz, too. While CW is only used by a third of Canadian operators, it is used widely across many bands.

Digital data modes have made a significant and indelible inroad into the ham bands in Canada. Over a third use them on HF (80- to 10-meters) with smaller shares in bands up through 70cm. Only the 24 GHz band has no reported digital data mode use in this survey. Data voice modes are highly popular in both the 2-meter and 70cm bands. Digital transmission is a significant part of Canadian ham operations.

The stalwart RTTY mode remains very popular on HF and adjacent regions. Slow-Scan TV (SSTV) is used mostly in the HF bands but also is popular on 2-meters.

In the use of transmit power, most Canadian amateurs say they use between 10 and 150 watts. Less than one-fifth (17%) use over 150 watts. Less than 10 percent use power approaching QRP levels (< 10 watts).

On the microwave bands, transmit power is often augmented with antenna gain. These bands have a niche following in Canada, fewer than ten percent. But among this small total share of hams, a small minority report using greater than 50 watts. The average

power use is about 40 watts. Many use far fewer power levels on the microwave bands but perhaps with high antenna gain. The median antenna gain here is about 22 dBi. A small portion use antennas with less than 5 dBi, some report gain levels of 30-50 dBi.

Antenna types follow an expected pattern if one casually examines the marketplace and technical articles on antenna building. On HF through 6-meters, single-element antennas are used by about two-thirds. These are likely dipole designs. Some 31 percent use multi-element designs, like Yagi beams. Magnetic loops have been adopted by about 8 percent of the hams in this survey. For VHF and UHF, the vertical antenna is the dominant type (77%). Very few use a horizontal antenna (4%) while one-fifth use a multi-element one (19%).

Conclusions on Amateur Radio in Canada

One metaphor for how people make sense of the world around them is the “personal windshield.” Imagine someone’s routine activities of driving to work in a city each day. The exact route might change a bit but consider that the person gains a clear perspective on the city’s nature through that selective slice of observations. These impressions matter in forming beliefs about that city. But also imagine the perspective gained by flying a drone all over the city, hovering in spots to observe specific places and activities, and traversing the full specter of that urban area. The latter would no doubt render a very divergent view from the former of the city.

What’s all this got to do with the RAC Survey 2021? It describes the process by which most hams gain their perspective and beliefs about the amateur radio hobby. They do that through their *personal windshield* of on-air conversations, visiting ham club meetings and ham fests, and reading media about the hobby. Many readers of this report might respond, “*Oh, I could’ve told you that (result).*” This might well be true. But it is *how* one knows something about the hobby that makes a world of difference. I hope this report on the 2021 RAC Survey of Canadian ham operators is like the drone that flies the nation trying to gain a fundamentally different perspective on the state of amateur radio in the country. It is the first national survey that I am aware of with the detailed behavioral data on amateur radio operations.

Activity on the ham bands in Canada is very healthy from these data. The tried-and-true bands have considerable activity. Niche bands have their committed operators. These data document the traditions and innovation that is typical in the hobby. There are some operators who spend a great deal of time in one or more of these activities with a few taking part in most of them. There are specialists, both in activities and in their “time portfolios” on specific bands on which they operate. In other words, a small minority are “gung ho” in how they practice the hobby while others tends toward a more moderate commitment of time. The average is about one hour per day on the air in some fashion.

The vocal minority who promote their own ham radio careers as the model for all typically advocate the recruitment of teens as the sole source of getting new amateurs

into the hobby. These results show that this is actually *only a minority* of Canadian hams who got licensed as a young person and stayed the course until their elder years. In fact, these data illustrate the entry of people into the hobby *at all ages* over the life span.

This is a clear warning to groups like RAC for policies directed at recruitment and promotion. Population projections by Statistics Canada coupled with the age distribution in the RAC Survey 2021 suggests that there simply will not be enough young people to replace the Baby Boomer hams now nearing Silent Key status or too infirm to operate. Recruiting *late-in-life* hams is an additional, not replacement, strategy to consider. This market has at least three characteristics that lend themselves to effective engagement in amateur radio. One, they tend to be empty nest householders. Two, they are at their peak earning period with higher discretionary income. Third, they have more time to devote to a hobby. The age-shifts projected in the Canadian population add to this market's viability as well.

There is a clear and distinctive age difference in the activity pattern of Canadian hams. If it's QRP and portable, younger hams tend to be involved. If it's a traditional mode of operating, more senior hams tend to be doing it. Study of the particular age patterns in these results is warranted. They have special significance for engagement with young, middle-aged, and elderly people about amateur radio.

The Elmering process and best-practices need a review. Coaching activity is practiced more by older hams. Yet, they themselves engage in activities that younger hams tend to not favor. Will younger potential hams be turned off by activities promoted by more senior Elmers if they do not find them favorable? This and related policy issues face RAC in the coming years.

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Appendix A. Survey Methodology

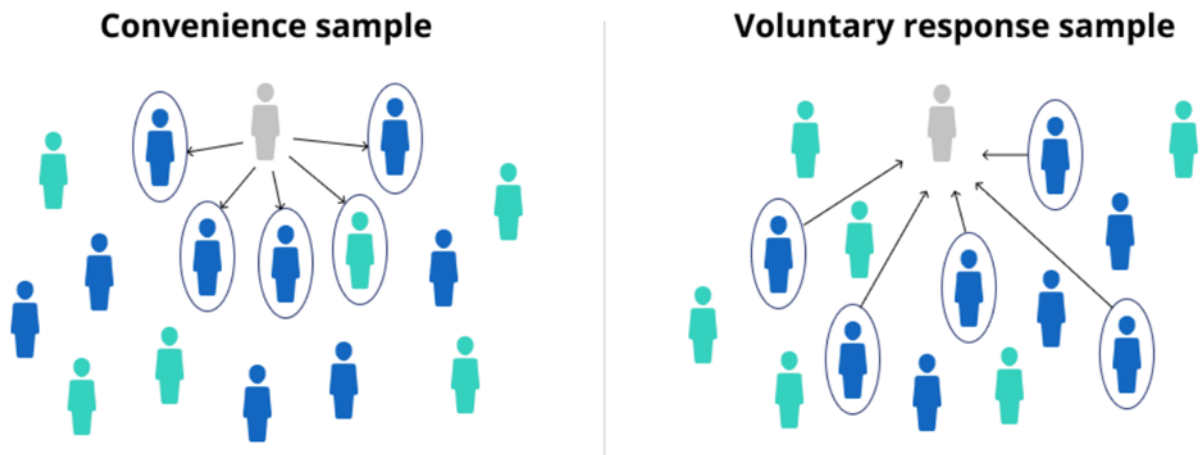
Survey Deployment

Paul Coverdale, VE3ICV (RAC Special Advisor for World Radio Conferences) created the instrumentation for the RAC Survey 2021. From March 3 to April 8, 2021, Radio Amateurs of Canada conducted an online survey (using KwikSurveys) to understand the operating interests and behaviors of Canadian Amateurs, in terms of what bands and transmissions modes are used, the amount of time spent, the operating focus, and other items of interest. A total of 2,089 responses were received, of which 1,630 (78%) were from RAC members. Approximately one-third of all RAC members took the time to complete the survey.

This is an example of “convenience sampling” as shown in Figure A1. If we put out a notice via e-mail or on a website that an online survey is open for responses, we have a “voluntary response sample.” While each have the internal validity of actual observed responses (subject to measurement errors), neither have the external validity of generalizing to a larger population of ham operators (see Earl R. Babbie. 2020. *The Practice of Social Research, 15th Edition*. Cengage Publishers.).

Figure A1.

Illustration of Convenience and Voluntary Samples



Shown in Table A1 is the dispensation of survey respondents in terms of their Province and the number of licenses in those Provinces. This helps us understand the coverage efficiency of the realized survey.

Province	# Licenses	%	RAC Survey	%	Ratio: Survey to Licenses
Alberta	3,902	9.6	172	8.5	0.88
British Columbia	8,937	22.1	384	18.9	0.86
Manitoba	1,201	3.0	106	5.2	1.76
New Brunswick	898	2.2	63	3.1	1.40
Newfoundland & Labrador	690	1.7	27	1.3	0.78
Nova Scotia	1,553	3.8	95	4.7	1.22
Northwest Territory	47	0.1	6	0.3	2.54
Nanavut	24	0.1	1	0.0	1.00
Ontario	12,787	31.6	828	40.8	1.29
Prince Edward Island	221	0.5	19	0.9	1.71
Quebec	9,082	22.5	265	13.0	0.58
Saskatchewan	988	2.4	48	2.4	0.97
Yukon	123	0.3	17	0.8	2.75
Total	40,453	100.0	2031	100.0	1.00

Appendix B. Additional Results

- How are portable operations related to QRP operating? I computed a cross-classification of whether each respondent said they participated in portable operations by QRP operations. Yes, they are definitely related. This does not mean that QRP operator operates in parks. Or the converse. It means that about two-thirds of each style of operating coincides with doing both at the same time.

Table B1. Crosstabulation of Participation in Portable Operations by QRP Operations, RAC Survey 2021

			QRP Operations:	
			No	Yes
Portable Operations:	No	Count	1059	157
		Percent	69.7%	35.5%
	Yes	Count	460	285
		Percent	30.3%	64.5%
Total	Count	1519	442	
	Percent	100.0%	100.0%	

Note: relationship is statistically significant (Chi-squared is 169.9, df = 1, p < .001). The Phi correlation for 2x2 tables is .294, p < .001.

- Percent precipitating in specific operating activities. I provide the following table of percent responding that they engage in the specific operating activities for reference. These results may be useful for future surveys or comparative work with existing data.

Activity	Percent
Casual Operating	69.79
Voice Modes	58.60
Digital Modes	52.21
Building Antennas	47.02
Mobile Operating	46.59
Local Rag Chewing	46.21
Net Participation	42.70
DXing	41.64
Portable Operations	37.27
HF Rag Chewing	36.84
Emergency Communications	36.50
Homebrewing & Kit-Building	35.88
CW Mode	32.18
Public Service	29.73
Contesting	29.06
SWLing	27.04
APRS Operations	25.22
QRP Operating	22.53
Collecting QSLs	20.41
Elmering & Coaching	17.34
Weak Signal Work	16.95
Satellite Operating	15.66
Weather Monitoring	14.36
Special Event Stations	13.93
ARISS Space Station	13.69

Restoration of Classic Radios	12.68
Awards	11.58
Remote Operations	10.23
Fox Hunting	8.98
Off Road Comms	8.17
Youth (JOTA etc.)	8.07
Traffic Handling	6.24
Microwave Operations	5.76
DXpeditions	5.33
Drones	5.24
EME	3.41
Radio Astronomy	2.88
High Altitude Balloons	2.64
Telemetry	2.40

Summary of Activity by Spatial Demography Controls

I have summarized below the significant differences in the activity by five control variables. For brevity, I have simply listed whether there were significant differences or not ($p < .05$).

Activity	Summary of Significance Tests by Control				
	RAC Member	Age	License	Province	Size of Place
Casual Operating	Yes	No	Yes	Yes	No
Voice Modes	Yes	No	Yes	No	No
Digital Modes	No	Yes	Yes	No	Yes
Building Antennas	No	Yes	Yes	Yes	Yes
Mobile Operating	Yes	Yes	No	No	No
Local Rag-Chewing	No	No	No	No	No
Net Participation	Yes	No	Yes	Yes	No
DXing	Yes	No	Yes	Yes	Yes
Portable Operations	No	Yes	Yes	No	Yes
HF Rag-Chewing	No	Yes	Yes	Yes	Yes
Emergency Communications	No	No	Yes	Yes	No
Homebrewing & Kit-Building	Yes	Yes	Yes	Yes	No
CW Modes	Yes	Yes	Yes	No	No
Public Service Activities	No	Yes	Yes	Yes	No
Contesting	Yes	No	Yes	Yes	No
SWLing	No	No	No	Yes	No
APRS Operations	No	Yes	No	No	No
QRP Operations	No	No	Yes	No	Yes
QSL Collection	Yes	Yes	Yes	No	No
Elmering & Coaching	Yes	Yes	Yes	Yes	Yes
Weak Signal Operation	No	Yes	No	Yes	Yes
Satellite Operation	No	Yes	Yes	Yes	No
Weather Monitoring	No	No	No	Yes	Yes
Special Event Stations	No	No	Yes	No	Yes
ARISS Space Station Contacts	No	Yes	No	No	No
Restoration of Classic Radios	No	Yes	Yes	No	No
Awards	Yes	No	Yes	Yes	No
Remote Operation	No	No	Yes	Yes	No
Fox Hunting Activities	No	No	Yes	Yes	No
Off Road Communication	No	Yes	Yes	Yes	No
Youth Activities (JOTA etc.)	No	No	No	Yes	No
Traffic Handling	No	No	Yes	Yes	No
Microwave Operation	Yes	Yes	No	Yes	Yes
DXpedition	No	No	Yes	Yes	No
Drones	No	Yes	No	No	No
EME Operating	No	No	Yes	Yes	No
Radio Astronomy	No	Yes	Yes	Yes	No
High-Altitude Balloons	No	No	No	Yes	No
Telemetry	Yes	Yes	No	Yes	No

Note: each activity was cross-tabulated by each control variable for a total of 39 x 5 (=195) tests. Only this summary is presented due to the volume of tables.

The results for the Principal Components Analysis of the 38 activities measured in the RAC Survey 2021 is summarized below.

Table B4. Total Variance Explained

Component	Total	Initial Eigenvalues		Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings ^a Total
		% of Variance	Cumulative %	Total	% of Variance	Cumulative %	
1	4.348	11.150	11.150	4.348	11.150	11.150	2.775
2	2.850	7.307	18.456	2.850	7.307	18.456	2.789
3	2.234	5.727	24.184	2.234	5.727	24.184	2.093
4	1.677	4.300	28.484	1.677	4.300	28.484	2.326
5	1.408	3.609	32.093	1.408	3.609	32.093	1.427
6	1.360	3.486	35.579	1.360	3.486	35.579	1.477
7	1.214	3.114	38.693	1.214	3.114	38.693	2.355
8	1.184	3.035	41.728	1.184	3.035	41.728	1.773
9	1.119	2.870	44.599	1.119	2.870	44.599	2.298
10	1.081	2.773	47.371	1.081	2.773	47.371	1.524
11	1.020	2.614	49.986	1.020	2.614	49.986	1.255
12	.990	2.537	52.523				
13	.985	2.527	55.050				
14	.979	2.510	57.560				
15	.934	2.396	59.956				
16	.920	2.358	62.314				
17	.874	2.241	64.555				
18	.850	2.180	66.735				
19	.835	2.141	68.876				
20	.806	2.067	70.943				
21	.789	2.024	72.966				
22	.766	1.965	74.932				

23	.719	1.843	76.774			
24	.713	1.828	78.603			
25	.698	1.790	80.393			
26	.687	1.762	82.155			
27	.652	1.673	83.828			
28	.645	1.654	85.482			
29	.609	1.563	87.045			
30	.597	1.531	88.576			
31	.567	1.454	90.030			
32	.562	1.442	91.472			
33	.555	1.423	92.895			
34	.523	1.341	94.237			
35	.496	1.271	95.508			
36	.482	1.237	96.745			
37	.464	1.189	97.934			
38	.404	1.037	98.971			
39	.401	1.029	100.000			

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

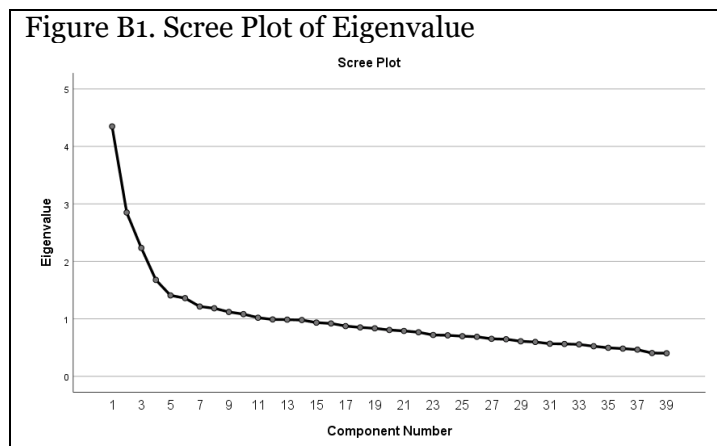


Table B5. Pattern Matrix

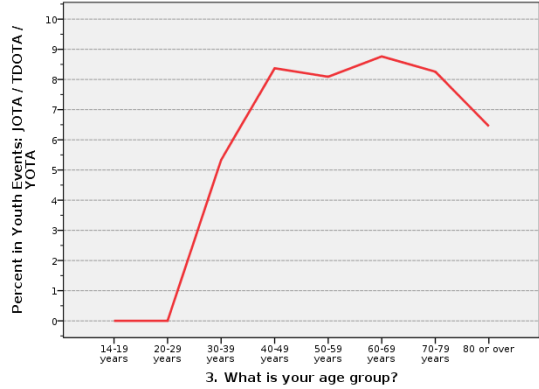
Amateur Radio activities:	Component										
	1	2	3	4	5	6	7	8	9	10	11
Emergency Communications	.766	-.122	-.001	.033	.117	.029	.006	-.012	.003	-.051	-.078
Public Service	.744	-.051	.031	.018	.021	.062	.050	-.078	.015	-.174	-.028
CANWARN/ Weather Spotting	.620	.125	-.006	-.008	-.033	-.012	-.078	-.094	-.031	.309	.072
Traffic Handling	.395	.017	-.016	-.047	-.206	-.162	.014	.274	.004	-.220	-.052
Mobile Operations	.337	-.102	.074	.020	.173	.278	-.030	.067	.272	-.067	-.101
Awards (RAC Operating Awards etc)	.014	.703	-.011	.073	.073	.146	.111	-.083	.036	-.055	-.003
Contesting	.003	.699	.107	-.017	.012	-.017	.034	-.021	-.072	-.137	-.104
DXing (chasing distant stations)	-.121	.677	.005	-.032	.007	-.022	-.087	-.021	.095	.127	-.130
Collecting QSL Cards	-.032	.656	-.074	-.052	-.026	.026	-.029	.052	.049	.068	.068
Special Event Stations	.226	.429	-.021	.126	.054	-.237	-.054	.204	.080	-.070	.126
Earth-Moon-Earth (EME or Moonbounce)	-.040	-.002	.742	-.015	-.106	-.080	-.091	-.103	.023	-.023	-.124
Microwave Communication	.004	-.049	.636	-.056	-.064	.073	.075	.210	-.040	-.165	.041
VHF/UHF Weak Signal Operation	-.034	-.024	.635	-.095	.051	.121	-.130	-.016	.103	.061	-.160
Radio Astronomy	.144	.046	.598	-.006	.100	-.118	-.029	-.026	-.037	.230	.310
Homebrew / Kit Building	-.047	.011	.125	-.706	.121	.126	.109	.113	-.048	-.124	.144
Antenna Design & Construction	.019	.054	.061	-.644	.081	.121	-.011	.017	.074	.005	.040
Restoring/Operating Classic Rigs	.005	-.092	.050	-.595	-.032	-.081	.035	-.097	.093	-.020	-.071
CW	-.107	.289	-.011	-.400	.095	-.161	-.027	-.021	-.152	-.058	-.207
Portable Operations (POTA, SOTA, Field Day, etc.)	.157	.180	.015	-.036	.680	-.009	-.040	.048	.078	-.107	-.019
QRP Operations	-.081	-.008	-.095	-.423	.613	-.078	-.139	.006	-.080	.027	-.019
Digital Modes	.126	.267	.044	-.137	.004	.536	-.084	.139	-.023	.065	.074
Automatic Packet Reporting System (APRS)	.187	-.022	-.013	.069	.159	.512	-.170	.061	-.016	-.220	.166

Youth Events: JOTA / TDOTA / YOTA	.275	.083	-.014	-.013	.169	-.505	-.199	.094	.075	-.108	.074
Traditional Voice Modes (SSB/AM/FM)	.085	.216	-.021	-.154	-.167	.316	-.260	-.025	.263	.055	-.081
Amateur Radio on the International Space Station (ARISS)	.035	-.054	.026	.096	.053	.003	-.801	-.030	-.001	-.035	.058
Satellite Operations	-.079	-.021	.143	.017	.061	-.030	-.782	.013	-.040	-.031	-.101
Remote Operations	-.010	.062	.015	-.043	-.099	-.068	.016	.656	-.027	.027	-.109
Telemetry	-.085	.036	.083	-.051	.060	.014	.046	.620	-.074	.069	.337
Drone Operations	-.114	-.102	-.037	.088	.128	.130	-.153	.401	.072	.011	-.109
Off road / 4 x 4 comms	.099	-.168	.017	.094	.242	.135	-.007	.360	.099	.037	-.110
Local rag-chewing	-.022	.023	.030	.002	.019	.046	.043	-.004	.781	-.072	.015
HF rag-chewing	-.100	.156	.015	-.136	-.019	-.124	-.020	-.054	.731	.102	-.050
Net Participation	.227	.048	-.058	-.013	-.108	.186	-.008	.058	.454	-.159	-.029
Casual operator	-.043	-.116	.010	.085	.112	-.151	.015	.006	.440	.010	.333
Fox Hunting	.081	-.020	-.020	-.117	.097	.011	-.126	-.141	.039	-.629	.135
Coaching and Mentoring (Elmers)	.119	.112	-.019	-.219	-.190	-.162	-.104	.207	.174	-.469	-.157
Shortwave Listening	.178	-.121	-.127	-.380	-.216	-.001	-.259	.123	.084	.426	.109
High Altitude Balloon Projects / Mid Altitude Balloon Projects	-.106	.066	.066	.004	-.179	.124	-.335	.002	-.105	-.236	.536
DXpeditioning	-.001	.168	.141	.045	.000	-.031	-.125	.063	-.100	-.006	-.474

Youth Event Participation by Age Group

The pattern of participation in Youth Events by age group is shown below (percent)

Figure B2. Line Chart of Percent participating in Youth Events by Age



Source: RAC Survey 2021

Notes

¹ For other data on the aging ham operator population in the United States and the United Kingdom, see <https://k4fmh.com/2021/08/28/the-secret-storm-approaching-cw-contesting/> or <https://k4fmh.com/2021/03/31/uk-regulator-ofcom-releases-ham-licenses-by-age-compares-favorably-with-us-estimates/>.

² The “life course” is the routine and mostly orderly progression of the transition of individuals among various recognized stages of life. The broadest definition is “The entirety of individual’s life from birth to death and the typical set of circumstances an individual experiences in a given society as they age.” (Source: <https://sociologydictionary.org/life-course/>).

³ In analysis not shown, there is virtually no distinction in reported inactivity during the amateur career and *current* RAC membership. We cannot determine whether past membership patterns is linked to periods of inactivity during the full period of license tenure.

⁴ It is debatable by many as to whether these constitute “contesting.” The participants and supporting organizations do keep score of contacts and submitted logs. They issue milestone awards. I consider them akin to contest activities because of these shared characteristics regardless of their recognized status as such.

⁵ In an Appendix table, it is shown that about two-thirds of QRPers operate portably (64%) but a similar percentage of portable operators say they do not operate QRP (62%). We cannot be sure within this survey instrument whether these are simultaneous activities or not so keep that in mind.

⁶ We note that, somehow, the oft-heard critique that an amateur activity “isn’t real ham radio” if the Internet is involved skips over APRS. This activity is not possible without the Internet’s role in the system.

⁷ We will examine the time spent on specific modes by frequency band in the following section. This will complement this section on activities.

⁸ In the Appendix, there is a chart (Figure B2) illustrating that participating in organized youth training activities (JOTA, YOTA) kicks in during the late twenties, peaking during middle age. Thus, the youngest hams do not appear to be engaged in peer teaching per se but younger adults do get involved in increasing proportions until their fifties.

⁹ Evidence from 20 years of the ARRL Sweepstakes Contest participation appears in Howell and Wright (2021). These results show a clear parallel of an incipient CW contesting decline in the ARRL Sweepstakes CW Contest.

Author Bio

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