Minutes of the Propagation Studies Committee

3 November 2018

Attendees:

Steve Nichols	G0KYA	Chairman
Dr John Worsnop	G4BAO	Vice Chairman
Chris Deacon	G4IFX	Secretary
George Jacob	G0HSV	
Alan Melia	G3NYK	
Ron Smith	G3SVW	
Dr Peter Duffett-Smith	G3XJE	
Prof Barry Chambers	G8AGN	
Simone Wilson	M0BOX	RSGB Board Liaison

1. Apologies for absence

Apologies had been received from full member Tim Fern, G4LOH and corresponding members G4CJC, G4DDK and G3YLA.

2. Matters arising from the minutes of the meeting held on 28 April 2018

These minutes had previously been approved via email and posted on the RSGB website. Matters arising will be dealt with under other agenda items.

3. PSC membership

3.1. New members

The Chairman welcomed George, G0HSV and Peter, G3XJE as new members of the committee and also Simone, M0BOX our new RSGB Board Liaison member.

Given that we had two new members present plus a new Board liaison member, the opportunity was taken for all those present to introduce themselves including their propagation-related interests.

3.2. Membership list

It was noted that, from a GDPR point of view, it is necessary to secure permission from all full, corresponding and associate members for their personal details to be included in the PSC membership list.

Action: G4IFX

4. Topics for discussion

4.1. RAL beacons

The only beacon thought to be still operating at Rutherford Appleton Laboratory is the 10m GB3RAL on 28.215MHz. This was reported as operational by John G3VPW (QTH Wantage) at the 2018 RSGB Convention.

Mike Willis G0MJW reports that here have been efforts to find a new home for all the beacons (5.29 MHz (?), 28.215 MHz, 40.05 MHz, 50.05 MHz, 60.05 MHz and 70.05 MHz), but nothing has yet been forthcoming.

4.2. Move to Groups.io

The move now appears to have been completed successfully. There may be occasional mismatches in terms of settings but these can either be fixed by the members themselves or with the help of the PSC webmaster, Alan G3NYK. It was agreed to leave the Yahoo in place for the time being, in case any problems with the transfer are still to come to light.

4.3. RSGB website updates

Alan has requested editor access to the PSC pages on the RSGB website so that he can clean them up. In particular there are a considerable number of dead links. Alan will then coordinate a review of the various pages by other members of PSC.

Action: G3NYK

4.4. Possible RadCom features and Book ideas

Steve is planning an article on propagation during the early stages of a magnetic storm.

Action: G0KYA

John has been discussing with Giles, RadCom technical editor an article about aircraft scatter.

Action: G4BAO

It was also noted that there is very little in the RSGB book catalogue about propagation above 30MHz. Steve stated that what is required is someone to coordinate the production of such a volume.

Action: All submit ideas for content to G0KYA

4.5. Newark Hamfest 2019

Steve G0KYA couldn't cover the 2018 Newark Hamfest as he was out of the country. The good news is that in 2019 the conference that normally takes Steve away has been moved to early September. There is therefore a good chance that he could attend the Newark Hamfest on Friday 27th and Saturday 28th September 2019. This can be decided at a later date, but the chances are a PSC stand could be run, perhaps with some support from other members.

Action: G0KYA

Peter will consider ideas on how to make the PSC display at Newark more 'sexy' (i.e. interesting and relevant to the average amateur).

Action: G3XJE

5. Projects and potential projects

5.1. Propagation prediction models and RadCom predictions

For background to this item, see Appendix.

Simone indicated that if PSC came up with an appropriate case for support, she would be prepared to argue the case for funding the ongoing operation of the proptest website (approx. £120).

Action: G0KYA/M0BOX

It was reported that the Pascal code for VOAProp may still be available even though the author has now passed away.

Action: G3XJE to investigate

5.2. Poldhu WSPR beacon

Les Jones G7THT at Poldhu ARC has reported (via G0KYA):

"Due to my declining health I have agreed with the Poldhu Amateur Radio Club committee to hand over the responsibilities of beacon keeper for GB3SSS to Robin Ridge M0RRX and this will be formally completed in the next few weeks. Robin is a retired local satcom engineer with over 40 years' experience and he will also manage the proposed new HF beacon project. As has been suggested in previous discussions, the club would like operate the beacon with the call sign GB3SSS on an allocated frequency in the 10m band. Subject to success on the 10m band then discussions could take place with regard to adding further frequencies in the future."

Poldhu has so far not progressed its 20m low-power WSPR beacon using the call GB3SSS. It previously was agreed with Murray Niman G6JYB that a low-power WSPR beacon on the standard WSPR frequency would be permissible under that callsign.

Action: G3XJE to consider possible propagation research projects based on WSPR

5.3. Goonhilly HF Web SDR

Work is ongoing at Goonhilly on a number of amateur radio projects, coordinated by Noel G8GTZ and Martin G8JNJ. Permission has now been granted for the team to use another plinth and building away from the first site looked at. Tests at the original site proved to be noisy HF wise, but the new site is said to be better. This will also give the team access to a Gigabit internet connection.

Noel says the priority is to set up a dish and web-enabled SDR for the reception of 10GHz signals from the Es'hailSat satellite and he is due to travel to Goonhilly this month. The

plan is also to try a KiwiSDR HF web-enabled receiver and a mini-whip type antenna at the site.

Steve has told them that if the team need RSGB funding to let him know, but at the moment they are happy to progress the experiment without. This is not a PSC project as such but Steve has offered to give any help that we can.

What is required for the HF WebSDR is a site with space and with a quiet RF environment. Peter reported that there might be space at MRAO and/or Glasgow University provided there was no cost to the university and no interference to the existing facility – i.e. no on-site transmission and no spurious emissions from the receiving equipment.

Action: G3XJE to investigate the possibilities and, if appropriate, identify next steps

5.4. Combined-mode VHF propagation

No report received.

6. Chairman's report (G0KYA)

6.1. Spectrum Forum Meeting

There was little propagation-related from the Spectrum Forum meeting, held in London on Saturday 27th October 2018, but one item that did warrant attention was frequent out of band activity by FT8 users on 5MHz. This was deemed a priority and RSGB wants to get the message out quickly.

While there is no here is no default 5MHz frequency within WSJT-X for FT8 on 5MHz, it has to be manually entered. Some UK operators have been transmitting above 5358kHz, probably by selecting 5357kHz as their dial frequency and then operating above 960Hz on the waterfall.

Working split is perfectly normal on FT8 so using 5357kHz lets operators see all the activity on the band. But RSGB wants to urge UK 5MHz users to not go above 950Hz on their waterfalls to stop out of band excursions.

6.2. GB2RS propagation report

This continues to be produced by Steve G0KYA, Jim G3YLA and John G4BAO. Ron G3SVW stood in for G0KYA while he was on holiday for two weeks and Sam G4DDK has helped out at times too. The report is generally prepared on Thursday and sent to RSGB late on Thursday, ready for Friday morning.

Predicting both ionospheric and tropospheric conditions up to 10 days ahead is tricky, but on the whole Steve thinks we do a good job and it is ahead of what ARRL and others are doing. Little feedback is received, but also no complaints, which is a positive!

6.3. 5MHz beacons

GB3ORK and GB3WES are still listed as operational. Both were heard on 5290 kHz on Tuesday 30th October 2018.

6.4. Propagation presentation videos

The HF presentation video has now been used by 120 clubs, some with a live Skype-based Q&A with Steve G0KYA.

The VHF presentation has been used by 66 clubs, with the offer of a Skype Q&A with Chris G4IFX, Jim G3YLA and John G4BAO.

The committee may wish to consider if any further presentations should/could be prepared.

6.5. G3YLA's PropQuest tool

The tool at http://www.propquest.co.uk continues to be developed and uses Chilton, Fairford and Dourbes Ionosonde data to plot in near real time the Critical Frequency FoF2, as well as predicted MUFs over a range of path lengths. Jim has submitted a separate report.

7. Member reports

7.1. John, G4BAO is continuing to act as RadCom microwave columnist and GB2RS contributor. He gave a gigahertz bands talk at the RSGB Convention.

7.2. Chris, G4IFX has now formally started his part-time PhD with Prof Cathryn Mitchell at Bath University with the working title: "Radio propagation through ionospheric sporadic-E". Although the initial focus is on the extension of his earlier polarisation measurements, later stages may be extended to include amplitude, phase (and derived Doppler) and potentially time delay to discover the nature of sporadic-E propagation at VHF.

7.3. Alan, G3NYK reported that his propagation work has mainly been 'on hold' recently. He also noted that a lot of sophisticated techniques now being applied on VLF – especially a new mode called EbNaut, which uses GPS synchronisation and autocorrelation and allows signals to be integrated over days. It allows paths to be probed at much lower power levels than normally would be possible and gets to within fractions of a dB of the Shannon limit. Use of this mode, plus integration over long periods, allows communication over very long paths. Alan also owns and moderates the RSGB LF group.

7.4. Ron, G3SVW has been continuing to give talks at local radio clubs. He will be putting on a combined South Manchester RC/PSC stand at NARSA and the Red Rose rally (West Manchester). He has been providing some cover for GB2RS propagation report.

7.5. Barry, G8AGN reported that his current main interest is still optical communications – visible, infrared and ultraviolet LEDs over ranges greater than 100km. Experiment seems to show that infrared light works over the widest range of conditions, including mist. Daylight communications are much more difficult because of the background light but noise from such sources as street lights is a problem over many paths even at night.

7.6. George, G0HSV works at a government laboratory and is prepared to explore the possibility of getting financial and/or other assistance with the continuation or relocation of the Chilton ionosonde. It would be useful to have access to published papers which use ionosonde data, as evidence of their value.

Action: G4IFX/G0KYA to supply some evidence to George

7.7. Peter, G3XJE is interested in working to help real radio amateurs with real noise problems and also ways in which amateurs can monitor the direction of arrival of signals. He can provide astronomical advice and has done so recently - wrote a book some years ago called 'Practical Astronomy with your Calculator'. He would be interested in helping amateurs to investigate phenomena below 10 kHz, including (for example) 'whistlers'. Another interest is Long Delay Echoes.

7.8. Martin, G3USF (corresponding member) is still maintaining his beacon lists at: https://www.keele.ac.uk/depts/por/28.htm and https://www.keele.ac.uk/depts/por/50.htm

7.9. Jim, G3YLA (corresponding member) has submitted the following report:

"Work continues on the refinement of the Sporadic E forecast parameter for the Propquest website. My colleague Dan Holley, who does the coding, has been particularly busy recently on company work, so we have not had much time this summer. There are some developments underway at the moment and I'm hoping to get some events in the southern hemisphere to test it out during their season over the next few months.

"The foF2 graph display continues to be a popular feature and has been remarkably reliable with only a few short term losses of data feeds from the main data centre in Boston, Mass. I still receive many positive comments from users and there will be inevitable pressure to increase the amount of data storage as time moves forwards. At the moment this comes within the Weatherquest costs, but I can see a time when this may need to be shared out. One particular reason is the request to add new stations to the list, which will require a big step up in storage requirements. The nice thing is that amateurs are beginning to use it more regularly to assess conditions and, as a result, build a better knowledge of how the bands and propagation work.

"I provide a blog for the GB2RS news bulletin on weather-related propagation each week, which consists of a 10 day forecast of weather conditions and likely propagation implications.

"Although I reduced the number of talks to radio clubs this year for work and health reasons, I expect to take on a few more in 2019, since I plan to retire next March. Just the one talk in 2018 to the local Norfolk Amateur Radio Club and of course a presentation to the RSGB Convention at MK in October."

7.10. Carl, K9LA (associate member) reports by email that he has had another busy year, including four Skype presentations on solar/propagation topics, ten in-person presentations (including HamSCI in Dayton, W9DXCC in Chicago, CTU in Chicago, 6m BBQ in Texas and Pacificon in CA) on solar/propagation topics. He is already scheduled for three in-person presentations and one Skype presentation on solar/propagation topics in 2019. He also writes a monthly feature on his website and is currently working on updates of the Propagation chapters in the ARRL Handbook and the ARRL Antenna Book. He is also an active participant in the HamSCI reflector.

7.11. Tomas, NW7US (associate member) has submitted the following report:

"I am still working full time as a senior software engineer. In my free time, the following activities are of interest to RSGB:

"1. I continue to host, program, maintain, and optimize:

a. Live Propagation Resources:

- https://groups.io/g/propagation-and-space-weather
- http://SunSpotWatch.com
- https://www.FaceBook.com/spacewx.hfradio
- https://Twitter.com/hfradiospacewx

"b. There are other web resources to which I push space weather data, or educational media.

"2. I continue to write in two magazines:

a. CQ Amateur Radio Magazine (https://www.facebook.com/CQMag/)

b. The Spectrum Monitor Magazine (https://www.thespectrummonitor.com/)"

8. Any other business

None

9. Date of next meeting

TBC.

10. Close

Chris Deacon G4IFX
PSC Secretary

APPENDIX - Propagation prediction models and RadCom propagation predictions

RadCom VOACAP tool

The new VOACAP-based tool for HF Propagation predictions (www.voacap.com/rsgb) went live this summer. This replicates the locations listed in RadCom, but allows users to specify their mode, power, antennas and location. The program was written by VOACAP expert Jari OH6BG and works well.

Recent updates have included long-path predictions for some locations and the addition of the SSN, VOACAP method, required SNR, man-made noise level and minimum take-off angle parameters so expert users can see what the predictions are based on. A "nice to have" would be a two-column layout, but Jari says this is tricky to implement and has been put on the back burner.

Marcus G0IJZ has suggested some changes to the VOACAP input parameters, which will be implemented in due course. These are:

1) It currently uses a minimum take-off angle of 0.1 degrees for all antennas/heights. A more conservative figure might be 3 degrees, which is the recommended minimum take-off angle in the VOACAP user manual to "prevent unrealistic antenna gain values at these very low angles from being used by the program" (see also the VOACAP.com website – http://www.voacap.com/minimumangle.html).

2) The current required signal to noise ratio in the RadCom VOACAP tool is 19 dB/Hz for CW and 38 dB/Hz for SSB. These values are much lower than those provided in ITU-R Rec. F.339 and the VOACAP manual guidelines: https://www.itu.int/dms_pubrec/itu-r/rec/f/R-REC-F.339-8-201302-I!!PDF-E.pdf

For example, in ITU-R Rec. F.339, the required SNR for CW is 31 dB/Hz for stable conditions and 38 dB/Hz for fading conditions, while for "just usable" SSB the required SNR is 47 dB/Hz.

Marcus says proponents might argue that CW commonly uses a narrower IF bandwidth than that listed in ITU-R F.339 and, therefore, it might be correct to use a lower required SNR. However, one reference suggests that a US study found that the human ear effectively processed to a bandwidth of ~50-200 Hz (i.e. similar performance might be expected if the IF bandwidth was 500 or 3,000 HZ, neglecting on-channel interference). Since the required SNR in VOACAP is an RF parameter (i.e. at the receiver), a value of 31 dB/Hz (or 38 dB/Hz) appears to be more appropriate, irrespective of the IF/audio bandwidth (neglecting machine decodes in even narrower bandwidths than 50 Hz). See http://web.archive.org/web/20041210033914/http:/n1bug.net:80/tech/w2rs/The%20Human%20Ear.pdf

A show of hands at the RSGB Convention showed that about 10 of the audience of about 60 at Steve's talk on "HF Propagation Questions" have used the tool.

RadCom propagation predictions

Gwyn G4FKH continues to produce the RadCom predictions, but Marcus G0IJZ raised some queries about the method used to produce them. Predictions via Gwyn's Predtest website presented S levels somewhat lower than those predicted when Marcus used ITURHFPROP with the text input/output formats for the same links. Marcus determined that Gwyn was deriving Signal Strength from the monthly median field strength (dB(1uV/m)) Es, El or Ei (depending on distance) produced by ITURHFPROP, which is incorrect. The correct method is to derive the Signal

Strength from the predicted Median Received Power, 'Pr' (dBW). The conversion to S-Meter units is then made in accordance with IARU Region 1 Technical Recommendation R.1, defining S9 for the HF bands to represent a receiver input power of -73dBm (-103dBW). This information was passed to Gwyn and has now been implemented for RadCom.

It is worth noting that James Watson HZ1JW who was originally involved in developing the Predtest website has corrected his calculations of S level accordingly (see https://soundbytes.asia/proppy/blog/page/40/revised-signal-strength-calculations/)

Another observation was that Gwyn's RadCom predictions gives low probabilities (i.e. no red colour and limited blue colour). While the current online RadCom VOACAP predictions use a required SNR that is too low, the required SNR currently in use on the Predtest website is too high (~15 dB in 500 Hz for CW or ~42 dB/Hz for 50% basic circuit reliability (BCR)).

Marcus spotted an error in ITU-R Rec. P.533-13 regarding the calculation of probability of propagation. Marcus has communicated this information with evidence back to Les Barclay and Chris Behm, who have advised Marcus that the next version will have the corrected equations.

This error explains why ITURHFPROP predictions show 'bipolar' probabilities for propagation (i.e. either very low or very high). The result is that amendments need to be made to ITURHFPROP, but these are unlikely to be completed (due to numerous approval processes) until at least mid-2019, according to Les Barclay G3HTF.

There are also some typos that need to be corrected in RadCom:

i) Johannesburg has two 'n's.
ii) Western Samoa is the old name for Samoa.
iii) Washington should have a D.C. at the end for clarity.

These were passed to G4FKH and he says they will be implemented from the January 2019 edition of RadCom.

In conclusion then, Gwyn thinks that his RadCom predictions are correct, saying: "I did an extensive survey in October which suggested that my November RadCom predictions were in the correct ball park area."

Marcus has produced prediction charts that show markedly more red, which shows a higher probability of propagation (i.e. greater than 67% of days in the month) of making a contact on many paths.

Gwyn's charts show no red at all and only a few smatterings of blue ("good" probability). This difference in chart colouring primarily relates to the high required SNR used in Gwyn's predictions and, in part, to the use of BCR instead of 'probability of propagation'.

As the RadCom predictions are only a guide I think we should continue with Gwyn's output for the time being and review the situation in 2019, and hopefully when a new version of ITURHFPROP becomes available. If Gwyn does decide to stop producing the RadCom charts, we are at least now in a position to continue their production in their current format, either by Marcus G0IJZ or by me (G0KYA).

Discussion as to changing the format of the RadCom charts have also been put on hold. Giles at RSGB was against having different options displayed at the 2018 Convention for people to vote on,

preferring a vote to be cast after they had been shown in RadCom. In discussions at the Convention and Spectrum Forum other RSGB personnel were against a vote full stop.

We can discuss other layout treatments once we are confident the charts are accurate. That is, post the new version of ITURHFPROP becoming available.

Steve Nichols, G0KYA