SUBJECT	BEACON COORDINATOR report		
Society		Country:	
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The table below shows the worldwide distribution of beacons at 1 April 2008. Thanks to national HF/Beacon managers for updating information and to the many beacon monitors worldwide. However, I need even more help with details of changes if the list is to be accurate and up-to-date. This is particularly important during solar minimum when many beacons cannot be monitored directly.

Band	Region 1	Region 2	Region 3	Total
1.8	4	1	-	5
3.5	10	-	-	10
(5)	4	-	-	4
7	12	3	-	15
10	19	3	-	22
14	9	6	7	22
18	9	8	7	24
21	9	10	7	26
24	10	6	8	24
28	88	273	24	385
Total	154	310	53	517

The current situation is broadly similar to what it was at Davos. However:

- Despite low solar activity the number of beacons has increased. Most are on 28MHz, where the beacon sub-band is now very crowded, particularly in North America. In many respects this

increase is healthy but, as the 2011 solar maximum approaches, the resulting congestion will reduce the usefulness of some beacons. More frequency sharing (as with the IBP and UK 5MHz beacons) is highly desirable, but little progress has been made.

- Some gaps in beacon coverage to which I drew attention at Davos have been filled. Warm thanks to the societies concerned. However, gaps remain, notably in eastern Europe and North Africa. I encourage colleagues to bring forward proposals to fill these empty spaces.

- By contrast, some countries are arguably 'over-beaconed'. Colleagues even speak of 'vanity' beacons. Considering the pressures on spectrum, it is increasingly important, to ask what useful purpose any additional beacons will serve. Many HF managers/beacon coordinators already apply this test. I strongly urge all societies in the Region to do so, while acknowledging that often beacons are put on the air without consultation with the national society (or the coordinator).

- The problem of QRM to the beacons remains unresolved. It is currently worst at 14MHz – but this probably reflects the fact that there is less activity on higher bands during solar minimum. Monitoring 14100 daily since 2006, I have found little interference on weekdays. However, on at least 20 weekends per year there is serious QRM, often for many hours, making reception of weak beacon difficult or impossible. Most of this QRM arises from contest activity. The problem is present during not only the biggest international contests but also the main regional contests and some national contests. The 14100 frequency is particularly vulnerable because it is affected by both cw and rtty/psk contests.

- Since Davos, the number of R1 beacons below 14MHz has increased. They are now at record levels. There are a few acceptable exceptions to R1's policy of discouraging beacons on these bands, notably DK0WCY, OK0EU and the ZS 7 MHz network, which is part of an educational project and is covered by our recognition of special factors south of the Equator. However, the great majority of the new beacons, though mostly QRPP with QRSS3, do not conform to R1 policy and have not been approved by the appropriate national society or the beacon coordinator.

- In creating and maintaining their beacons, beacon keepers make a valuable contribution to our hobby, which deserves recognition and thanks. Most beacons are simple transmitters running 10 watts or less to simple antennas. They have served us well and will continue to do so. Yet we must also move forward and innovate. Beside these 'traditional' beacons we need more advanced beacons that meet the standards of frequency accuracy and timing required for serious propagation studies, particularly those employing narrowband techniques. An early example, the UK 5MHz beacon network, has given excellent service for some years and provides a high-grade basis for propagation studies. More recently, a new generation of GPS-controlled DDS chips and fresh design approaches have led to a new generation of microwave beacons in the UK and the GB3RAL beacon cluster at 28, 40, 50, 60 and 70MHz. An appendix to this report describes some of the key features of GB3RAL. A fuller version is provided in a paper by Mike Willis, G0MJW, for Committee C5 at this conference.This should be a challenge and encouragement to further development to ensure that the amateur beacon service at HF commands the respect of professionals and fellow amateurs.

- To enable propagation studies to keep pace with such beacon developments we also need innovation in developing automatic monitoring systems, particularly by employing SDR techniques. Already, SoftRock provides a suitable and reliable way of avoiding the need to commit a main rig to continuous monitoring. It is possible to envisage a further new generation of internet-connected monitoring stations to provide a more consistent picture of propagation patterns.

- The IBP/NCDXF beacon network has given excellent service over many years. Regrettably, for various reasons, at any one time several of the beacons have been out of service or functioning below desirable performance levels. More important, the network is ageing and it no longer meets

the best technical standards. Its future development is of course in the hands of NCDXF, to which we have a great debt of gratitude. It would be good to know what their plans for the network are.

Work of the Beacon Coordinator

I continue to maintain the worldwide HF beacon list (www.keele.ac.uk/depts/por/28/htm). This is reproduced by several national societies and serves as a useful tool in beacon coordination. This entails checking internet sites and reflectors daily and incorporating information directly from national HF managers and beacon operators - to whom my thanks. There is room for improvement in getting information about QRT beacons. This sometimes slows the process of reallocating vacant frequencies. My thanks are also due to deputy coordinator Ulrich, DK4VW for wise advice and support. I also note with pleasure the appointment of Bill, WJ5O, as Region 2 beacon coordinator, filling a longstanding gap. He has already had a beneficial effect on developments in North America.

Martin Harrison, G3USF
Region 1 HF Beacon Coordinator
April 2008

<p style="text-align:center">Appendix</p>
<p style="text-align:center">Current GB3RAL Beacons</p>

Specifications

At the outset in order to provide a reliable facility several specifications were set that had to be met. Frequency, power, antennas and shutdown requirements were specified in the license. Other significant specifications were.

Spurious outputs and harmonics

Because of the location and because of the use of non-amateur bands, the spectral purity of the beacons needed to be very high.. The level of both harmonic and non-harmonic spurious outputs was to be as low as practically possible and a maximum level of –60 dB with respect to the wanted signal was set.

Frequency and timing accuracy

For automated measurement and for weak signal detection the frequency of the VHF beacons must to be accurate. Keeping frequency drift under 1 Hz is desirable. This is 1 part in 10^8.

Antennas

The antennas had to be very durable. Amateur class antennas are frequently not durable enough for installation on commercial sites. One can imagine what might happen if one of our antennas fell off a tower and caused injury or damage.

The design

A modular design was developed and this is shown in Figure 1. This consists of a GPS based frequency and timing source, a set of four DDS signal sources, four high power amplifiers combined into two pairs to save rack space and a common oversized power supply.
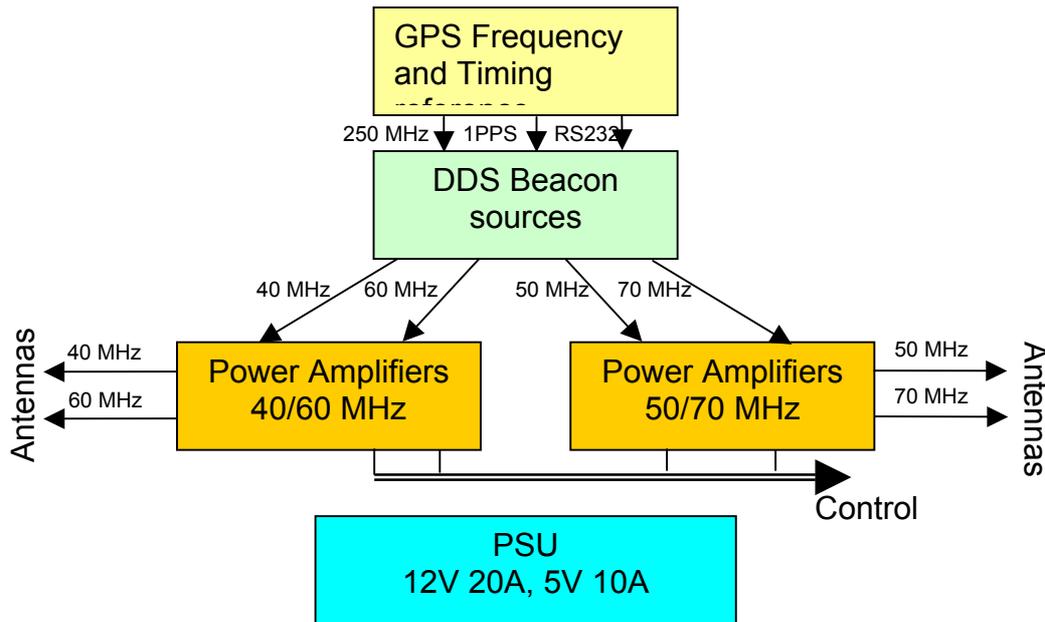
Figure 1 - Block Diagram of multiband-beacon

The entire system is driven by a GPS receiver which controls a 10 MHz ovenised frequency reference to around 1 part in 10^{10}. This receiver also produces the RS232 signalling of time and the one pulse per second signal which are used by the timing software. A low phase noise 250 MHz VCXO is locked to the 10 MHz GPS reference using a Reflock II designed by CT1DMK[1] with the 120 MHz input range extended using a pre-scaler. The frequency stability of the reference exceeds our ability to measure it. The error is less than 1 Hz at 70 MHz.

The beacon signal generating unit contains four signal source PCBs based on the AD8952 chip and designed by G4JNT. A PIC microcontroller controls each DDS using the timing data provided by the GPS RS232 and one pulse per second outputs. To avoid any key clicks, the keying waveforms are shaped using a 16 point root raised cosine function.

The RF output of each source is filtered and then amplified to 10W by a high power linear amplifier.

The transmit sequence

As the modulation of the beacon is software defined almost any keying sequence is possible. Clearly CW keying of the callsign and locator is essential. Beyond this the JT65B weak signal mode developed by Joe Taylor K1JT[2], allows the beacon to be identified at significantly lower signal strengths than with a plain CW ID. This weak signal detection capability may show up interesting propagation effects and also partly compensates for the relatively low 10 W EIRP.

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[1] Reflock II – Now available from TAPR www.tapr.org

[2] Joe Taylor K1JT - http://physics.princeton.edu/pulsar/K1JT/

The current sequence is shown in Figure 4. It repeats every two minutes and includes CW and JT65B ID, a period of plain carrier and a period where the phase of the carrier is reversed each second as a timing marker and to assist in manual identification. Beacons that simply transmit a plan carrier with infrequent CW ID are difficult to distinguish from interference.
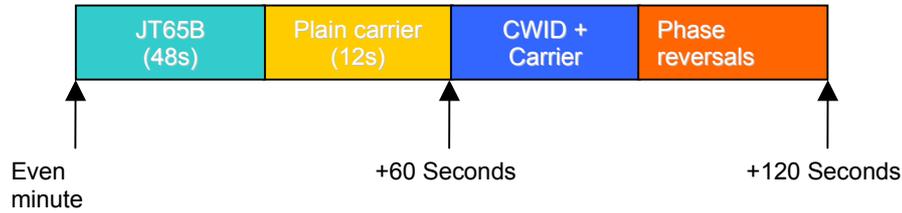

Figure 4 - Keying sequence

All the beacons start each two minute sequence together, triggered by a common signal. Differences between the arrival times of the start of the sequence at a distant site will be mainly caused by differences in the propagation channel.