AN INTRODUCTION TO BEACON DXING:

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There has been a growing interest in Beacon DXing, something which for a great many years was always viewed as a 'minority' interest, but thanks to organisations like the NDB List and clubs like the Longwave Club of America (LWCA), this type of listening has now become a lot more widely enjoyed by many listeners around the world. Back in the 1990s I produced a publication called 'An Introduction to NDB DXing', which later evolved into a much larger e-book called 'The Beacon Hunter's Handbook', and this was available from the former Beaconworld website, but due to various health problems, and the vast amount of time it took me to keep this up to date, it largely vanished from the Internet when I closed down the Beaconworld site back in May 2010. It was obvious that some sort of publication which would provide useful information to newcomers to the hobby was still required, but not wanting to get back into the situation of having to spend a lot of what little spare time I have in keeping it up to date for the same reasons as before, and because there are still copies of the old publications available from various websites, I thought a simpler and more easy to manage publication using some of the essential parts from the old book, plus a few new additions might be the easier option. I have used some of the older material to produce this publication, and given it a slightly different title to avoid any confusion with the former publications, some of which still survive and can be found on various parts of the Internet, but for this one I have tried to use a format more in line with that used in the other introductory files that can be found on the DGPS and NAVTEX sections of the NDB List website, and anyone wanting to know more about those digital modes, and how to start monitoring them, can download both of the publications from the following page: http://www.ndblist.info/dgnavlist.htm

INTRODUCTION:

There are a number of different types of radiobeacon that are used throughout the world, some are used by aircraft and the aviation industry, and a small few remaining marine beacons still serve the Maritime community following the closure of the majority of them back in 1999. The beacons used by these services are generally referred to as 'NDBs' or Non-Directional Beacons, but there are also many other types of beacon in use as well, including the Very High Frequency 'VOR', VORTAC or 'TACAN' or DME beacons which are also used by the civil and military aviation community. Alongside these are the increasingly popular 'Propagation Beacons' used by many ham radio enthusiasts throughout the world to help show when many the various Ham bands are open, and also more exotic types such as the mysterious Single Letter HF Markers (SLHFM) used by Russia and a few other countries for all sorts of unknown reasons. A newer form of beacon which replaced many of the old Marine Beacons is the DGPS type, and you can find out more about these via the address given in the previous paragraph. As you can see, there is no shortage of beacons to keep us happy, and to provide lots of interesting listening challenges with their low power outputs. All except the DGPS beacons can be recognised without the need for any computer decoding software if you are able to read the Morse Code reasonably well, but there are some software programs such as CWGET and MultiPSK which will help you to do this even if you can't. Part One of this publication concentrates mainly on NDBs, but Part Two takes a look at the various other types of beacon which can be found on the LF, MF, HF, VHF, UHF and even SHF Bands, Part Three takes a quick look at the sort of equipment required for all of these bands.

PART ONE: A LOOK AT NON-DIRECTIONAL RADIOBEACONS:

In this first part we will take a look at what types of Non-Directional Beacons are in operation, the modes of operation they use, and the terms used to describe them, both 'official' and 'unofficial'.

CONTENTS:

SECTION ONE: TYPES OF NDBs CURRENTLY IN COMMON USAGE:

You will come across a number of different terms when referring to Non Directional Beacons, and the table below gives a list of the ones that are most commonly used, and is followed by a brief explanation of what they all mean.

CAL	=	Calibration Beacons
LOC	=	Locator Beacons
Lctr	=	Locator Beacons (as above)
LIM	=	Locator Beacon at Inner Marker
LMM	=	Locator Beacon at Middle Marker
LOM	=	Locator Beacon at Outer Marker
NDB	=	Non-Directional Beacons
RC	=	Radiobeacons - (symbol shown on charts to indicate NDBs)
VOR	=	VHF Omni-directional Range

AERO BEACONS: Usually located near to Airfields, and also found on Oil Rigs in the North and Irish Seas, and International Waters.

MARINE BEACONS: Usually located around the coast, e.g. At Lighthouses, or on Light Ships, though very likely to disappear completely over the coming years and be replaced by DGPS systems. Some are still operational in countries like Russia, but sadly their days are probably numbered.

You will also come across the terms ‘En-route’, or ‘Waypoint’ when referring to beacons too, and this is usually in relation to the beacons that are located away from airfields. For example, if an aircraft is travelling from one airfield to another, a Waypoint or En-route beacon may be situated somewhere in between the two airfields, and the aircraft can use this to navigate towards that position (these routes are often known as ‘Airways’ – think of a Motorway/Freeway/Autobahn in the sky!). On long journeys several of these may need to be used on a particular flight path. In official publications such as AERAD and Jeppeson, these are often denoted by just being listed with the two letters of the country’s ICAO code (e.g. - Epsom, UK - EPM on 316 kHz is listed as ‘EG’ (EG is the ICAO code for the UK), whereas the nearby airfield at London’s Heathrow is ‘EGLL = EG (UK) + LL (London Heathrow), this tells us that EPM is most likely a Waypoint beacon.

SECTION TWO: THE MODES OF OPERATION PRESENTLY USED BY NDBs:

The various different types of beacon in use, and what these differences actually consist of have often confused many Beacon enthusiasts. A brief explanation would be that most radiobeacons are very similar technically, with the main differences being the modes that are used, and the frequency of the identification signals. Beacons used for Marine navigation generally sound different and offer a longer carrier for DF purposes, generally using mode A1A. Aero beacons on the other hand, use mainly A2A or Non A2A modes. There are exceptions to this rule however, and as will be seen, a large number of the Aero NDBs operating in France use only the A1A mode (Note - as of late 2012 a number of these have now changed over to Non A2A operation). At first glance this may sound a bit confusing, but for the beacon DXer this can actually be quite helpful, since this can offer clues as to country of origin, which is handy to know when finding an unlisted beacon during your searches. We will take a further look at the various types of ID signal patterns later in this chapter.

A number of beacons are listed in the ‘official’ publications with titles such as 'Locator beacon’, and these are basically the same as standard NDBs, but will also have a specified 'Instrument Approach' procedure as well (usually listed in Aeronautical Flight Supplements) which may be used by pilots when making an approach to the airfield. These are provided as an additional approach aid during the notified hours of operation at a particular airfield, and as such may only be operational at certain times of the day (though this does vary from airfield to airfield).

The terms, LOM, LIM, LMM generally refer to the location of the locator beacon in question - e.g. LOM - at the 'Outer Marker' position on the approach to the runway, LIM - at the 'Inner Marker' position, and LMM the 'Middle Marker' position. At these sites a beacon will often be co-sited with a Marker transmitter, which the aircraft will detect as it flies overhead. To the radio enthusiast these differences will to all intents and purposes be irrelevant, though as you can no doubt appreciate, this difference will be of considerable importance to the pilots, who may well be heavily reliant on these aids for getting their aircraft safely on the ground.

As I said previously, most Marine Beacons use Mode A1A, though some countries (France and a number of Eastern European countries for example) also use this mode for a number of their Aero beacons. Knowing this

can prove to be of great assistance when trying to identify an unknown signal. The majority of Aero beacons will generally be of the A2A or Non A2A variety though, and you will find that some of the idents just send the callsign over and over again continuously (usually at around 7 words per minute) without any sort of long 'dash' or 'gap', whilst others send the ID once and then follow it with a 5 or 7 second dash (though these lengths may vary from beacon to beacon, and in the case of Marine beacons be up to 47 seconds. See following section on station idents for more on this subject!

CALIBRATION BEACONS

With the demise of the Marine Beacon service these are becoming increasingly rare. Basically these beacons are provided for the specific purpose of calibrating and aligning a ship's DF equipment. The Calibration Beacon will generally be co-sited with another beacon, but will operate on a completely different frequency, and only be activated when requested by a ship - in many cases only when accompanied by a small payment. The range of these stations is usually only around 5 nautical miles, and hours of operation during the daylight period - this is one of the reasons that reception of these beacons is very rarely ever seen in radio hobby publications. The frequency range recommended for many of these in the ITU regulations is '406.5 to 413.5 kHz, though 410 kHz is considered to be the usual channel to watch, and as of late 2012 ships and platform support vessels are often reported as appearing around there using their ship's callsign. There is no pattern or schedule as to when these will appear, so either regular checks on the channel, or watching for postings from other enthusiasts on the ndblist mailing list may be the best way of catching them.

MODES OF OPERATION:

Below is a brief explanation of the different modes used for radiobeacons.

A1A	On-off keying of the unmodulated carrier - requires BFO to be switched to the 'ON' position all the time (if your receiver doesn't have a BFO it should be switched to the 'CW' position).
Non A1A	Operates in much the same way as A1A (tends to be rarely used nowadays!)
A2A	On-off keying of modulating audio frequency during the identification period, when the carrier is either continuous or keyed with an audio frequency and the BFO switched off. There is a modulating audio frequency on the carrier during the DF period, when the BFO may be switched on or off.
Non A2A	Continuous carrier with on-off keying of a modulating audio frequency. Similar to A2A mode except that the receiver must have the BFO switched off during the identification period, and on during the DF period.

SECTION THREE: A FEW WORDS ABOUT STATION IDENTIFIERS (IDENTS):

Listeners will quickly become aware of the fact that not all beacons sound, or identify themselves in exactly the same way. In the case of many of the old Marine Beacons you would have noticed that the beacon identified itself twice in Morse Code and then transmitted a 'long dash'. The reason for this was that the recommended method for marine beacon identification consists of a 'long dash' of approximately 47 seconds, followed by the call letters repeated at least twice over a 13 second period. This cycle should have been repeated every minute throughout the beacons' operating period, and if you are fortunate enough to catch one of the few remaining ones that is the sort of pattern you should hear.

Prior to the major re-organisation of the marine beacon system on the 1st of April 1992, a different system was in operation which consisted of a 22 second period during which the Callsign was repeated 3 to 6 times, followed by a 'Long Dash' lasting approximately 25 seconds, another Identification Period of 8 seconds**,** and finally a 'Silent' period of 5 seconds. Most beacons should be now be found to using the newer system, but it is possible that from time to time you may still come across the odd beacon operating using the older method.

In the case of Aero Beacons it will be found that the majority of them use the Non A2A mode with Double Side Band and full carrier, and in most cases all you will hear is the beacon's callsign being repeated continuously. The reason for this is that to 'Direction Find' (DF) the signal, the onus is on the user to switch his receiver's 'BFO' to the 'ON' position and then use the heterodyne from the transmitted carrier to obtain a null. In the case of an A2A transmission, an audio tone or 'Long Dash' will be transmitted on the carrier in between idents, and the user can then attempt to 'DF' the signal during this period.

In the case of Marine Beacons it will also be noted that most only use a 'Two Letter Callsign', usually bearing letters which are similar to the name of the beacon's operating location. A couple of good examples of these were: 'SB - South Bishop, Wales - 290.5 kHz' and 'BY - Baily, Ireland - 289.0 kHz' (sadly both are now long departed along with most of the other UK and Irish Marine Beacons in early February 1999). As you can see, in the case of names with more than one word, the first initial of each word may be chosen, whilst in the case of names of just a single word, the first and last letters are often used. This is not a hard and fast rule though, but in the event that you are trying to identify an unknown signal this can prove to be very helpful to your investigations.

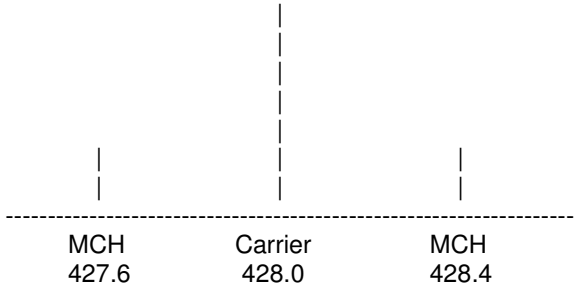
Pitches and Offsets - It will often be noted that when you tune in to an Aero beacon using a receiver set to the SSB or CW position, the actual CW Ident will appear to be slightly off the listed frequency. This is because in the case of most aeronautical beacons, Mode A2A or Non A2A is used, which is in effect AM or Double Sideband. If the receiver you are using has a narrow enough IF filter fitted you will be able to hear the carrier (i.e. a loud audio tone) on the listed frequency (centre frequency), and the actual CW ident at a set distance above and below this carrier. In the case of aerobeacons in the UK, it is generally traditional to use an offset or pitch of 400 Hz, which in the case of one my local beacons - MCH on 428 kHz (now also closed down) that meant that the carrier would be heard on 428.0 kHz, and the CW ident at 427.6 and 428.4 kHz. If you happen to be listening to the beacon on a receiver which is set to AM or DSB though, chances are that all you would have heard was the just the callsign superimposed onto the AM carrier, even when you were tuned dead on 428.0 kHz. To make things even more complicated, some other countries will instead a modulated tone of 1020 Hz (Germany and Spain for example), and if you just happened to be using a very narrow filter and were tuned in to Spanish NDB 'MNF' on 428 kHz using this offset, you might well have heard idents on 426.98 and 429.02 kHz as well. As you can see from this, in the event of beacons of differing pitches sharing a channel, it is very easy to assume that one station is slightly higher or lower in frequency than the other, when in fact most official publications would only show the same carrier frequency of 428 kHz for both beacons.

Why is all this necessary you may ask? Well, a look back at the description of the different modes used on the previous pages would show that for direction finding purposes the aircraft would use the AM mode to tune in the beacon ident (necessary to know which beacon they are tuned to and where it is located), and, in he case of Non A2A transmissions, the BFO would need to be switched in (or the CW position selected) to give a constant carrier, which would shows minimum signal strengths when attempting to take a bearing with the DF equipment. Some types of beacon will use mode A2A, which is often tone modulated to allow the bearing to be taken whilst still switched to the AM mode. As if all that isn't complicated enough the many of the Aero beacons in France (and nearly all of the remaining marine beacons) use mode A1A (or Non A1A) and can only be tuned in properly when the receiver is set in the CW position. These show no offset, and the ident (and a tone of between 15 or 47 seconds) will appear on the actual (listed) carrier frequency and are not offset in any way.

To give a more graphic example, the French Mode A1A Aero beacon CTX at Chateauroux on 428.0 kHz would give an audible ident and tone only when the receiver was set to the CW position and tuned to 428.0 kHz. Confusing isn't it, no wonder so many people find it difficult to know what frequency they should be tuned into, even when they have a top quality receiver with a very good digital readout.

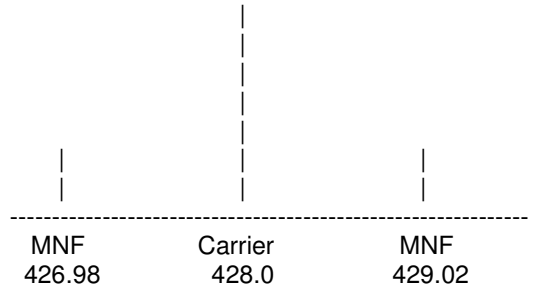
I hope the above information helps to clarify this situation a little, and I have added a few simple illustrations below to help explain the point more easily:

A typical 400 Hz Beacon:



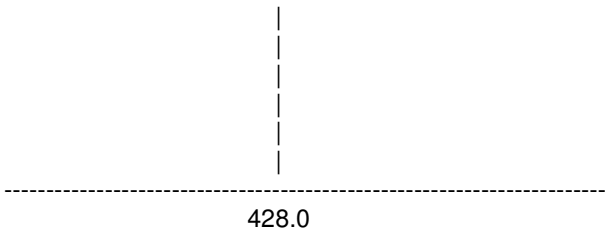
1.) MCH - 428 kHz 400 Hz offset

A typical 1020 Hz Beacon:



2.) MNF - 428 kHz 1020 Hz offset

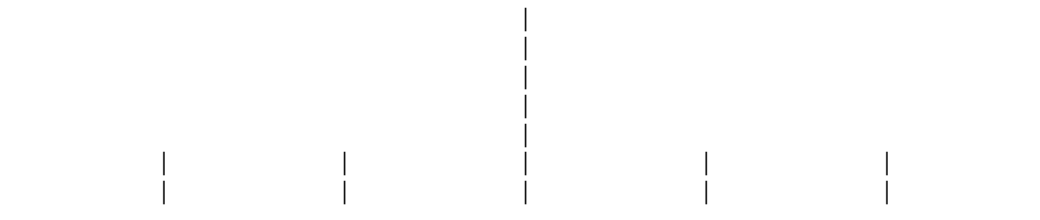
A typical Zero Hz Beacon:



428.0

3.) CTX - 428 kHz Zero Hz offset

How all the beacons would appear together:



	MNF	MCH	CTX	MCH	MNF
4.)	426.98	427.6	428.0 Carrier	428.4	429.02

This was how the three beacons would have appeared as you tuned across the band from 426 to 430 kHz.

Note# A French mode A1A beacon with zero offset such as CTX - Chateaureux would only appear with its Ident exactly on 428.0 kHz, and may be masked by the carrier of the other two beacons - see the Paragraph about DSP and Analogue Filters later in this publication for details about how to deal with this sort of problem.

As can be seen from the above examples, signals that are actually on the same channel can appear to be on different frequencies because of the different types of offsets that are in use. In Figure 1. you can see that the 400 Hz offset of the UK aero beacon ‘MCH’ on 428 kHz would cause the ident to appear at 427.6 and 428.4 kHz, whilst those of ‘MNF’ in Spain Figure 2., which uses a 1020 Hz offset, would appear at 426.98 and 429.02 kHz. Figure 3. shows that a typical French NDB with a 'zero' offset and its ident appearing exactly on the carrier frequency would be sharing the same frequency as the carrier from the other two beacons. Figure 4. shows how the idents would appear to the listener as they tuned across the band of frequencies between 426 and 430 kHz (assuming both beacons were audible that is).

This may seem complex enough to grasp, but can be even further complicated, because another beacon operating on a higher or lower channel may obliterate one of these sidebands with its own ident offsets, and may leave only one of the original ident sidebands audible. If you happen to be using a narrow IF Filter with a bandwidth of around 250 or 500 Hz the two idents may make the signals appear to be operating on separate channels, whilst in AM mode it only appears the once. In reality both idents are coming from the same beacon operating off the same carrier frequency, it's just the method used for reception that makes this appear as two signals. For a more detailed look at the workings of pitches and idents I would strongly recommend reading a copy of Sheldon Remington’s excellent publication ‘On The Art of NDB DXing’, (now only available from the following website at:

http://pe2bz.philpem.me.uk/Comm/-%20ELF-VLF/-%20Info/A-107-Art-of-NDB-DXing/index.htm

Don’t worry if you found the previous section complicated, you will soon get the hang of things, thankfully things will get a little easier from now one, I promise! ☺

TWO AND THREE LETTER CALLSIGNS:

With Aero Beacons you will find that in the majority of cases a Three Letter Callsign is used, again with letters that are often similar to the beacon's location. A few examples here are: 'MCH - Manchester, England - 428.0 kHz', and 'PIA - Piacenza, Italy 440.0 kHz'. This is not always the case however, and there are many beacons with Two Letter calls, or letters that seem to bear little resemblance to their location. This can be misleading since the letters may be a reference to the 'local' name of the airport. A good example of this is the UK Aero beacon 'KIM' on 365 kHz, this is located near to Humberside International Airport but doesn't initially appear to bear any relationship to the name of this airfield. A look at the address of the Airport though soon shows the answer: "Humberside International Airport, KIrMington, South Humberside DN39 6YH, England". It now becomes clear that KIM is related to Kirmington, which is the name of the area in Humberside where the beacon is situated. I've also noticed a tendency amongst some of the French NDBs to use letters relating to two towns rather than just the one, with a good example being CVT on 347 kHz, which stands for Chalons / Vatry.

Doing a little research into things like addresses or 'local' Airport names can be helpful in assisting with the identification of an unknown station or callsign. This is not a hard and fast rule, and despite your best efforts many calls will bear no relation whatsoever to anything immediately identifiable, and may prove very frustrating to your attempts to gain a definite ID. This is where having a good selection of publications, maps, charts, atlases and other information sources will prove very fruitious to your efforts. Being a member of radio club with a newsletter covering both Marine and Aero Beacons like the LWCA, or a specialist beacon reflector such as the 'NDB List' or the 'Lowfer' reflector can prove to be a great asset in this regard.

HOURS OF OPERATION:

This is an oft neglected but very important point, and one, which can be easily overlooked. Many of the larger airfield and waypoint beacons will often be left switched on for full 24 hour operation, but in the case of a small or private airfield, landings may only be permitted during certain hours and the beacon may only be switched on during those periods of activity, usually on prior request from the incoming aircraft. Many DXers have also noticed that a number of the Oil Platforms in the North Sea don't leave their beacons on all the time, and the Aeronautical Information Publication (AIP) produced by the Civil Aviation Authority, also contains some very interesting information about this in section 'ENR 1.15 Off-Shore Operations'.

The following piece was extracted from Section 5.1.4:

"NDBs on both fixed and mobile installations generally operate on shared frequencies. NDBs that share frequencies should only be switched on if requested by the helicopter pilot, and then only after the frequency has been monitored by the pilot and found to be vacant immediately prior to switching on. The pilot should advise the NDB operators as soon as they no longer require the use of the NDB. When no longer required the NDB should be switched off. Additionally, in order to assist helicopters in transiting fields a small number of NDBs on fixed installations have been assigned frequencies that enable them to operate as close to H24 as practical. Pilots may find these NDBs already on and that they remain on after they have advised the installation that they no longer require their use."

I was very pleased to receive an e-mail from Peter Cork, a North Sea helicopter pilot with Scotia Helicopters, who gave me some very useful information about how pilots use these platform beacons. Peter said:

"As a North Sea helicopter pilot and ex-Royal Signals radio operator, I can verify that rig beacons are used as an aid to location in poor weather by helicopters. They form an intrinsic part of a "let down" procedure used by the helicopter crews in conjunction with the aircraft radar. Using the beacon the helicopter homes to the overhead (of the installation), and once the NDB needle swings, the aircraft then flies a "teardrop" manoeuvre that takes it out to about 5 miles, the aircraft then turns inbound towards the rig using the NDB needle and aircraft radar to establish a safe inbound track. The aircraft will fly a stepped descent during this procedure going down to around 200 above sea level. If the rig becomes visual then a landing is carried out, but if by a certain point the crew cannot se the rig they perform a "go around" and will either give it one more go, or divert to an onshore airfield. Once the aircraft has landed the crew request the beacon to be switched off (it is controlled by the radio room) so that it doesn't block the frequency for other rigs/aircraft in the area that may need to also use the beacons. My experience is that the beacons have a useful range of about 10 - 15 miles, and if you are receiving them onshore then you are doing well, and are probably using much more sensitive equipment than fitted to the aircraft.

Although MW NDBs are getting rapidly consigned to history throughout much of Aviation, for us they are still a very useful aid to navigation as it gives an unambiguous method of proving a position (of a rig). GPS prevails on all North Sea helicopters these days, and very good it is too, having used "Decca" in the past (also now gone) then accurate navigation over endless tracts of featureless surface is not the "challenge"

that is used to be. Beacons being on or off is for us entirely weather dependent, they don't have to be on for us to find the rig. The sort of weather doesn't necessarily have to be bad (stormy) but Fog and low cloud are principally when we would request "beacon on". So fairly benign conditions can be in the area, and yet you will still be unable to land - due to a low cloud base. The early summer months are notorious for sea fog offshore (June and July), I have flown overhead rigs at a 1000 ft sat in the bright sunshine, done a let down, and not got in due to the visibility and cloud base being out of limits, and having to return back onshore".

My thanks to Peter, for this very useful insight into how North Sea platform beacons are used. Indeed, from my own monitoring experience the 'foggy' days have often been the golden ones for the dedicated platform chaser, and I regularly watch the late night BBC "Weatherview" programme to see if there is any likelihood of Fog Banks over the North Sea. Fog Banks are bad news for pilots and mariners, but can be a godsend for platform beacon chasers.

To find out more about the workings of oilfield beacons I would recommend a visit to the NATS website where you can download a copy of the AIP in .pdf format: http://www.ais.org.uk

As you can see from the passage above, hearing some of these beacons may be more a matter of luck than planning, though with a lot of patience and persistence it's certainly not impossible. One option may be to leave your receiver 'parked' on one of the listed channels for long periods and hope for some activity, another is to make frequent checks of all the oil platform beacon channels at regular intervals, and this is the method that has worked best for me in the past. If your receiver has lots of memory channels, it's well worth programming all of the Oil platform beacons into a memory bank and tuning through them as often as possible. The same tactics can also be employed for many of the 'limited hours of operation' beacons, and the recent arrival of many Software Defined Radios (SDRs), has now provided many listeners with a great way of pre-recording a large section of the band over a sizeable time period, and then search for them later, More about these types of radio will be covered in a future publication.

If the beacon is a 'daytime only' operator, but is within a reasonable distance of your location, daytime reception may well be possible, and checking for them during their listed hours of operation should produce some good results. Again, a good selection of official publications can provide essential information about hours of operation at specific airfields, and as I've said previously, it's certainly well worth investing in copies of these from time to time (or trying to find the information on the internet if your country provides it, many now do). Many of these 'daytimers' will often change their operating hours slightly during the winter months when the hours of daylight are much shorter. Hours can also change when daylight saving ends and clocks go back or forward in March and October, and the beacon may be switched on or off an hour sooner or later than expected.

Of course, for many people who have to go out to work for a living, daytime listening opportunities may be very limited, and other demands such as family, sports, gardening, shopping, XYL demands and other hobbies etc. may prevent you from having much opportunity for any daytime DXing. All is not lost though, and I have noticed that on the odd occasion, one of these restricted hours beacons has been left switched on all through the night. Whether this was deliberate or accidental I couldn't say, but it does pay to make regular checks of frequencies where restricted hour beacons are listed, you may just get a very pleasant surprise one of these fine nights. My preferred method of doing this is to compile a 'most wanted' list, and check these frequencies at as many different times of the day as possible and whenever spare time permits. You can quickly scan through these channels in 5 or 10 minutes, and can often squeeze a short session somewhere into a busy schedule (or record it on your SDR).

Below is a list of terms often found in 'official' publications that show the hours of operation of an airfield:

H24	-	Operates 24 hours a day.
HJ	-	Operates during the daytime.
HN	-	Operates during the night.
HO	-	Operates during times to meet operational requirements.
HS	-	Operates for scheduled services.
HX	-	Operates at no specific hours.

Be aware that callsigns do change from time to time and often for a wide variety of reasons. In recent years there seems to have been a tendency for many beacon callsigns to change to newer IDs which 'tie up' with local airfield or place names, and if you do happen to come across a 'new' beacon or a callsign which you haven't heard before, or can't find listed anywhere else, you would be well advised to check all the airports which have names that might just match the call you've heard, and then check to see if you can find details of this in any official listings, or even if it might be an existing beacon which has just changed to a new frequency to avoid interference from another beacon but has retained its existing 'descriptive' call letters.

EMERGENCY BEACONS:

What do we mean by 'Emergency Beacons'? Well, for a start, I'm not talking about the flashing things found on the top of Fire Engines and Ambulances, the types of 'Emergency Beacons' that I'm referring to are the back up systems found with many of the normal NDB transmitters. Often when reading reports you may come across references to these, or see logs showing the normal call letters followed by a small letter (e) in brackets. The reason for this is that many NDBs will often consist of two transmitters, the main one and an emergency back up system (dual transmitter). You can imagine that in the event of a NDB transmitter going faulty, or even failing altogether, pilots and aircraft depending on these systems for an accurate airfield approach might well be put at risk and in this event the secondary, or 'back up' transmitter will take over. In many cases (but not all), the back up transmitter will add an extra letter 'E' after the main ident to show that there is a problem, and alert the beacon's operator, or nearby airfield Navaid Technicians to the problem. You can usually tell when a beacon is operating in this mode because the 'e' will have a slightly longer space before the letter, and this shows that it is not just a part of the normal ident. One UK beacon, which is often reported with an extra (e) is LUT from Luton Airport, this often sounds like LUT e:

. _ . . / . . _ / _ .

If this beacon was reported as LUTE it would cause confusion, and to the ears it just wouldn't sound like the word LUTE, it would sound like LUT E. With me so far? To avoid this sort of confusion many NDB enthusiasts would report this as LUT(e), which in itself could lead to confusion since the ID heard didn't send any 'bracket' characters in Morse code along with the original ident. I must admit that I am so used to reporting the extra (e) in that way that it never occurred to me to give an explanation of why this is done. My thanks to Ugo Lazzarini of Italy, for bringing this very important point to my attention.

That isn't the end of the story though, and although adding an extra (e) might be a common practice in the UK and a number of other countries, there are other methods of showing that a transmitter may be malfunctioning, and I think it is only right that I should give a brief description of the other types that I've come across so far. In Canada for example, most beacon idents have a long dash of approximately 6 seconds after the main ID, and in many cases, if a transmitter develops a fault and switches to the back up transmitter this will change to a longer 12 second dash.

One other type that had me confused for a while was, I believe, very common with some of the older 'Soviet' built systems. I heard the beacon 'POZ' from Pozarevac in Serbia during the winter of 2001/2002, and one night it was sending its ident with offsets of plus and minus 400 Hz, and the next night with its more 'normal' 1020 Hz offsets. After a bit of head scratching and the re-reading of a few old articles, I eventually discovered that this was done deliberately to show technicians which of the two transmitters was in use.

I should think that to a pilot monitoring the beacon in the AM mode very little difference would have even been noted. I'm sure that things like this must have caused confusion to many DXers over the years, a 1020 Hz offset might be hidden behind a local beacon and never or rarely heard, yet when the 400 Hz signal appears and it is on a clear frequency it can appear to us like a 'new' beacon. If you have come across any signals like this you might well have been hearing some sort of back up NDB transmitter at work.

I'm sure that there are probably other methods used to show that a beacon is faulty, the ones above are just the ones I've discovered so far. If anyone out there knows of any other types please do let me know, I'd be more than happy to include them here in the next edition.

WHAT THE EXPERTS HAVE TO SAY:

Below are some extracts from what some of the major beacon manufacturers say on this subject on their websites.

From top US manufacturer 'Southern Avionics':

Transmitter shuts down when power falls below an adjustable value, or when VSWR rises above an adjustable value. With a dual system a shutdown signal initiates a transfer from the primary transmitter to the secondary transmitter.

http://www.southernavionics.com

European manufacturer 'Pharos Marine' has the following in their beacon specifications:

Automatic changeover to standby transmitter if output power drops below pre-set value. Current consumption increases above pre-set value. Temperature increases above 80°C on heat sinks. Automatic changeover to standby mixer if Output signal drops below pre-set value.

Automatic changeover to standby Morse clock/coder board if Morse code disappears:

http://www.pharosmarine.com

And the top UK manufacturer 'Fernau Avionics' has a very informative description on their website:

The Fernau 2060 NDB is normally supplied in the dual configuration, providing two completely dualised transmitters. The standby transmitter is automatically started in the event of failure of the main transmitter. A system control unit on each transmitter monitors the respective transmitter and according to the limits set, will initiate a changeover in the event of failure. VSWR, Power, Synthesiser Lock and modulation are monitored by the system control unit. The Auto Changeover unit allows selection of either main or standby transmitter. http://www.fernau.com

IDENT HARMONICS:

This is another great source of great confusion, but thankfully one that isn't too common. Some beacons with 400 Hz or 1020 Hz offsets might on occasions send out harmonics at multiples of these offset frequencies. In the case of a 400 Hz offset this would appear at plus or minus 800 Hz, 1200 Hz, 1600 Hz etc. above or below the listed 'carrier' frequency, and with 1020 Hz offsets at plus or minus 2020 Hz, 3030 Hz, 4040 Hz etc. If you have a powerful 'local' beacon in your area it may well produce some ident harmonics, most of which are probably only a few milliwatts in strength and not even noticeable to anyone listening in the AM mode, but with the use of the CW Mode, a very narrow IF filter, and an extremely sensitive or 'large' antenna array, it can easily become an extra source of QRM for the enthusiast to have to deal with. There is probably nothing wrong with the transmitter's setup, and the beacons may well be operating well within specification, the problem is often caused by the way that us NDB enthusiasts choose to listen to the signals.

There are two ways of looking at these signals, either as a great asset to the enthusiast, or as an extra pest. First let's look at them as an asset:

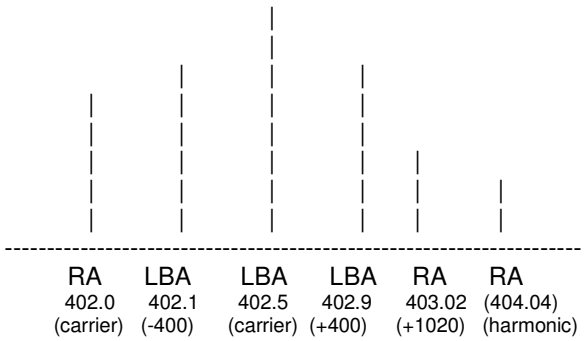
One NDB that was regularly heard sending an ident harmonic was the Czech military beacon 'RA' at Ceske Budejovice in the Czech Republic. This operated on 402.0 kHz with an offset of 1020 Hz. The upper sideband ident would normally have been audible on 403.02 kHz when using my usual method of listening, but unfortunately for me I happen to have a 'powerhouse' local beacon operating from Leeds Bradford Airport some 26 miles (42 km) to the east (LBA) on 402.5 kHz. This beacon has an offset of 400 Hz, and its (very strong) upper sideband appears on 402.9 kHz - so even with a very narrow filter I was hard pressed to separate this signal from RA's ident on 403.02 kHz. On the other hand, when RA was sending out an ident harmonic at +2020 Hz this was audible on a clear frequency of 404.04 kHz, and it would have been unlikely that I would ever have heard this beacon on its upper sideband otherwise, so in this case, the harmonic was a clear asset to my DXing (RA has now closed, my thanks to Karel Honzik for informing me about this!).

NOW LET'S LOOK AT THESE HARMONICS AS PESTS:

Another powerful 'local' was BPL on 420.0 kHz from Blackpool Airport (this has since moved down to 318.0 kHz and is now less troublesome), this some 36 miles (56km) to the west of my location. This beacon had produced a number of harmonics of its 400Hz offsets, all of which were audible here at plus and minus 400 / 800 / 1200 / 1600 / 2000 Hz, and this would often block out any weak signals over a 4 kHz section of the band. In this instance the harmonics were most definitely a pest as far as I was concerned, but as the frequency of 420.0 had some 30 beacons listed as operating on that channel in Europe, to a more distant listener, its harmonics might have offered the only chance of ever actually hearing it. No doubt some DXers in parts of the Czech Republic close to Ceske Buedjovice would have felt just the same way about RA's harmonics as I did about BPLs.

The fact that we have to live with though is that beacons are not put there and run for the benefit of radio enthusiasts who happen to like a challenge, and so I doubt that any airport navaid technicians would be too worried about what does or doesn't make our lives easy or difficult. Unless the beacon was operating out of specification or causing problems for pilots, complaining about them might not do any good at all (they may even have decided to close it if a costly repair was required). The tactful way to approach these operators might be to casualty comment on its extra products when you send them your very friendly and reception report letter informing them about your catch! ☺

Below is a graphical example of all the above just in case it still doesn't make much sense to you:



This is how the two different beacons would appear as you tuned across the band from 402 to 404.5 kHz.

As can be seen from the above drawing, RA would stand a better chance of being heard on its harmonic frequency of 404.04 kHz at this location.

SECTION FOUR: TRANSATLANTIC BEACON DXING

This section takes a look at Transatlantic Beacon DXing, and if you have never yet tried this, you have been missing out on one of the most challenging and rewarding aspects of this hobby. Whilst the winter months with their longer nights and lower static levels are generally considered to be the best time for this type of activity, even the much shorter summer nights can prove to be surprisingly productive, especially if you plan your listening periods more effectively. See Section Five for a more thorough look at Summer DXing for more information about how to do this.

Listeners in Western Europe, especially those in the British Isles and Scandinavia, seem to have a very good chance of hearing Transatlantic beacons, and this is helped greatly by the favourable sea paths across the Atlantic Ocean, which are often known to give some 'Sea Gain', and also the fact that during the winter months, the eastern coast of North America can be in darkness by 5pm local time, and therefore provide us with a path of darkness between both sides of the Atlantic, and at a reasonable time of night for many European listeners at that. It does appear that European listeners have an advantage over our North American friends though, and reception to the west generally seems better than it is to the east. Having said that though, there have been some remarkable receptions of European and North African NDBs by some of the Canadian DXers, so it may just be that there are more DXers in Europe looking out for North American beacons than there are doing it from the other side of the pond. Some DXers located on the west coast of North America have reported some really impressive Trans-Pacific catches though, with Australasia, Japan, China and Russian and Asian NDBs heard, so it is possible that there is some advantage for listeners looking for signals from the west.

One thing is for sure though, hearing that very first Trans-Atlantic, or Trans-Pacific Beacon is something really special, and even after hearing around 60 of them over the past ten years, I still get the same enjoyment every time I hear one, even if I've heard it many times before, and I'm sure I'll never start to take reception of these NDBs for granted. During the recent Solar Minimum between Solar Cycles 24 and 25, Transatlantic reception was often very good even for listeners in Eastern Europe and Italy, so wherever you happen to live you should never assume that you will never have a chance to hear these signals, during the solar minimum several listeners in France and Germany even managed to heard the NDB on Easter Island, which is located in the Pacific ocean of all places, and Roelof Bakker in the Netherlands even heard an NDB from Dead Horse Alaska.!

A very good article on this subject proved to be a great help to me when I first started to look for these types of beacons, and this was written by my good friend and very experienced NDB DXer Arthur Owen, G2FUD, who very sadly passed away several years ago. Rather than try to re-write an article that is still very relevant, even some fifteen years on from when it was written. I thought it was more appropriate to reproduce Arthur's article here in this section as it seemed like the natural place to include an article on Transatlantic Beacon chasing. This was something that Arthur had always specialised in and was a master exponent of. Hopefully it will prove to be as helpful to any newcomers to T/A Beacon DXing as it was to me when I first became interested in the subject.

It's also worth a quick mention that T/A propagation tends to be at its best around the time of the Solar Minimum, and when I wrote this in September 2008, it became apparent that we seem to be having an extended Solar Minimum, which went on for around four years. Many predictions said that the new Cycle 24

has already begun at that time, but even now as we prepare to enter the year 2013 the cycle has never really got going, and still some impressive Transatlantic catches are made, especially now that thanks to being able to pre-record entire nights of activity has allowed a great many more people to search for these elusive signals.

LW BEACON DX STARTS AT 1,500 MILES

By Arthur Owen, G2FUD

In the UK, you soon get tired of hearing only European beacons night after night. A reasonably good antenna and receiver will add hundreds of them to your log. 'DX' means 'long distance', but it also suggests a challenge - so, when you feel like a change from 'local' beacons, why not strive for the real DX? Hunt out the LW beacons that are over 1,500 miles (2,400 km) away - in Canada, the USA, the West Indies and beyond, and also in Greenland, and on various Atlantic islands.

Consider the facts…

* In the seven months between 1 September 1996 and 31 March 1997 (my last complete transatlantic LW DX season), and listening every night only from 2230 until midnight GMT, I had 821 transatlantic beacon loggings. (The current season is also going well).

* During those 242 consecutive nights, only 59 nights produced no transatlantic (T/A) beacon at all (and even those poor nights were nearly all at the beginning, or the end, of the seven-month DX season. During Nov/Dec/Jan, there were only 2 nights without T/A beacons).

* Some nights produced up to 18 Canadian NDBs before midnight GMT.
* The two most regularly heard T/As were:

QX 280 kHz, Gander, Newfoundland - heard on 129 nights.

YHR 276 kHz, Chevery, Quebec - heard on 103 nights.

ESSENTIAL:

The whole of the signal path between you and the distant beacon *must be in darkness*. When used as navigational aids, LW beacons are short-range transmitters, and their ground wave in daylight may not extend farther than 50 to 100 miles. Night-time propagation is quite different, of course, and, under good conditions, a LW beacon can sometimes be heard several thousand miles away (but don't try to use it for navigation!).

Newfoundland is the nearest bit of North America, and, as the clocks there are 3½hours behind the UK in Winter, it will be late evening here in the UK before any transatlantic beacons can be received on this side of the Atlantic. Later, as the dusk rolls westwards and moves inland from the Canadian Maritimes, other provinces, and the USA, gradually come within our reach.

So, the first rule is: listen in Winter, preferably after 2230 GMT. In Summer, the entire T/A signal path will not be in darkness until the small hours of the night in the UK (but, even then, it's an uphill struggle because of the high level of static crashes, and the different Summer propagation, so night-birds may find it rather disappointing).

For T/A DXing, forget about the familiar Mercator projection seen in most atlases, and think in terms of Azimuthal Equidistant projection (Great Circle). Canada is closer to us than any part of the USA, so the first beacons to come through, when LW propagation conditions are reasonably good, are likely to be from Newfoundland (e.g., QX 280, Gander) or in Quebec Province (e.g., YHR 276, Chevery).

DIFFERENCES:

Learn to recognise a Canadian NDB. Our own marine NDBs send in CW mode, with ID followed by a long 47 seconds dash, while most of our aero NDBs send only an ID and no dash.

Nearly all Canadian NDBs send one ID followed by a 6 seconds dash. The transmission is modulated by a 400 Hz tone - so if I want to hear QX 280 at Gander, NF, I tune to 280.400 kHz, and NOT to the listed frequency of 280.000. (Most US beacons, however, send ID but no dash, and modulate with a 1000/1020 Hz tone - so, for CLB 216, Wilmington, NC, I tune to 217.012 kHz).

That 6 seconds dash is your best friend when hunting Canadian beacons. If it's a weak signal, rising and falling in the noise, that dash stands out even when you cannot read its ID. Hang on to any 6 seconds dash you hear; even if the ID is too weak just then, it may well be more readable in a few minutes time. DX beacons often fade in and out - and you may be tuning in when they're 'out'.

Some Canadian NDBs are on frequencies where there are no European NDBs - and their 6 seconds dash quickly alerts you. If it's weak, hang on for a while (or return in a few minutes time to the same precise setting), and it may then be stronger. Use the dash as a guide to when the ID starts.

When there are one or more European NDBs already on a frequency, listen carefully for any sign of a weaker NDB underneath them sending a 6 seconds dash - it could be a Canadian. Don't be put off if the stronger Europeans blot out the T/A DX at first. As the Canadian NDB is sending a dash after its ID, and the Euro NDB will usually not be doing so, they will drift apart in time, so that the ID of the Canadian can often be read in the brief gap between repetitions of the Euro NDB's IDs. Here, too, the dash is invaluable since it warns you when the ID is about to start. (Happily, it's not always like this. On good nights, T/A propagation sometimes results in some of the Canadian NDBs dominating the frequency, and the usual Euro NDBs there will be much weaker than usual, or even inaudible).

A number of Canadian NDBs live inside our European LW BC band. Our megawatt BC stations will usually wipe out any chances of hearing any DX NDBs that are close to their frequencies - but the extent of this may depend on your antenna & receiver performance, and on whether that night's T/A conditions are exceptionally good or not. BBC Radio 4 (Droitwich, Burghead & Westerglen) on 198 kHz, and Atlantic 252, annihilate several nearby Canadian and US NDB channels. Some LW BC stations, fortunately, close down around 2300 but, alas, not many. One small mercy is that there are very few Euro NDBs within the LW BC band.

ANTENNAS:

Canadian NDBs are at least 2,000 miles away from the UK, and some of them use very low power to simple wire antennas, so you will stand a better chance with an outdoor LW active antenna. The better your antenna and receiver perform with weak signals on LW, the more often you will hear T/A beacons. Normally, I expect to hear Canadian NDBs on most nights of the week in Winter - and before midnight. My back garden, a few miles SW of Manchester, lacks the space for effective long antennas, and, for some years now, I have used Graham Maynard's ALN-1 outdoor 15 x 15 ft (5 x 5 m) 2-turn active vertical loop. I also have the L-400B LW active antenna from LF Engineering Inc. (a 0-500 kHz vertical mounted on a 9-ft wooden pole in the garden). I keep switching between the two to find the best signal.

RECEIVERS:

Use your receiver's narrowest IF filter bandwidth. Most of the time, I use the 56 Hz IF filter bandwidth on a Watkins-Johnson HF-1000, but many of the DX signals I hear are still quite readable at the more usual 250 or 500 Hz 'CW' IF filter settings. When DX conditions are rather poor, an outboard audio filter (e.g., Datong FL2/3, or MFJ & Timewave DSP) may resolve a weak ID for you. Headphones always bring you 'nearer' to the DX.

Canadian NDB channels are spaced at 1 kHz intervals - but don't forget to add the 400 Hz offset to the listed frequency when you tune. Try for the Canadian NDBs listed below - they are the ones most often heard in the UK. You may not hear any of them for some nights - it will depend on your equipment, and on T/A propagation conditions - but once you hear that very first T/A NDB, you'll be hooked. And finding the next one will seem much easier.

YOUR 'BEST BETS' IN CANADA (September to March)

kHz	ID	Name
220	BX	Blanc Sablon, QC
263	QY	Sydney, NS
276	YHR	Chevery, QC

280 QX Gander, NL
281 CA Cartwright, NL
323 YWP Argentia, NL
340 YY Mont Joli, QC
347 YG Charlottetown, PE
356 AY St Anthony, NL
360 PN Port Menier, Anticosti I., QC
374 SA Sable Island, NL
378 HO Hopedale, NL
379 CM Channel Head, NL
385 NA Natashquan, QC
390 JT Stephenville, NL
396 JC Rigolet, NL
404 YSL St Leonard,NB
414 BC Baie Comeau, QC

For some years, my 'Transatlantic LW DX Season' has run from September 1 to March 31, and during these seven months I listen for T/A NDB DX every night between 2230 and midnight local time (and sometimes a bit later). As well as looking for new beacons, every previously-received T/A NDB frequency is checked at least once every night. On this regular nightly basis, the 'sound and feel' of each NDB channel becomes very familiar, and it gives me some idea of what to expect that night.

Check the solar data, propagation reports and forecasts from WWV, or from DK0WCY on 10144 & 3579 kHz (every five minutes on CW), or on the Internet (such as Jan Alvestad's excellent site at: http://DXlc.com/solar/). Treat them as useful guides to conditions - but remember that T/A DX is sometimes heard even on supposedly bad nights. Occasionally, when conditions seem hopeless, and no T/A at all has been logged during my DXing session, I have suddenly heard a rarer NDB like LT 305, at Alert, up at the top of Ellesmere Island in the Canadian Arctic (Lat. 82 32 North - the nearest Canadian NDB to the North Pole). So... don't give up too soon.

WHERE ELSE?

As well as the North Americans, there are NDBs in Greenland, on various island groups in the Atlantic, in Africa and the Middle East that can be heard in the UK. The first 'over 1,500 miles' beacons that I check every night are:

SAL 274 Sal Island, Cape Verde (off the West African coast). No tuning offset. Sends dash. 2762 miles / 4445 km away. Although SAL is further away from me than many Canadians, it is amazingly consistent. During the whole of 1997, there were only 7 nights when I didn't hear it - and on 4 of those nights it was due to ear-splitting noise from a faulty lamp in the road outside.

OZN 372 Prins Christians Sund (near southern tip of Greenland). 400 Hz offset. No dash, and sends one ID only every 30 secs. Often louder than Euro locals BV and ODR. 1593 miles / 2564 km away. (*Note: this ident pattern has now changed to a more frequent one – AG*)

SMA 323 Santa Maria, Azores. 1020 Hz offset. No dash. 1575 miles /2535 km away.

SAL 274 and SMA 323 are heard almost every night round the year (propagation conditions are VERY bad indeed if neither is heard - which is very rare).

OZN 372 is heard before midnight on most nights from September to April - and, being three-quarters of the way across the Atlantic, is a good indicator of each night's possibilities. If the 'Big Doughnut' of polar absorption is stretching as far South as OZN that night, and I don't hear it, Canadian DX may also not get through.

To further whet your appetite for Canadian DX, amongst those I heard during December 1997 were: YCO 372, Coppermine, NW Territories at 67 49 North, 115 49 West (on 4 nights). LT 305, Alert, NWT (on 15 nights). YZS 362, Coral Harbour, NWT (on 7 nights). UX 378, Hall Beach, NWT (on 2 nights). YQ 305, Churchill, Manitoba (on 3 nights). Up in the frozen North, JAN 362, Jan Mayen (on 10 nights). Down in the USA, CLB 216, Wilmington, North Carolina, was heard on Christmas Day. Almost all of these were heard before midnight GMT, so you don't have to stay up half the night - but you might hear even more DX if you do…
Note# Although this article was written in 1997, many of the beacons mentioned in the article are still active in 2012, and many NDB DXers still use these as 'early warning' systems, SAL, JC and OZN are always the first beacons that I check for before starting my T/A listening sessions. (AG).

SECTION FIVE: GO SOUTH WEST YOUNG MAN (or woman)

SOUTH AMERICAN NDBs:

During recent years many European Beacon enthusiasts have had great success when chasing NDBs in the United States and Canada, and on occasions and under the right conditions, have also heard beacons from some of the Caribbean islands as well. During late 2007, as Solar Cycle 23 started to near its end and the Solar Minimum, generally the peak time for LF reception approached, several European enthusiasts started to log NDBs from Brazil in South America with increasing regularity. These continued to be heard throughout the winter of 2007 / 2008 and onwards as the extended Solar Minimum continued, and even during the summer months, when periods and paths of darkness have been very short at times, and there has still been the odd one that has made it all the way over here. Peter Conway, G3UFI of Sussex, England has been the most successful at hearing these, and to date has logged at least twelve of them (I've only managed a paltry two so far!), and has heard them with great regularity. Listeners in France, The Netherlands, Germany and Norway have also received some of them, and to date around 18 have been received in all, so the reception of these signals has not been a fluke.

Below is a list of the ones heard in Europe at the time of writing this section:

kHz:	Call:	Location:	COU:
215.0	TRS	Teresina (PI)	BRA
220.0	TUI	Tucurui (PA)	BRA
240.0	TIR	Tirios (PA)	BRA
260.0	CZS	Cruzeiro Do Sul (AC)	BRA
260.0	FLZ	Fortaleza (CE)	BRA
275.0	MSS	Mossoro (RN)	BRA
280.0	SLI	Sao Luis (MA)	BRA
350.0	STM	Santarem (PA)	BRA
360.0	JAC	Jacare-a-Canga (PA)	BRA
365.0	CVL	Caravelas (BA)	BRA
365.0	PNB	Parnaiba (PI)	BRA
405.0	BVI	Boa Vista (RR)	BRA
410.0	PEL	Ponta Pelada (AM)	BRA
415.0	ANP	Anapolis (GO)	BRA
520.0	BHZ	Belo Horizonte (MG)	BRA
1645.0	MLZ	Platform Merluza (SP)	BRA
1730.0	FRA	Juiz de Fora (MG)	BRA
1734.0	XPC	Chapeco (SC)	BRA

It's not just Brazil that has given us the surprises, French NDB DXer Vincent Lecler, probably had the catch of the Solar Cycle 23, when on the 26th of October 2007at 0551utc, he logged the beacon 'IPA' 280.0 kHz, Rapa Nui on Easter island in the Pacific Ocean – a distance of some 13,614 kilometres. This was a truly amazing catch, and even allowing for a good sea path, was still a major achievement for a European listener to make.

Gio Romanini, PY2CDS, read about the reception of the STM beacon here in the UK in a monthly column that I write for the LWCA magazine 'Lowdown', and he phoned the airport there (Aeroporto de Santarém) to inform them about the reception of their beacon. Gio managed to speak to the right person, and received some very interesting information about the NDB, along with a picture of the antenna. Below is the technical information about the STM beacon supplied to Gio by Janderson, the maintenance technician at STM:

Manufacturer:	NAUTEL
Model:	ND-4000A-021-230
Frequency:	350 kHz
Operational capability:	1000 Watts
Ident:	STM
Antenna height:	72 metres
Power reaching the antenna:	700 Watts

Other impressive catches have been made from other parts of South and Central America too, and no doubt the boundaries will continue to be pushed even further back in the coming years too. At one time T/A DXing for beacon enthusiasts meant Canada or North America, but now it means anywhere in the Americas, and by the time the next Solar Minimum has been and gone (if I am still her that is) I will no doubt be reporting even greater achievements by other NDB DXers.

SECTION SIX: SUMMERTIME BEACON DXING:

Many listeners assume that NDB DXing is purely a winter pastime, and once the shorter nights arrive after the Spring Equinox, there is little possibility of hearing anything unusual. Well it's true that the shorter nights do leave less time and shorter paths for the signals to propagate through a path of darkness, and there is no doubt that static levels are considerably higher for much of the time, but if you are prepared to try listening at very unsocial hours, and even put up with the odd burst of static rattling your eardrums whilst wearing your headphones, the rewards can be well worth the efforts required indeed.

THE TWO SEASONS:

In the past I once considered that NDB DXing had seasons, and that the Autumn / Fall / Winter months were the peak time for serious DX chasing, and certainly the very long periods of darkness during the months of November / December and January, and the low static levels due to the lower risk of nearby thunderstorms was a great help, but after reading an article entitled "Radio Propagation" by US DXer Michael Mideke, I very quickly changed my opinion. In his article Michael touched on the possibility of Summertime DXing, and stated that some of his most distant receptions had occurred during the months of July and August. Michael also said that summertime noise levels often restricted listening to the pre-dawn hours when static levels were at their lowest, and I thought this might be something well worth looking into.

Armed with a suitable supply of matchsticks to keep my eyes open, and a careful study of Geoclock to see when local Sunrise was due to take place, I decided to see if any sort of DX was possible at this time of year. One of things that I quickly noticed was that unlike in the Winter months, when local dawn would often not take place until around 0800, and not always at a convenient time day, in the Summer months this pre-dawn period could easily begin as early as 0300 local time.

This had several advantages over the same time period in Winter, for one thing the number of local electrical appliances in use at that time of day is vastly reduced thanks to most of the neighbourhood being safely tucked up in bed, and central heating systems, television sets, and other interference making devices such as Lawnmowers, Power Drills and all manner of other electronic items are stowed away or switched off for the night. As Michael had said in his article, the static levels were also very low at that time of night, and the band seemed surprisingly quiet, much quieter than I'd ever imagined that it would at that time of year anyway!

SUMMER TRANS-ATLANTIC OPENINGS:

I decided to check my favourite Canadian / Trans-Atlantic frequencies to see if anything was audible, and as it was now just an hour or so away from local Dawn I thought it would be good to monitor these frequencies over the period either side of the arrival of local daylight here. Much to my great surprise the almost nightly winter visitor, my favourite beacon 'JC' at Rigolet in Newfoundland, was coming in well on his usual frequency of 396 kHz, and during the next hour he appeared to get stronger and stronger. I was a bit surprised by this at first, since it wasn't always anything like that strong even in the peak winter months. After a bit of thought I realised that the reason for this was that the daylight rapidly approaching from the east was now suppressing the interference from beacons further east in mainland Europe and Scandinavia, leaving just the clear path towards the west in darkness and still propagating to my location.

I continued to monitor JC for almost 50 minutes after local dawn, and up until the time when it eventually faded out. At that time the Sun was streaming in through my window, and it was very eerie to be listening to a beacon from several thousand miles away in these conditions. Since the signals are reflected from layers still in darkness and somewhere out over the North Atlantic, the arrival of daylight does not imply an instant cut-off point in local reception, and this period either side of dawn can often be considered something of a "Golden Hour".

On subsequent nights I again monitored during this period and I logged a number of "first timers" and had some of my best ever transatlantic catches. From that date onwards much of my beacon listening has taken place in the early hours, and I've regularly logged Canadian NDBs right through until September, when they often seem to disappear for several months, and are sometimes rarely heard again until mid to late November. I'm not totally sure why this happens (though there are theories about a mid-winter anomaly), but I'm not complaining, and being able to log Canadian NDBs in the UK for around just 9 months of each year is quite okay by me.

Another interesting thing was noticed too, and that was the relative strength of some of the signals compared to the ones received in winter pre-dawn periods. I wouldn't say that the Summer is responsible for

any dramatic increases in signal levels, but what I do think happens is that the pre-dawn signals in Summer appear at a time when local electrical QRM is at it's lowest point, after all, how many people (other than crazy radio enthusiasts) are up at that time of day anyway? There is no doubt that the band is electrically quiet in the wee small hours, but with Winter Dawns often arriving at a time of day when all manner of electrical devices are in use, as families prepare to get off to school / work etc. the overall background levels are inevitably much higher. In my opinion this offers a big advantage to the Summer DXer, though of course any advantages can be offset by other factors too, which we will take a look at in the next section. Dawn enhancements can be a great asset though, and I've taken great advantage of these during the summer months, and logged many beacons (both NDB and DGPS) that would otherwise have proved difficult at other times of the year.

THE DOWNSIDE OF SUMMER LISTENING:

I mentioned previously that the bands can be electrically very quiet in the early hours in the Summer months, and allow us some good opportunities for receiving DX signals, but there can also be many disadvantages too, and in this section we will take a look at some of them.

STATIC:

Definitely a LF DXer's worst enemy, and trying to winkle weak beacon idents out from underneath loud bursts of static can not only be difficult, but downright painful too, especially if you like to wear headphones during your listening sessions. Unfortunately, the warmer weather in the Summer months does often produce many Thunderstorms, and even if these are not in your local area the static bursts can propagate over many hundreds, if not thousands of miles / kilometres just like the radio signals do, and these can compete with your precious DX signals. I don't have to explain just how dangerous Lightning can be, not just for the receiving equipment but for the listener too, so you don't want to be attached to your precious radio by a pair of headphones when the stuff is flashing about in your immediate vicinity anyway. Thankfully, static levels also tend to be at their lowest level in the pre-dawn period, so again that's a good reason for setting your alarm clock and giving it a go at this time.

D LAYER ABSORPTION:

With the Sun shining for up to 18 hours a day the D Layer will be heavily ionised for much longer periods than it would be in the Winter months, so for long periods of the day, even ones with low static levels, you will probably only hear beacons over a limited distance throughout much of the daytime. Again, openings will occur, but in mid-Summer when darkness may only last for four or five hours, the timing of your DX hunting sessions will be very important. A popular time for many DXers is the pre-dusk / pre-dawn periods, when interesting Greyline openings may occur, so the periods from about one hour before local sunset to one hour after local sunrise can be the best time to plan your operations.

OTHER DIRECTIONS:

That has covered the pre-dawn period and its behaviour towards signals coming in from the west, but what about signals arriving from other directions? Well once again the very useful Geoclock (or DX Atlas) programs have proved their worth here, and after studying the patterns for the summer months it was very noticeable that the areas covered by the Greyline do change rapidly during this period, and different parts of Europe and North Africa can share a Greyline path with the United Kingdom at certain times of year.

Another point quickly noticed was that for those of us at these northerly latitudes (53 North at my location), the northern sky never really gets completely dark in the middle of summer, and the areas just to the north of the UK are in almost 24 hours of daylight at this time. I was curious as to whether this would allow Greyline type reception, and to my sheer delight and surprise, the Geoclock predictions of a Greyline path to the Middle east bore fruit in a big way, when a Beacon In Bahrain (BI on 352 kHz) appeared for a period of about 20 minutes or so. It was interesting to hear it fade in and then peak for a couple of minutes before starting to fade out again and then quickly disappear, a true example of Greyline reception at its best. To prove this was no fluke I checked it again over several nights, and you could almost set your watch by its appearance, and even note the several minutes that its arrival time changed over a period of days as the nights gradually shortened. Curiously this was only received here during the month of July, and the pattern does seem to repeat itself year after year, so it was definitely no fluke that I received it.

CONCLUSIONS:

Whenever Summer arrives here I always check the night-time paths, and I would certainly recommend that anyone with severe withdrawal symptoms from lack of beacon hunting, or are just insomniacs like me, should blow the dust off their receiving equipment and join the growing band of all year round NDB chasers. Summer DXing requires a little more forethought and planning than Winter DXing does, but it's definitely well worth the extra effort, especially when you are rewarded with an interesting catch. When this article was first written in middle of June 2004, the Canadian beacons were audible around dawn on most days of the week.

SECTION SEVEN: YOU'VE HEARD IT, NOW HOW ABOUT GETTING IT VERIFIED?

Hearing a beacon from way outside of your own area can be very exciting, but once you've heard it you will probably want to try and get it confirmed with a verification (QSL) of some sort from the beacon operator. Unlike broadcast stations, Radio Amateurs, or some of the commercial utility stations, many beacons don't have their own QSL cards, though this doesn't necessarily mean that you won't receive a verification in return for your request, but it does often require a different approach when sending out reception reports. Many beacon DXers have very large QSL collections, and can attest to the fact that by approaching this subject in the correct manner it can be well worth making the effort, and very successful and rewarding as well.

WHAT TO INCLUDE IN YOUR REPORT:

As with any reception report, certain details need to be included in your letter. Frequency heard, time of reception in UTC or their local time (preferably both), the date and the call letters heard etc. One of the big problems with beacons though is that they just send their ID over and over again repeatedly and don't contain any definitive programme information of any sort, so how can you prove it was actually their beacon that you heard then? One useful idea is to include details about the 'characteristics' of the beacon ID (these do vary considerably), and information such as: "callsign repeated twice over a 6 second period, followed by a tone or gap of 6 seconds" may be enough to prove to the operator that it was indeed his beacon that you were listening to. Details about the offset used (as explained in the earlier sections) may also be worth including too. A general overview of conditions at the time of reception may also be of interest, since reception may often be enhanced towards a particular area on certain days for all manner of reasons (solar activity levels, geomagnetic storms etc. etc). Nowadays it's not unusual for some listeners to send reports on floppy disks or CDs, and allowing the recipient to hear the signal for themselves may create a good impression.

A recent addition to my shack was a digital stopwatch; these are very cheap and ideal for ident timing, and a printed screen dump of a Cool Edit recording may also suffice as well.

Anything that can help to prove you heard the beacon will improve your chances of convincing the operator that you heard their beacon. Don't forget to include a detailed description of your receiving set up, and try and explain in some detail about just how your receiver works (e.g. the bandwidth of IF Filter used, or any accessories such as an Audio or Digital Filter). Just quoting a model number may not mean very much to the recipient, who may have little knowledge of non-commercial radio equipment. Some DXers make up a small information sheet about themselves and their equipment, and a little information about their area, such as a colour postcard may help too. Sometimes a small photograph of the receiver or the aerial used is a good idea, since it will give the recipient a better idea of just what your receiving set up actually looks like.

Since the beacon keepers don't (usually) solicit reception reports, and often don't have printed QSL cards of their own on hand, it may be a good idea to include a PPC (pre-prepared card or letter) along with your report as well. This can include all the relevant information required, with a space left alongside for the beacon keeper to fill in, stamp or sign. You will also need to include either return postage or International Reply Coupons (IRCs), which may be purchased from your local post office or stamp shop. Personally, I always include a self-addressed sticky label, since this can save the verifier a lot of time struggling with writing unfamiliar addresses, and is often greatly appreciated. Finally, remember that the recipient may be far more interested in you and your location than in your technical details, and a little local information or tourist information sent along with a friendly letter may produce a much more positive response than a formal technical one!

E-REPORTS:

With the advent of broadband and much wider use of the Internet in most parts of the world, a cheaper, quicker and much faster way of sending reports can be to use the e-mail address of the beacon operator

and send a report via that route instead. Some enthusiasts have had great success in doing this, and the extra advantage for the recipient is that they receive the report almost immediately, and some have even responded the same day. You may not get that nice printed QSL card, but some will have an almost identical electronic version which can be e-mailed as an attachment, so this can save them a lot of time and trouble in changing IRCs or stamps, and also have very little cost attached to either party.

BEACON ADDRESSES:

Finding these can often be the most difficult part of beacon QSLing. To date the only publication that I have come across which specifically listed NDB Addresses was the 'NDB Address List' produced by the Malmoe DX Club, but sadly this no longer seems to be available. Another useful source used to be the excellent monthly 'European Utility Newsletter', which could either be purchased or downloaded for free from their website. Unfortunately, due other commitments the printed version of this was discontinued, and the group now exist via the EUNL mailing list which can be found at Yahoogroups. Some of their old files may still available from their member's only area. Another method often used with some success when a specific address can't be found, is to try sending it to the airport address (or central address in the case of many waypoint or en-route beacons) and marking it for the attention of the Navaids Department. The reply may well return from a different address, but it does frequently seem to get through via this method. I've often found the local reference library to be a good source of 'official' and 'Industry' publications (Jane's, Euravia etc.), and of course there are many websites such as airnav.com which can provide this information for North American DXers.

PPCs – "PRE_PREPARED CARDS":

Also known as PFCs (Pre-Formatted Cards), or PFLs (Pre-Formatted Letters), these are 'blank' QSL cards/letters, which are created by the listener, and which are sent to Beacon operators who don't or might not have any ready-made cards of their own. The idea is that the Beacon Keeper or Airport Manager fills in the blank spaces, and then signs or stamps the card to duly verify that your reception report is correct. For the majority of NDBs, the listener will either have to be content with receiving a personal letter from the operator, or will have to create some form of pre-prepared card of their own to send along with their reception report if they prefer to receive that sort of thing.

TYPES OF CARDS AND WHAT TO PUT ON THEM:

There are no hard and fast rules about this, in fact, the listener can be as creative as they like here, and as long as the operator can make sense of what it is, will very often receive a very attractive looking confirmation once this is signed and returned. In earlier years cards would often have to be printed at a local print shop, or typed up onto a piece of plain card or on the back of a postcard, but nowadays and thanks to the widespread use of personal computers, it can be quite an easy task to create a simple template using a fairly basic graphic or photo editing programme (I use Paint Shop Pro X4), but there are some 'free' programs such as 'GIMP' which can be found on the Internet, and many recent versions of Windows will often come with the MS Paint program already included. With such a template the user just has to make a copy and then fill in a number of details (Date, Frequency etc.) before printing it and then posting it off. Needless to say this has many advantages in that all cards can be personally tailored, and it doesn't require the listener to have a large (and expensive) print run to create these beforehand.

MIND YOUR LANGUAGE:

One other thing worth mentioning is that of which language to send your reports in. In North America this shouldn't be much of a problem, since most operators will speak and read English (though some Canadian operators may prefer your reports to be written in French), but for many other more distant parts of the world this may require a little more thought, and a report sent in international languages such as English or French may not be understood. There used to various sources of material available for helping the listener to produce foreign language reception reports, but many of these, such as Gerry Dexter's excellent 'Language Lab' series no longer seem to be widely available nowadays, so unless you can find one on eBay or Amazon, internet users may be better off using the (free) online translation services such as Google Translate or Babel Fish to do this. Users of the Google Chrome web browsers have automatic translation options built in, and again can prove useful when trying to find addresses and information from non-english speaking countries.

Many top QSL Hunters suggest trying to send reports in a 'main' language such as English, German or Spanish and hope that one of these may be understood by someone at the station, and this does often work,

if using this method then do try to keep your reports as simple as possible, and use more visual methods of communication (small .gif or .jpegs can help here) rather than long and wordy passages which the recipient may find difficult to understand.

TIMING OF "IDENTS":

I mentioned at the start of this chapter that a digital stopwatch could be very useful for timing the beacon idents that you hear, and of course if you can make a reasonably accurate timing of the cycle of the beacon, or the length of the long tone or gap between idents, this may well be very helpful in proving your reception of the beacon. I managed to pick up a very inexpensive LORUS stopwatch at the local Argos catalogue store for just £5 (about $8US / Euros 8), and this proved ideal for the task.

For really accurate timing a programme such as Cool Edit, Goldwave or Spectran will show a visual image of the signal, you could also print this out and post it along with your report.

JUST TO SUMMARISE WHAT WE'VE COVERED IN THIS SECTION:

1. Have a good source of QSL Addresses, and try to get the report to the right place.

2. Find out if the beacon produces its own QSLs or requires a PPC/PFC.

3. Include sufficient information in your report to prove your reception.

4. Create your own personalised PPC/PFCs or Pre-prepared Letter Forms.

5. Be sure to include return postage or IRCs, most beacons won't have a budget for this.

6. Include a friendly letter with some personal information about yourself and the hobby.

7. Try to find out what languages the operator will accept reports in wherever possible.

8. Send me details about your results and experiences so that I can include them in future editions, this will be a great help to other newcomers.

A FINAL NOTE:

As well as Pre Prepared Cards, some listeners prefer to send pre-prepared letters, and again as with the cards, you can make these as creative or as simple as you like here. Just remember to include the very important details such as your name, and when you do receive the card back it you should provide a 100% confirmation that you did indeed hear their transmission. QSL collecting can be great fun, but as with most other types of 'utility stations', you have to do a little more work to get your hands on one than would be required with a Radio Ham or Shortwave Broadcast Station, which is used to dealing with such things. A little effort can be very rewarding though, and you can also have a lot of fun producing unique and individually customised cards of your own to send out, that in itself can make your hobby all the more interesting. Good QSL Hunting!

SECTION EIGHT: UBOs - UNIDENTIFIED BEACONS AND ODDITIES:

Over the years a number of beacons have frequently been heard which don't appear in any of the 'official' beacon listings. Some of these can be explained away by the fact that they are situated on private airfields, and are not part of any official VFR (Visual Flight Rules) plans. Others though are more difficult to track down, and recently we've become aware of a phenomenon known as 'Negative Modulation', or 'Reverse Modulation' as it may also be known. This is a strange situation where the CW ident can become 'inverted' and the dits and dahs then become spaces of the same length, and likewise the spaces invert and then become tones. This can produce some very strange sounding IDs, and can often be characterised by their uneven spacing, or by a very long dash which can appear between the callsigns. Many of the ones that are frequently heard are often located in Eastern Europe, though negative calls have also been heard from Western European countries as well from time to time from time to time. Vaino Lehtoranta of Finland, gave a us a good explanation of this phenomena and said that:

“The main reasons for the 'negative keying' or actually a reverse modulation of the carrier level (amplitude) are related to the high Q of an electrically short antenna. The carrier and the sidebands all see slightly different load impedance (matching). The effect becomes more pronounced when the water present in some form inside the antenna circuit itself is transformed into another form. The ATU (antenna tuner) cannot compensate for it and result is a higher level of negative modulation. ICAO spec for such unwanted effect is +1/-1 dB”.

A graph pad can be very useful in working these out, and by drawing them on the pad and filling in the gaps above the dashes, a rough idea of what the 'normal' ident might be can be quickly arrived at. From my own observations this phenomena seems to occur mostly with beacons using 1020 Hz offsets, and having a wider bandwidth than the 400 Hz or 'zero' Hz offsets. At low frequencies, and with a physically short aerial, a total bandwidth of 2020 Hz seems to be more prone to this effect than a beacon with an 800 Hz bandwidth. As can be appreciated, at low frequencies the difference in wavelength over even such a short span can be quite considerable.

UNRAVELLING THE NEGATIVE IDENTS:

Another method that can be used to great effect is to try out the following formula put together by experienced NDB DXer Michael Oexner (author of the excellent ‘European NDB Handbook’). Michael suggests using the following method for unveiling the correct ‘positive’ IDs of these stations:

Procedure to unveil the positive keying callsign:

1). Add a “**dah**” before the first **"dit"** of the negative callsign.

2). In the negative callsign, the short period of silence between two adjacent (i.e. inside a single Morse code character) **"dits"** or **"dahs"** or **"dit-dahs"** or **"dah-dits"** becomes a **"dit"** of the positive keying.

3). The **"dah"** of a negative keying becomes a character separator in the positive keying.

4). In the negative callsign, the long period of silence (character separator) between two Morse code characters becomes a **"dah"** of the positive keying.

5). The very long silence between two consecutive IDs of the NDB becomes a very long dash.

This might be a little bit hard to follow at first, but if you transform ILA like that, you'll soon find you can easily create the letters CF!

1). ***dah*** to be added in front.

2). Space between **"dit dit"** becomes ***dit***.

3). Silence (character separator) between I and L becomes ***dah***.

4). Space between **"dit dah"** of **"dit dah dit dit"** becomes ***dit***.

5). **"dah"** of **"dit dah dit dit"** becomes *character separator*.

6). Space between **"dah dit"** of **"dit dah dit dit"** becomes ***dit***.

7). Space between **"dit dit"** of **"dit dah dit dit"** becomes ***dit***.

8). Silence (character separator) between L and A becomes ***dah***.

9). Space between **"dit dah"** becomes ***dit***.

10). **"dah"** of **"dit dah"** becomes *character separator".

Combining all that stuff creates: **dah-dit-dah-dit dit-dit-dah-dit**, and voilà, that's CF! Some folks have reported *ILE* (instead of *ILA*) as an UNID on or around CF's frequency. This is just another way of interpreting the somewhat strange sounding negative keying callsign. One interpretation takes the long dash between the callsigns into account, thus creating "dit-dah"; the other omits the long dash, thus creating only "dit".

Other examples are mainly to be found around some other NDBs operating from Eastern Europe, especially the Polish NDBs seem to be specialised on negative keying. ☺

GDA	-	322	becomes EAF
DAR	-	409	becomes FNA or FNE
GRU	-	364	becomes ERL etc.

You can try the above recipe on a couple of other strange UNIDs (all of the "long dash after ID variety"), have fun! So remember, if you do come across an unusual callsign don't immediately assume it's a new station, it may well be just a faulty keyer' which has 'gone negative'

SOME OF THE THEORIES ABOUT THE ORIGINS OF UNIDS…

Robert Connolly, the author of "Non Directional Beacons of Europe", and editor of the Radio User magazine's "NDB DXing" column, came up with a number of interesting thoughts about why there are so many unidentified NDBs around, and why they aren't listed in any of the 'official' publications such as the AERAD, DoD, or Military Flight Information publications (FLIPs). I also found an interesting article about 'Meaconing' (hat's not a mis-spelling either!). If you should have a theory (or theories!) of your own about why there are so many unidentified beacons on the band, why not share your thoughts with us and I will be happy to add them to the list:

ROBERT'S THEORIES:

1). Possible military beacons across Europe etc. with information classified. This was the case with FNR and GMN in Eire, and it is only recently that GMN has appeared in the RAF Flip Document.

2) Some may be temporary NDBs being used while a VOR etc. is on long term servicing or rebuilding. This occurs quite often and can only be tracked down through International Notams. Usually however the ID is the same or similar to that of the original navaid.

3) Re - location of oil rigs to various fields. According to my Navtex reports about ten rigs are constantly being moved about the various fields.

4) NDBs, which have been installed at small airfields for flying clubs etc. Some of these are used on an irregular basis and the airfield are so small they are not listed in Aerads etc.

5) Naval ships, which carry helicopters. There must be some system of helicopters finding and identifying their own ship, especially during periods of radio silence and or darkness.

6) Meaconing - Not a mis-spelling - see the section about Meaconing!

Quite a few interesting thoughts there, and to confirm what Robert suggested in item 2, I recently found the following information in the 'stop press' supplement in the December 04 copy of Aerad:

"MARSEILLE: *UFN temp VOR/DME installed 'MRM' 113.45/Ch 81 (N4322.8 E00519.7) & temp NDB 'MJ' 406 (N4326.4 E00513.1) usable in the event of unavailability of VOR 'MRS'."*

In cases like this, checking the Notams for the suspected area may well be the only way of getting positive confirmation of where the beacon is operating. Several times during the years 2000 to 2002 a 'unid' callsign was heard, and we were able to identify it by checking out many of the online 'Notam' websites. See the Datafile Section for details of where this information can be obtained.

Another useful piece of information was found at the website of Southern Avionics Company (SAC) - (see Datafile), SAC are one of the world's largest suppliers and manufacturers of radiobeacons, and they give the following useful information in a FAQ page on their website:

http://www.southernavionics.com

Question: Who buys SAC radiobeacon systems?
Answer: Anyone, anywhere who needs to pinpoint a location or provide an instrument approach.

- General Aviation Airport Owners.
- Civil Aviation Airport Owners
- Government Aviation Agencies

- Offshore Mineral Explorers
- Offshore Production Platform Owners
- Wilderness Area Mineral Explorers
- Transcontinental Pipeline Owners
- Fishing Fleet Owners
- Ship Owners for Onboard Heliport
- Heliport Owners
- Military Strategists
- Disaster Relief Organizations

As can be seen from the above list, NDBs are used in a very wide variety of applications other than just the usual airfield types, and in many of these instances a beacon is likely to only be activated temporarily, or may even operate from a number of different locations.

MEACONING:

Like anyone brought up in the UK during the 1950s or 60s, whenever I see the word 'meacon' I immediately think of 'Dan Dare', but in this case we're not talking about a little green alien who files around on a small disc, but rather an unusual way of using (or perhaps that should be mis-using) a radio beacon. I was quite surprised when I came across the following piece of information when searching through a website run by the FAS, a US Military scientific organisation. This had a fascinating section relating to jamming, but like many of these publications was later removed from the internet for security reasons.

I'd never thought about the possibility of beacons being deliberately misused like this before, but it could well explain away some of the more transient and mysterious beacons which appear, and then just as quickly disappear again - certainly some food for thought there!

Basically, the article stated that Meaconing was a system of receiving radio beacon signals from NAVAIDs and re-broadcasting them again on the same frequency to cause confusion with navigation. An enemy could conduct Meaconing operations against a country's military to prevent their aircraft or shipping from arriving at their intended targets or destinations.

It list some of the enemy Meaconing causes which could be successful against an opponent --

- Aircraft could be lured into hot landing zones or enemy airspace.

- Ships could be diverted from their' intended routes.

- Bombers could be induced into expending ordnance on false targets.

- Ground stations could receive inaccurate bearings or position locations.

With a large number of Airshows taking place throughout Europe during the summer months there are often lots of good opportunities to study various types of aircraft antenna systems at close range. This could be very instructive as 'Electronic Warfare' is a popular tactic nowadays, and it was always possible to see what types of antennas were available for deployment. However, following the terrible events of 9/11 the military are far more sensitive than they used to be, and this is very understandable, so if visiting an airshow or airbase, good common sense should be shown at all times or you could find yourselves under suspicion of espionage.

Attempting to take photographs of military antennas or other such equipment might not go down too well, and do remember that a group of UK and Dutch plane spotters were very nearly imprisoned in Greece for doing nothing more sinister than collecting aircraft numbers and taking photographs. If you are in a position to take photographs do try and get the permission of the crewmen first, and if you are in any doubt about the reaction of the owners please DON'T do it at all, it isn't worth the risk!

MILITARY NDBS:

A number of UNID callsigns were heard by DXers in North America at various times, and there was much speculation as to their origins. Well-known Canadian DXer and Propagation expert Jacques d'Avignon came up with the following answer to this back in August 1997, in response to a question from a DXer about the origins of the callsign "UAA":

"The beacon identified as UAA is a National Defence beacon that has no permanent location. There are identifiers assigned to national Defence that have no permanent site. The ID's are: UAA, UFF, UGG, UJJ, UKK, UNN, USS, UTT, UWW and UZZ. No frequencies are assigned to these and they can be heard anywhere in the band. They are classified as tactical/transportable beacons".

It's not unthinkable that this sort of practise is fairly common amongst military operators, and many of the other 'unids' heard throughout Europe and North America are also owned and operated by the military. Many of these might only be active during a military exercise, and therefore only operational on very rare occasions. Do keep a look out for any unusual callsign patterns appearing on specific times and dates.

OIL PLATFORMS:

Quite a few of the beacons that we've managed to identify or DF (Direction Find) have proved to be located on North Sea Oil Platforms, or platform support vessels. For some reason many of these don't appear on any of the usual aeronautical charts, and I can only assume this is to deter other pilots from using them as part of their flight plan. Doing this could potentially be very tricky if on arrival in the area it was found that the beacon wasn't active. As I explained in an earlier section, many of these beacons are only activated on request, or by prior arrangement with the operator.

It will also be noted that a lot of oil platforms seem to operate within the Medium Wave Broadcast Band, and again the frequency of operation might offer a clue as to whether what you're hearing might be from an Oil Platform. A document found at the UK CAA website showed that certain frequencies were allocated for mobile rigs operating within a specific area of UK waters, and amongst the frequencies listed in this document, many of the rigs operating in these sea areas must use 579.5, 597.5, 897, and 949 kHz .

CALL LETTERS:

Following another discussion about 'Single Letter' and 'Two Letter' beacons on the NDB List e-mail Reflector, Roger Caird of Dublin Ireland posted the following suggestions regarding why some beacons have more or fewer letters, these make a lot of sense, and can prove very helpful when applied to one or two letter 'unid' beacons:

"Most of these Russian "one letter" and "two letter" beacons seem to be landing aids for airports, in the case of 365.0 - AD, it is a Locator beacon for Runway 02 at Sochi Airport. In the olden days there were usually three MF NDB's associated with the approach to certain runways, at most airports.

They were:

An Outer Locator, a Middle Locator and an Inner Locator. The Outer Locator would be a general landing aid to assist the pilot to line the aircraft up with the runway. This would be a "Two-Letter Beacon" The Middle and Inner Locators would be progressively closer to the runway threshold, and would, I suppose, be very low-powered beacons. As these had to be identified as the aircraft flew over them, their ident had to be fairly short, i.e. 'One Letter'.

Most MF/LF approach aids have now dispensed with one or both of these, Middle and Inner Locators and they have been replaced with VHF narrow vertical-beam beacons on 75MHz. As far as I can remember, these VHF beacons illuminate a warning light in the cockpit, to let the pilot know how close he is to the touchdown point. Continuing with the same surmise, the "Three Letter" beacons usually seem to be "en-route navaids" and would be more powerful NDB's, the longer ident would not cause any problem as the pilot would only have to confirm the coding of the beacon from some considerable distance".

This theory also holds good for Ireland, at any rate, all the approach procedure beacons are "2-letter": OB, OC, OE, OK, OL, OP. These are all Outer Locators, hence, I presume, the "O" in the ident. I am only aware of one "Single-Letter" NDB in Ireland, "S" on 316.0 (withdrawn from use years ago), and I'm fairly confident this was an Inner Locator. The U.K. also conforms to this standard (almost). However, I can also think of several instances where this theory doesn't work: North America, 389.0-CP Caparica, Lisbon, with a protected range of 250nm".

This produced a very interesting thread on this subject, and it became apparent that different countries do use different call letter systems. This prompted me to take another look at some of the callsigns previously shown in the UNID List. One thing did quickly become noticeable, nearly all of the beacons which only have a single letter call are situated in a very small number of countries - mainly in Eastern Europe and Scandinavia, but a number of Spanish beacons also appear to use this system too.

After studying the callsign list in the ENDBH (European NDB Handbook), the following countries were shown to use single letter calls:

Albania	ALB	*	Egypt	EGY	*	Latvia	LTV	*	Slovakia	SVK
Armenia	ARM	*	Estonia	EST	*	Libya	LBY	*	Spain	ESP
Azerbaijan	AZE	*	Finland	FIN	*	Moldova	MDA	*	Sweden	SWE
Belarus	BLR	*	Georgia	GEO	*	Poland	POL	*	Turkmenistan	TKM
Bulgaria	BUL	*	Hungary	HNG	*	Romania	ROU	*	Ukraine	UKR
Canada	CAN	*	Kaliningrad	KAL	*	Russia	RUS			
Czech Republic	CZE	*	Kyrgystan	KGZ	*	S. Pierre & Miq.	SPM			

That's still quite a long list, but it does perhaps narrow things down a bit. I've also noticed that in the UK at least, many of the military beacons e.g. the ones located at active RAF bases, seem to use Two Letter calls. I don't know if this is an active policy, or just the remains of some older system, but I will be taking a much closer look at the calls of unid beacons in future to see if they offer any clues as to who the operator might be. If anyone does have any more information about the way callsigns are allocated I'd be very interested to hear from them. Thanks to Roger for giving us a good insight into what might be a valuable clue!

ALGERIAN MILITARY:

Over the past few years DF bearings on a number of commonly heard NDBs would indicate that North Africa is the likely source. We suspect that one of the biggest culprits for unidentified and unlisted NDBs is the Algerian military, which seem to have most of theirs on the classified list. Since it's very difficult for NDB DXers to get QSLs from them it's very difficult to say whether or not we're correct, but in terms of DF bearings and ident patterns they continue to be our number one suspect.

With the recent political situation in this country it’s difficult to say whether things will now change and the country become more open in the near future, but if anyone is planning a holiday in any of the countries close to Algeria (Tunisia, Morocco etc.) and can take a rough bearing on any of these that would be a big help to us in confirming where they are located. Even if it is not possible to take DF bearings, just letting us know if they can be heard there during daylight hours could be a big help to us.

THE MILITARY IN GENERAL:

During the past year we have been fortunate enough to identify some of the previously unidentified beacons, and it turned out that a number of these were situated on military training bases, particularly those containing helicopters. During training courses it's possible that these are switched on purely for training or navigation exercises, and this may well account for their erratic appearances. Again if anyone has more information about these, or has even served in any of the forces using them in this manner I'd be interested to hear about how they were used.

NORTH AFRICAN OILFIELDS:

Some recent research and a number of DF bearings have made me think that quite a few of the irregular 'unids' may also be coming from Algeria or other North African countries. I suspect that a number of them are of military origin, but also suspect that a greater number may be from oilfields rather than from airfields.

There are many large oil and gas fields in Eastern Algeria, and also a great many in Libya as well. Some aeronautical charts show a number of the Libyan oil fields, and also reveal that many of them are of the 'Two Letter' beacon variety. Assuming that many of the Algerian oilfields - a number of which appear to be located in largely uninhabited 'desert' areas, are operated in the same way, it's not unreasonable to think that many of these beacons will be of the 'Two Letter' variety as well.

Again, a number of DF bearings, particularly on 'Two Letter' beacons seem to indicate that the Libyan and Algerian oilfields are the source of a good many of our 'unids'. Although a lot of the current 'official' publications only show a very limited number of these beacons, I suspect that there are a great many more, which aren't shown there. I have a very old US military aeronautical chart of North Africa dating back to the

1980s, and this does show a vast number of two letter beacons at various Libyan oil wells. Later and more modern charts no longer show many of these, and whilst a number of them will no doubt have closed down, I do suspect that there are a great many still operating, and no doubt some of these find their way onto various UNID Lists from time to time.

QUIZITIVE IDENTS:

This is a new theory and a very interesting one. NDB List member Brian Keyte noticed that certain beacons were producing a very strange ident, and one, which shouldn't have been there. Several of these were noted, strangely enough, all on the RAF's beacons 'BZ', 'LA' and 'CWL'. A good example was that from the beacon at RAF Brize Norton - BZ on 386 kHz. The normal upper and lower sidebands are often heard with a very 'raspy' sound to them and Brian had noticed that an 'unid' beacon with the callsign 'AIT' was often heard exactly on 386.0 kHz, and this had a very similar characteristic to the 'BZ' idents some 400 Hz above and below.

Brian did some research into this and managed to work out how the 'quizitive' idents were related to the dots, dashes and gaps in the positive idents. He says*:*

"It's quite simple really, any CHANGE in the positive - from silence to tone or from tone to silence - generates a 'warble' on the carrier lasting for about one dot's length. That's all there is to it".

Brian even wrote a short BASIC program that used that rule. Running it using the three RAF NDBs that have the 'Quizitive' condition - LA -RAF Lyneham, BZ – RAF Brize Norton and CWL – RAF Cranwell, generates exactly what the 'quizitive' idents actually sound like for each. This is what he got when he ran the program on these three idents:

LA - 282 kHz

_ ___ _ _ _ ___
___ _____ ___ _

CWL - 423 kHz

___ _ ___ _ _ ___ ___ _ ___ _ _
_ ____ ___ ___ __ _ ___ _____

BZ - 386 kHz

___ _ _ _ ___ ___ _ _
_ _____ _ __ _____

This produces all sorts of possibilities for the identification of some of our long-standing unids, and whether this is a general phenomenon, or just something peculiar to the RAF remains to be seen!

Brian also wrote a small programme, which also converts 'negative' idents into 'positive' ones, I'm sure both of these will prove very useful in our quest to track down all of the UBOs! Called 'B_KEYER", this comes free in the 'added software', which is included on the ENDBH and NANDBH CDs, and can also be downloaded from the NDB List website at www.ndblist.info

Thanks to Brian for working out the answer to this one, and creating the B-KEYER software for the benefit of fellow Beacon enthusiasts.

SECTION NINE: USEFUL INFORMATION SOURCES:

One essential item the newcomer to NDB chasing will require is a list of NDB callsigns and frequencies, and there are various types that are available, both in the printed format and on the Internet. If you would prefer to have a printed copy of beacons then there are several excellent ones that you should check out, and the details of where to find them can be found below.

If you are keen to get started though and don't want to wait for your printed copy to arrive, or are just wanting to try out NDB Hunting to see if it is something that you might like, but don't want to invest in the printed versions just yet until you are sure, then you might try out one of the various sources that can be found on the Internet, such as the unique and impressive REU / RNA / RWW online database, which is not so much a

listing of all the beacons that are in existence, but rather a listing of all the ones that have actually been heard in recent years. Another one worth trying out is the excellent 'WWSU' (World Wide Search Utility) produced by list member Alex Wiecek in Canada, and which allows the user to look up a callsign and see who it might belong to. Again you can find out details of where to find these from the links below:

ENDBH (EUROPEAN NDB HANDBOOK) & NANDBH (NORTH AMERICAN NDB HANDBOOK):

The European NDB Handbook and North American NDB Handbooks, both produced by ndblist members Michael Oexner, are printed copies covering many thousands of NDBs in those parts of the world, and full details of where to obtain these can be found at the link below. Please note that you can also obtain this on CD and run it on your PC, or print your own copies out if you prefer. These come specially customised for the listener, and will also show distance and bearing to the user's home location as well:

http://www.ndblist.info/beacons/NDBpublications2012.pdf

NON DIRECTIONAL BEACONS OF EUROPE:

Another list covering NDBs in Europe, the Middle east and North Africa, is the NDBE, which is produced by list member and editor of the UK magazine Radio User's NDB DXing column, Robert Connolly, GI7IVX, and more details of where to obtain this can be found on Robert's website at the link below. Please note that this publication is also available in .pdf format as well:

http://www.komf.fsnet.co.uk/publicat.htm

RNA-REU-RWW THE ONLINE SOLUTION FOR BEACON ENTHUSIASTS:

The RNA / REU and RWW are systems that bring together information on over 6200 NDBs, DGPS and Navtex stations and Ham Radio Beacons, cross-referenced against the logs of over 150 data contributing listeners throughout the world. It has sophisticated filtering and reporting options and also automatically generates reception maps for every station in the system. You can also enter your own loggings as well, so this is a truly 'interactive' setup, and this also helps to keep the database as up to date as possible.

All of the team responsible for producing the database are members of the NDB List, DGNAV List and NAVTEXDX List, and automatically harvest any loggings posted there and add them to the database, this ensures that the information in there is as up to date as possible. You can of course send in your own logs to the site without being a member of any of the above groups.

If you'd prefer to go straight to the REU and RWW pages, the links are shown below:

REU (Received in Europe) Page:
http://www.classaxe.com/dx/ndb/reu/

RNA (Received in North America) Page:
http://www.classaxe.com/dx/ndb/rna/

RWW (received World-Wide) Page:
http://www.classaxe.com/dx/ndb/rww/

WWSU – WORLD WIDE SEARCH UTILITY:

Another very useful source of information can be found in the form of Alex Wiecek's WWSU, which is available from his website at the link below, this is a searchable utility, which you can install on your PC for free, and for a small registration fee you can receive all future updates, and also edit and update the records in there. Alex is a Navaid Technician in Canada and knows a thing or two about them, and here is nothing else quite like this around, so it's well worth checking out as a starting part if you are new to the hobby. Details of where to find and download a copy of the program, which will run on most PCs and most versions of Windows can be found below:

http://www.ve3gop.com/files.htm

These are just a few of the available sources, and there may be more, clubs such as the Longwave Club of America produce a monthly newsletter called 'The Lowdown', US magazine Monitoring Times as a monthly column written by Kevin Carey, and as mentioned previously, UK magazine has a NDB DXing column written by Robert Connolly. Another ndblist member Herman Schoemaker also edits a column called 'Section NDB' in the Benelux DX Club's monthly bulletin. For listeners in North America the 'Airnav' website provides a professional service for aviators, and this has a search option which allows users to look up a callsign or airfield to find out more details about. There are also many other radio clubs around the world which have NDB related columns in there as well, plus many individual websites, far too many to include here. You can find links to many of these sites on the NDB List website though.

USEFUL LINKS:

AirNav:	http://www.airnav.com/
Longwave Club of America:	http://www.lwca.org
Monitoring Times:	http://monitoringtimes.com/html/below_500_khz.html
Radio User:	http://www.pwpublishing.ltd.uk/?page_id=629
Section NDB – Benelux DX Club:	http://www.bdxc.nl/images/editorsrood.jpg

SECTION TEN: ABBREVIATIONS IN USE ON THESE PAGES:

As is often the case with any aspect of utility DXing, you are likely to encounter a lot of jargon or abbreviations, a great many of which may not initially mean anything to you. To help you quickly identify some of the terms which you are likely to come across whilst beacon DXing, I have included a list of some of the more common ones below. A more comprehensive abbreviation list can be found on the NDB List website.

ADF	Automatic Direction Finding
AM	Amplitude Modulation
BFO	Beat Frequency Oscillator
CAA	Civil Aviation Authority (UK)
CAL	Calibration Station
CON	Consol Beacon
DAID	Dash After ID
DBID	Dash Before ID
CW	Continuous Wave (Morse Code)
DF	Direction Finding
DGPS	Differential Global Positioning System
(e)	If this letter is heard after an ident, it often means there is a problem with the transmitter. This extra (e) will alert the beacon operators to the problem.
ENDBH	European NDB Handbook
GP	Glide Path
H24	Beacon Operational 24 Hours a day
HU	Hours Unknown
HV	Hours Variable
IDENT	Identification signal /Callsign
IF	Intermediate Frequency
ILS	Instrument Landing System
IM	Inner Marker
IRC	International Reply Coupons
LF	Low Frequency (30 to 300 kHz)
LH	Lighthouse
LIM	Locator Inner Marker
LLZ	ILS Localiser
LMM	Locator Middle Marker
LOC	Locator Beacon (NDB having instrument approach procedure published)
LOM	Locator Outer Marker
LOOP	Type of 'directional' Aerial used by many beacon DXers.
LSB	Lower Side Band
Lt.	Light (House)
Lv.	Light Vessel (or Light Ship)
MF	Medium Frequency (300 to 3000 kHz)
MKR	Marker
MM	Middle Marker
MSK	Minimum Shift Keying

NANDB	North American NDB Handbook
NDB	Non Directional Radiobeacon
NULL	The point at which the received signal is at its weakest when tuned with a directional aerial such as a Loop.
OM	Outer Marker
PFC	Pre-Formatted Card
PFL	Pre-Formatted Letter
PPC	Pre-Prepared Card
QSB	Fading, or disturbance to propagation
QRM	Normally used when referring to ‘man made’ interference
QRN	Normally used when referring to static or ‘natural’ interference
QSL	Verification of Reception.
RC	Non-Directional Radiobeacon
RD	Directional Radiobeacon
RX	Receiver
SDR	Software Defined Radio
SSB	Single Sideband
USB	Upper Side Band
VOR	VHF Omni-directional Range
ZERO BEAT	This is the point at which the heterodyne, or tone becomes almost inaudible when tuning an AM carrier with the receiver switched to the SSB or CW positions (and also allows you to hear any weaker stations which may also be operating on the same channel!). It can usually be found at the mid point of the carrier e.g. between the upper and lower sidebands.

PART TWO: A LOOK AT THE OTHER BEACONS YOU CAN HEAR

In this part we will take a look at some of the other types of radiobeacon that can be found on the LF, MF, HF Bands (Long Wave, Medium Wave and Shortwave in other words), and also the even higher VHF (Very High Frequency), UHF (Ultra High Frequency) and SHF (Super High Frequency) Bands. The majority of these are the ones used by many radio hams to give an indication of when and how well the radio signals are propagating from a particular area. Many of these are operational 24 hours a day and 7days a week, whereas others may just appear at specific times, either way, they can make for an interesting challenge for any radio enthusiasts who like looking for such things. Since the propagation can vary greatly at different times of day or year, and the part of the Sunspot Cycle that we happen to be in at that time, there is always something you can look out for at any time of the day or night. There are also other types of beacon that can be found on these bands, though with the ones found on the much higher VHF, UHF and SHF Bands, with the exception of anomalous propagation periods such as those found during Tropospheric openings, Sporadic E, openings or periods of Auroral activity, these will be pretty much audible 24 hours a day. On top of these the VOR, VORTAC, TACAN and DME beacons used by the aviation industry will be found on the VHF Bands, and these are also becoming a popular DX target during periods of enhanced propagation as well. With other beacons such as the Lowfer / Medfer / Hifer Beacons, and the mysterious Single Letter HF Markers (SLHFMs) as well, not to mention the often irritating, but also DXable Drift Net Beacons, you will never run out of targets. In the following sections we will take a look at where you can find many of these Beacons, and how you can get them verified as well.

SECTION ONE: AMATEUR PROPAGATION BEACONS

We all like chasing the NDBs on the LF and MF Bands, and that's why we're here isn't it, but there is life outside of this range of frequencies and beacons do exist on the High Frequency bands as well, and these can be just as much fun to chase after and get into your logbook. If you are fed up with just hearing the usual daytime 'local' NDBs and want to try something different, or maybe just want take a break from digging around at the bottom end of the spectrum and try taking a look at what goes on up at the top instead, you can do this without affecting your more usual NDB chasing habits, and these can prove to be the perfect filler for the times of the day when the LF band isn't performing at its best, which is all too often the daylight hours, particularly during the summer months. Unlike the Low Frequency Band, which is generally at its peak during the solar minimum years of the Sunspot Cycle, the higher Shortwave Bands such as the one at 28 MHz tend to be at their peak during period around Solar Maximum, so no reason you can't enjoy the best of both worlds. First off though let us take a look at the most widely used ones, the Radio Amateur Propagation Beacons, these can now also be found on the newer Low Frequency allocation around 136 kHz in some parts of the world, and more recently on the temporary Medium Frequency allocation around 500 kHz, and from late 2012 / early 2013, the newly allocated 472 – 479 kHz Band as well.

AMATEUR PROPAGATION BEACONS:

There are a great many of these in operation, and they can be found on many of the bands, both at HF, and on the much higher VHF, UHF and even SHF frequencies - in fact, the highest one shown in my list is operating on 134,928.800 to 134,928.990 MHz, or 134 GHz to be more exact. Now I'm not suggesting that many people will be wanting to listen up in that part of the spectrum - even if you did you'd probably have to build your own gear, and put a beacon at the end of your back garden so that you had something to listen to - but I'm really just highlighting that beacons do exist in all kinds of weird and wonderful places.

More realistically, the amateur beacons that you might want to listen to are more likely to be found on bands from about 1.8 MHz (160 metres) up to 50, 70 or 144 MHz (6, 4 and 2 Metres). The basic reason for having these propagation beacons is to help radio hams work out what parts of the world (or countries) are currently propagating in your direction, and to give you some idea of what countries you might be able to hear or contact - no point in looking for stations in Australia if there isn't a propagation path between your QTH and that country is there?

Amateur beacons come in various formats, there are the internationally co-ordinated beacon chains (IBP) which time share a single frequency and operate to a fixed schedule, and a good example of these are the

International Beacon Chains run by the IARU (International Amateur Radio Union) and NCDXF (Northern California DX Foundation), usually these will run a fairly high level of power varying between 100, 10, 1 and 0.1 watts in the case of the IARU / NCDXF chains).

There are also a large number of 'private operator' beacons, most of which are generally run by a 'Ham', or Radio Amateur clubs or organisations for the purposes of propagation research, or an interest in knowing where their signals can get to at various times of the day or night and under widely differing band conditions. The power levels for these can vary greatly, but in general power levels will usually be less than 25 watts, with just 1 or 2 watts erp not being uncommon. Some are genuine 'QRP' at power levels of just 100 or 200 milliwatts, and there are even QRPP Beacons running just a few milliwatts which require computer software to see them as often they are inaudible to the human ear. As you can see, hearing beacons at these power levels can provide the listener with quite an interesting challenge.

Private operator beacons can be found all over the world, but the vast majority of these will be found at locations throughout North America, and the reason for this is that the licensing conditions in the USA and Canada which permit individuals to do this. The situation in many European countries is very different, and someone wanting to do this will probably have to apply for a special licence or callsign and go through a certain amount of red tape. In the UK for example, individual 'unattended' beaconing is only permitted on bands above 70 MHz (4 Metres). It's difficult to give an exact figure for the number of ham beacons which are currently operating, some run 24 x 7 for many years, whereas others can be transitory in nature, and only operated on certain days of the week or at certain times of the year. Some operators will switch their beacons off when operating on other bands to avoid breakthrough problems on their own equipment, whilst others will just switch them on when the fancy takes them. This may sound a little chaotic, but in reality it makes the chase that little bit more interesting since you never know what will turn up the next time you tune in and that all adds to the mystery.

Just as an example though, my personal HF beacon log shows that I've heard over 500 of them on the Shortwave bands alone in the last 10 years - not all at the same time thankfully, but it does go to show that there is no shortage of targets, and there are still many left that I haven't yet managed to hear, plus new ones coming on air all of the time. What's more, if you like to collect QSL cards you will have a very good chance of getting one from a radio ham - they all know only too well what a QSL card and a reception report is for.

After you've worked your way through all of the HF beacons don't despair because there are plenty more beacons on the 50, 70, 144, 432 and 1296 MHz Bands to go after. These can be more difficult due to the very different types of propagation that occur on these bands, but again that can make the challenge of finding them all the more interesting for you. At periods of solar maximum in any Sunspot Cycle it is not unusual for F2 propagation, the type that gives us the very long distances on the shortwave bands, to reach well up above 50 MHz and bring in beacons from very far away during the winter months. In the summer months (April to September), Sporadic E openings are frequently to be found, and hearing beacons from one or two thousand kilometres away won't be all that unusual. With other more exotic modes such as Backscatter, Meteor Scatter, and Auroral reflection to add to the fun you will probably find that there are a lot of countries and loggings in your personal logbook (and quite a few QSL cards) after spending just 12 months or so doing this.

PROPAGATION:

Unlike the LF bands, which propagate all year round and generally just become difficult to use in the summer months because of high static levels, the higher bands such as 28 MHz have specific propagation patterns. For example, the (roughly) 11 year sunspot cycle produces more sustained F2 openings (signals reflected from the F2 Layer, often with skip distances of 4000km+) on almost every day between the months of September and April at Solar Maximum, though this figure can be reduced to just one or two days (or even none) at Solar Minimum. In the summer months Sporadic E openings can be an almost daily feature at any stage of the solar cycle, and the closer (1000 to 2000 km) distant beacons which are generally not heard by F2 are often only heard via this propagation mode, and usually at very high signal strengths and for varying durations.

During the last solar maximum which peaked between 1999 and 2002, the reception of beacons on 28 MHz was often amazing with around 90 to 100 logged on some days, but from 2005 onwards until around 2011 very few North American beacons were heard, and other than during the periods of Sporadic E during the summer months when a number of European beacons were audible, reception was very poor. So far Solar Cycle 24 has proved to be very disappointing and much lower than the previous one, and apart from some very good F2 propagation around October / November 2011, and slightly less good conditions in October November and December 2012, the band has not been anything like as good as it was during Cycle 23. Things may still improve, but some predictions say that this cycle may have already peaked, only time will

tell if this is so. During this stage of the last cycle even reception of very low powered (QRP) beacons of less than 1 watt erp was often common at distances of around 4000 miles on 28 MHz, but this is the nature of Shortwave propagation, and there are always bands at lower frequencies that will propagate and be within the Maximum Usable Frequency range. As a rough guide to what you might hear, below is a description of a typical day's propagation:

At frequencies as high as 28 MHz the band is more of a 'daylight' band, so most signals will be heard during periods of local daylight, or during the short period just after darkness falls. Signals can occasionally heard later at night, but these openings are usually down to exceptional propagation modes such as Auroral or Sporadic E. Propagation can vary greatly on this band depending on which parts of the world is currently in daylight and darkness at the time you are listening.

For European listeners, early mornings will see a path of daylight to the east, and this can produce 'short path' openings to Japan, Australia and other parts of the Far East. From late afternoon the path of daylight will be to the west and more North and South American beacons will be heard. Sometimes in the early evenings (especially at this time of year), a path of daylight to the west can stretch from Europe, across North America, and right across the Pacific to Australia, and signals travelling this route are known as 'long path' openings. For North America members, mornings should see 'short path' openings to Europe and the Middle East, and late evening openings to the Pacific, Australasia and Asia. Checking or doing 'sweeps' at regular intervals throughout the day can produce lots of different paths to different locations, and this can produce many extra beacons.

WHERE TO FIND THE AMATEUR BEACONS:

If you have read this far you are probably interested enough to want to hear a few of these beacons, so of course you'll want to know where to look for them won't you? Well below is a 'rough guide to HF / VHF / UHF Beacon Bandplans, so tune around there and you should very soon have a few of them in your logbook.

135.7 to 137.8 kHz - Also known as the 2200 Meter Band, you may come across some hams ‘beaconing’ on there.

472.0 to 479.0 kHz - A new band available to some countries from late 2012, some stations have beacons on there.

493.0 to 515.0 kHz - Temporary allocation which saw a number of stations with 24H beacons on there.

IARU / NCDXF Beacon Chains: (International Beacon Project = IBP)

14.100 MHz (14.099 to 14.101 - reserved exclusively for beacons)
18.110 MHz (18.109 to 18.111 - reserved exclusively for beacons)
21.150 MHz (21.149 to 21.151 - reserved exclusively for beacons)
24.920 MHz (24.919 to 24.921 - reserved exclusively for beacons)
28.200 MHz (28.199 to 28.201 - reserved exclusively for beacons)

28 MHz Beacon Bandplan:

28.190 to 28.199 MHz Regional Time Shared International Beacon Project
28.199 to 28.201 MHz Worldwide Time Shared International Beacon Project
28.201 to 28.255 MHz Continuous Duty International Beacon Project
28.256 to 28.302 MHz (Beacons also operate within this mixed mode area)
50 MHz Beacon Bandplan:

50.020 to 50.080 MHz (was exclusive, but a new bandplan will see the following allocations soon)

New Bandplan:

50.000 to 50.030 & 50.400 to 50.500 MHz (some beacons have already started to migrate here)

70 MHz Beacon Bandplan: (note# this band is only available to the UK and a limited number of countries)

70.000 to 70.030 MHz (Exclusive)
70.030 MHz Personal Beacons (private low power unattended operating permitted within the United Kingdom)

144 MHz Beacon Bandplan:
144.400 to 144.490 MHz (Exclusive)

432 MHz Beacon Bandplan:
432.800 to 432.900 MHz (Exclusive)

1296 MHz Beacon Bandplan:

1296.800 to 1296.9875 MHz

Those are the 'official' bands shown in the International Bandplans, but there are beacons operating on many other bands such as 1.8, 3.5, 7, 10, 18 and 24 MHz as well, either with or without the approval of the IARU. Some of the areas to check for these are:

1810.0 to 1960.0 kHz - (they tend to be in no particular sector on this band)
3549.0 to 3602.0 kHz - (but you may find some outside of this range)
5258.0 to 5290.0 kHz - (some Ham propagation beacons here, and several heard outside of this range)
7020.0 to 7050.0 kHz - (but you may find some outside of this range)

BEACON IDENTS:

HF Beacons tend to identify themselves in a different way to aeronautical beacons, and in the case of Amateur beacons the operator's callsign must be included in the message. Some idents are very short - the NCDXF / IARU beacons chains just give their callsign followed by four tones of several seconds at varying power levels, 100 watts, 10 watts, 1 watt, and finally 100 milliwatts. Many of the privately operated beacons will include additional information along with their callsign, such as power output, Locator Square (* see footnote), name of their location, aerial type etc. Some examples of 'typical' ham beacons can be seem below:

VE4ARM sends "vvv de VE4ARM Amateur Radio Museum Austin, MB grid EN09 5W GP"

VE9MS sends "de VE9MS/B VE9MS/B FN65 K"

VP8ADE sends "VP8ADE ANTARC ----------20 second tone----------"

A look at the above idents shows that VE4ARM is a Canadian station (VE = Canada), 'MB' means that it is located in the province of Manitoba, and its Grid locator square is EN09. Power output is 5 watts, and the aerial type is a Ground Plane.

These idents will be repeated continuously in most cases, though some operators will have several messages, which are repeated in sequence, a good example is the ident formerly used by KJ7AZ, the solar powered beacon located in Wyoming:

"vvv vvv vvv de KJ7AZ solar power beacon on 28.284 at 18 wpm and 13 wpm spacing beacon"

"vvv vvv vvv de KJ7AZ co-ordinates 4147.25N 10714.56W Grid Square DN61JS altitude 6780 feet QTH Rawlins Wyoming beacon"

"vvv vvv vvv de KJ7AZ radio is a HTX100AT 5 watts. Antenna is an Altron at 29 feet. Beacon"

"vvv vvv vvv de KJ7AZ QSL Information is correct in callbooks. Active on APRS and on 28.450 W5EN mobile. End of beacon and restarting beacon"

As you can see, idents can vary greatly, but this all adds to the interest of monitoring them.

*Note The Grid Locator system mentioned is called the 'IARU Locator System' or the ‘Maidenhead’ system as it is still know in some quarters, and this is very useful in helping to work out where a beacon is coming from. Basically, the world is divided up into a series of squares each of 20° degrees longitude (east/west) by 10° degrees latitude (north/south), these large squares are given a two-letter code consisting of pairs of letters between AA and RR. For example, my locator square is 'IO' or 'Italy Oscar', and most of the British Isles also lies within this square. The 'I' is the longitude square, and the 'O' the latitude square, the point where these cross is in 'IO' square. This large square is again subdivided into 100 smaller squares consisting of 2° of longitude by 1° minutes of latitude, and these are numbered from 00 to 99 starting from the southwest corner. Each of these squares is again sub divided into another 100 smaller squares, and lettered from AA to XX, again starting from the southwest corner. My home location is situated in square 83,

and block 'VP' of that square, on a suitable chart this can indicate the location of my location to within several hundred yards.

There are various software programmes available such as OH3NJC's Locator calculator, and this can be downloaded for free from the internet, and allows the user to insert their own grid square and the one given by the beacon to work out the distance and bearing. There are also useful 'shareware' programmes such as 'GridSquared', which are very useful for calculating Grid locations, again, typing this name into a search engine will shows lots of places where such programmes can be downloaded from.

REPORTING & QSLING:

Many listeners like to receive QSLs, and many beacon operators like to receive reception reports to find out how well their beacon is being heard and what the propagation conditions were like. But how do you go about sending reports to ham beacons?

If you are a licensed radio ham yourself you will already be familiar with what a QSL Bureau is, especially if you are a member of one of your national radio societies. You send a number of report cards or QSL cards to your outgoing QSL Bureau Manager and he will then sort these and send them to overseas radio societies along with the cards of other hams. At the receiving end these are again sorted and placed into envelopes addresses to the recipient, and when sufficient cards are received to fill this envelope it will be posted to him. This system works well and is certainly a lot cheaper than sending out individual cards direct to the beacon operator. It does have a drawback though, in some cases it can take months or even years to reach its destination, and by that time the report may be of little interest or use to the recipient. If the report is received and a card sent back through the bureau system it can again take a long time before the card gets back to the sender and this time lag does often make the whole exercise a lot less interesting.

Another problem may be that the beacon operator doesn't use the bureau, or doesn't ever receive the reports, and in that case a 'direct' report via the postal system might be the best bet. Reports can be received within a week or so, though this can prove quite expensive if a lot of reports are sent, and return postage or a SASE has to be included. The drawback with this system is that the reporter will need either an international callbook, or access to the Internet, where sites like http://www.qrz.com and http://hamcall.net/call will allow you to look up a callsign's details and perhaps to find out the beacon operator's snail mail or e-mail address.

Thanks to the wonders of the Internet and e-mail, reports can now also be e-mailed to operators, and this is by far the fastest, cheapest and most efficient way of letting operators know that their signals are being heard. Some of the beacon operators now even include an e-mail or website address in their idents, and these make it very easy for any listeners to respond to them. I have received replies within hours of sending reports using this method, and it can be a big help to the operator, especially if his / her beacon is suffering interference form another source whilst it is still happening. There is also a new service now, which allows 'electronic' QSL cards to be sent and received, and this looks like it could become more popular in the near future. You can find out more about this service, which is also available to listeners who don't have a ham callsign too, and how it all works from: http://www.eqsl.cc

REPORTING CODES:

I'm sure that most beacon operators will be only to happy to receive reports from you, but do be sure to add all the relevant information such as: date, time (utc), frequency, message heard, local conditions, your equipment, any interference to their signal, and propagation conditions at the time. Many hams and listeners like to use the RST Code (Readability, Signal, Tone) to send and receive reports, and other codes such as the popular SINPO, SIO and SINFO codes used by broadcast listeners aren't really suitable for this application. If you are planning to send a written report you might prefer to give a description of what the signal sounded like in plain language, but if you send QSL Cards, listener cards, or e-mail reports, you might prefer to stick with the standard RST codes.

It would be wrong of me to say that the RST codes should be used for reports to ham beacons (or any other CW station for that matter) without attempting to give an explanation of what the RST Code is, or how it works. I have included a table below showing the full RST Code, but before that a brief description of the code, how it is used, and why it is so useful, and why you might prefer to use this for your reception reports

RST - READABILITY, SIGNAL & TONE:

If you are a CW operator the less words that you can send in a message the better. This is the reason that so much 'jargon' and so many codes are used instead of plain language, it's much easier to send the letters 'QRM' than the sentence "there is interference on your signal" - just count the dits and dahs in each and you'll see what I mean! The same goes for sending reports about signal quality - '599' says that a signal is 'perfectly readable', is an 'extremely strong signal', and has a 'pure DC note' far easier and more efficiently than the words can! The problem with such codes is remembering which is which, though if you print and cut out the table on the following page you'll at least have something you can easily refer to. For most signals the 'T' code will normally always be '9', but sometimes a beacon ident will sound a bit 'chirpy', (and you'll know exactly what that means when you hear one).

Chirp is caused by problems with the transmitter and any 'pulling' of the signal causing slight changes to the note which give it a strange chirping type sound), this can often be caused by instability in the power supply, or poor design in the transmitter, but that is far to complex a subject to go into in any depth here. For the DXer it's not always easy to work out which of the 'T' codes should be used to describe this (even hams have problems with it, personally I tend to favour 'T5 - Musically modulated note' to describe chirp, but I may be wrong). This is more of a problem for you if you're using a QSL card, which only has small 'RST' boxes to fill in, if you're writing your report in a letter just use plain language if in any doubt.

The 'R' and 'S' codes are more or less self explanatory, but it's pretty much a judgement call when it comes to assessing what the signals you are hearing should be, and if you asked several different people to describe what the RST code of particular signal was you'd probably get a lot of different answers and opinions. Please note that some radios have 'S meters' calibrated in S points, but this isn't always a good guide as many receiver manufacturers seems to have their own definition of what an 'S point' is, descriptions like "40 over 9" are okay if you are just doing signal comparisons with someone using a receiver calibrated the same way as yours is, but if you plan to use the RST Code you should base this on an 'audio report' e.g. does it sound perfectly readable and extremely strong - a signal can be R5 even if it's barely moving your 'S Meter'.

As I said previously, deciding what signal report to give is very much a judgement call, but it does get easier with experience, and that is why the RST Code shown below is such a big help.

One final point should be mentioned about the RST Code, and this is a valid one for many of the other codes and jargon used by amateurs too - 'language'! If the beacon operator, or recipient of your report doesn't speak the same language that you do a report of RST 599 will be perfectly understandable to him, whilst 'perfectly readable', 'extremely strong signal', 'pure DC note' etc. written in English may mean little or nothing to the non-english speaker. Morse code is much maligned these days, but is still far and away one of the best and most efficient low-tech data systems when it comes to making effective communication with other people, especially if those people don't speak the same language that you do. I hope the above tutorial helps to make a little more sense of the RST code to readers, if you are still confused by it my apologies for not explaining things better.

And at that point we'll end this party political broadcast on behalf of the Morse code Enthusiasts Party, and begin our look at the RST Code on the next page.

THE RST CODE:

R1 Unreadable
R2 Barely Readable, occasional words distinguishable
R3 Readable with considerable difficulty
R4 Readable with practically no difficulty
R5 Perfectly readable

S1 Faint, signals barely perceptible
S2 Very weak signals
S3 Weak signals
S4 Fair signals
S5 Fairly good signals
S6 Good signals
S7 Moderately strong signals
S8 Strong signals
S9 Extremely strong signals

T1 Extremely rough hissing note
T2 Very rough AC note, no trace of musicality
T3 Rough, low-pitched AC note, slightly musical
T4 Rather rough AC note, moderately musical
T5 Musically modulated note
T6 Modulated note, slight trace of whistle
T7 Near DC note, smooth ripple
T8 Good DC note, just a trace of ripple
T9 Purest DC note

Finally, the Morse idents used by beacon operators will use some punctuation or abbreviations as well as letters, and the most commonly heard ones will be for suffixes such as '/B', '/BCN', '/Beacon', where an 'oblique' or 'stroke' is inserted and this appears as (dah-di-di-dah-dit) . Break signs (=) are often used (dah-di-di-di-dah'), AR - 'End of Message' (di-dah di-dah-dit), the Comma (dah-dah-di-di-dah-dah), Full Stop (di-dah-di-dah-di-dah), End of work (VA) (di-di-di-dah di-dah). A full list of Morse abbreviations can be found in the Morse Code section elsewhere in this publication.

THE NEW HAM BAND AT MF

Following the demise of the Marine CW service, which operated between 435 and 526.5 kHz, a number of countries have allowed experimenters to operate on small allocations around 500 kHz, and there were hopes that some sort of permanent band would be allowed here, with a small allocations on 500 kHz itself for ‘historical’ stations to operate, sadly there was been much opposition to this plan from the International Maritime Organisation, who had plans of their own for a new digital system on this band, but at the 2012 World Administrative Radio Conference (WARC) the delegates voted to permit an new secondary allocation on frequencies between 472.0 and 479.0 kHz. As of late 2012 a number of countries had already permitted operation on here, and many more will commence from the beginning of January 2013. Sadly, the temporary allocation around 500 kHz will soon be phased out, but a number of countries will allow operation to continue for a little while longer to allow users time to modify their equipment and move down to the new band.

Many hams did take out the experimental licences and have been making good use of the experimental allocation and the useful propagation that it offers, and many stations operated beacon on there (some like Germany only allowed beacon operation), whether we will see quite so many on the new band remains to be seen, but to date it has been reported that a beacon has been operational from Greece, so I am hopeful that we will find a few new ones appearing there.

VHF BEACONS:

Three Bands come under the heading of VHF, and these are the 50 MHz (6 Meter Band), 70 MHz (4 Meter Band) and 144 MHz (2 meter Band), and all have exclusive beacon allocations on them. Although 50 and 70 MHz propagation will generally be of the Sporadic E type during the summer months between April and September, at Solar Maximum it is sometimes possible for the MUF (Maximum Usable Frequency) to go higher than 70 MHz, and on such occasions some remarkable distances can be recorded, sadly the current Solar Cycle 24 has rarely got above 30 MHz as yet, so we have had to be content with mainly Sporadic E openings, though even these can be quite impressive, with many beacons from as far away as eastern Europe and Scandinavia heard here during 2011 and 2012. The 70 MHz Band was mainly a UK and Ireland allocation, but as many Band One TV services have closed down in parts of Europe during recent years, a number of other countries have now allowed limited operation here, and several Portuguese beacons have been heard in the UK on a number of occasions during 2012.

The 144 MHz Band can be more tricky as the Sporadic E openings do tend to be far fewer at these frequencies, but the do happen, and when they do some amazing distances can be recorded and all kinds of unusual propagation beacons from distant places can be received. The best times are often during ‘Tropospheric’ openings (lifts), which can occur when slow moving areas of High Barometric Pressure are overhead, which can be during the summer months, or in January when the weather is very cold and the temperatures remain below 0C for days on end, and the skies remain clear. This doesn’t always happen, but when it does you need to make the most of them. Auroral propagation may also be possible during the periods around Solar maximum, and also Meteor Scatter can produce signals at certain times of year, but a lot of homework and patience is often required to get the best from this band. In the UK the band exclusively allocated to propagation beacons can be found between 144.400 to 144.490 MHz.

UHF BEACONS

The 70cms or 430 MHz Band (440 in North America) also has an exclusive allocation for propagation beacons, and in the UK at least, this can be found in a 500 kHz sector between 432.4000 to 432.500 MHz. Propagation can be similar to that on 144 MHz when there is enhanced propagation, but the ground wave tends to be even shorter than that at 144 MHz, so unless you have a high gain aerial, or are at a reasonably high location, you may not hear very many of them except during Band openings. It can be well worth 'going portable' to a local high spot though, you never know what you might hear there. This is definitely a band for those people who really like a challenge.

I've not had the opportunity to listen to any beacons on the 23cms band yet, but as some of the newer HF Transceivers now come with this band included and many scanners cover this frequency range, it is probably well worth including here, as the band does have many beacons operating on it, and in the UK the Bandplan shows that there are two allocations, 1296.750 to1296.800 MHz which is for local beacons using up to 10 watts erp maxim, and 1296.800 to 1296.994 MHz which is allocated exclusively to propagation beacons.

EVEN HIGHER – SHF BEACONS AND ABOVE

There are beacons on the many bands above this, and even the highest band show, the '2mm' Band has an exclusive allocation between 134,928.800 to 134,928.990 MHz, or 134 GHz to put it another way. Since commercial equipment isn't readily available for these bands, they generally in the domain of home brew experimenters, so there is little point in me including more information here at the moment.

SECTION TWO: SINGLE LETTER HF MARKER (CLUSTER) BEACONS

SINGLE LETTER HF MARKERS:

Also known as 'Cluster Beacons' or 'Single Letter Beacons', it could be argued that these signals are not really beacons, since some are said to be channel markers, but it does appear that the ones that do operate in Clusters are likely to be mainly propagation beacons, so that makes them fair game for many beacon chasers. Not too much information appears about these signals, but they frequently used to crop up on UDXF Mailing List http://groups.yahoo.com/group/udxf So what are they exactly?

Well, according to popular belief, and according to various articles many of them are used as Propagation indicators most likely belong to the Russian Navy, and are located at Russian Naval bases in the CIS countries. These can be found operating on various frequencies between 2 MHz and 25 MHz, and a well known cluster can often be found operating in the 7MHz Amateur Band around 7.039 MHz. These 'Single Letter Beacons', or 'Single Letter HF Markers' (SLHFMs), or even "Cluster Beacons" as they are often described, can provide a nice change for the beacon DXer who wants to look for something a little bit different, or wants to study the radio propagation from those regions. As well as the Cluster Beacons, some of the others are sais to be Channel Markers, and from time to time CW or RTTY has been heard on these channels. Personally, I like to look for these at least several times every year as they do occasionally change, or occasionally new ones may even appear. I have enclosed a list of all the known ones below, which was based on a list posted on the UDXF Mailing List by Tom DF5JL, and also a useful website created by Fritz Nusser at the following location:

http://www.astrosol.ch/networksofthecisforces/navymorsenetworks/beaconsandclusterbeacons/index.html

I can't verify the accuracy of all of these since I haven't yet managed to hear all of them, but Tom and Fritz seem to know what they are talking about, so they should make a great starting point, and my thanks to them sharing this information with us:

KHz:	Call:	Location:	COU:	COUNTRY:	TYPE:
3166.8	P	Kaliningrad	RUS	Russia	Marker
3203.8	L	St. Petersburg	RUS	Russia	Marker
3593.7	D	Sevastopol	UKR	Ukraine	Cluster
3593.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
3593.9	S	Severomorsk	RUS	Russia	Cluster
3594.0	C	Moscow	RUS	Russia	Cluster
3595.1	A	Astrakhan	RUS	Russia	Cluster
4043.0	P	Kaliningrad	RUS	Russia	Marker

4325.9	R	Izhevsk	RUS	Russia	Marker
4428.4	L	St. Petersburg	RUS	Russia	Marker
4557.7	D	Sevastopol	UKR	Ukraine	Cluster
4557.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
4557.9	S	Severomorsk	RUS	Russia	Cluster
4558.0	C	Moscow	RUS	Russia	Cluster
4558.1	A	Astrakhan	RUS	Russia	Cluster
5111.0	P	Kaliningrad	RUS	Russia	Marker
5153.7	D	Sevastopol	UKR	Ukraine	Cluster
5153.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
5153.9	S	Severomorsk	RUS	Russia	Cluster
5154.0	C	Moscow	RUS	Russia	Cluster
5154.1	A	Astrakhan	RUS	Russia	Cluster
5154.3	K	Petropavlosk Kamchatskiy	RUS	Russia	Cluster
5154.4	M	Magadan	RUS	Russia	Cluster
5312.0	D	Sevastopol	UKR	Ukraine	Marker
5465.8	R	Izehvsk	RUS	Russia	Marker
7038.7	D	Sevastopol	UKR	Ukraine	Cluster
7038.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
7038.9	S	Severomorsk	RUS	Russia	Cluster
7039.0	C	Moscow	RUS	Russia	Cluster
7039.1	A	Astrakhan	RUS	Russia	Cluster
7039.2	F	Vladisvostok	RUS	Russia	Cluster
7039.3	K	Petropavlosk Kamchatskiy	RUS	Russia	Cluster
7039.4	M	Magadan	RUS	Russia	Cluster
7077.5	D	Sevastopol	UKR	Ukraine	Marker
8494.7	D	Sevastopol	UKR	Ukraine	Cluster
8494.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
8494.9	S	Severomorsk	RUS	Russia	Cluster
8495.0	C	Moscow	RUS	Russia	Cluster
8495.1	A	Astrakhan	RUS	Russia	Cluster
8495.2	F	Vladisvostok	RUS	Russia	Cluster
8495.3	K	Petropavlosk Kamchatskiy	RUS	Russia	Cluster
8495.4	M	Magadan	RUS	Russia	Cluster
10871.7	D	Sevastopol	UKR	Ukraine	Cluster
10871.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
10871.9	S	Severomorsk	RUS	Russia	Cluster
10872.0	C	Moscow	RUS	Russia	Cluster
10872.1	A	Astrakhan	RUS	Russia	Cluster
10872.2	F	Vladisvostok	RUS	Russia	Cluster
10872.3	K	Petropavlosk Kamchatskiy	RUS	Russia	Cluster
10872.4	M	Magadan	RUS	Russia	Cluster
13527.7	D	Sevastopol	UKR	Ukraine	Cluster
13527.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
13527.9	S	Severomorsk	RUS	Russia	Cluster
13528.0	C	Moscow	RUS	Russia	Cluster
13528.1	A	Astrakhan	RUS	Russia	Cluster
13528.2	F	Vladisvostok	RUS	Russia	Cluster
13528.3	K	Petropavlosk Kamchatskiy	RUS	Russia	Cluster
13528.4	M	Magadan	RUS	Russia	Cluster
15064.7	V	Khiva?	UZB?	Uzbekistan?	Marker
15064.7	V	Khiva?	UZB?	Uzbekistan?	Marker
16331.7	D	Sevastopol	UKR	Ukraine	Cluster
16331.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
16331.9	S	Severomorsk	RUS	Russia	Cluster
16332.0	C	Moscow	RUS	Russia	Cluster
16332.1	A	Astrakhan	RUS	Russia	Cluster
16332.2	F	Vladisvostok	RUS	Russia	Cluster
16332.3	K	Petropavlosk Kamchatskiy	RUS	Russia	Cluster

16332.4	M	Magadan	RUS	Russia	Cluster
20047.7	D	Sevastopol	UKR	Ukraine	Cluster
20047.8	P	Kaliningrad	KAL	Kaliningrad	Cluster
20047.9	S	Severomorsk	RUS	Russia	Cluster
20048.0	C	Moscow	RUS	Russia	Cluster

These 'beacons' are not active all of the time, sometimes you will hear four or five operating close together, and they will be audible at the same time for many days, at other times there may just be a single beacon heard, or even none at all. In their own way they can be very interesting to monitor, and can provide an interesting challenge during the times when no 28 MHz beacons are audible.

SECTION THREE: DRIFT NET BEACONS

These are very strange signals that have puzzled many HF beacon monitors for quite some time. Often you will be tuning across the 28 MHz beacon band when you will come across a long tone, which is then followed by a two-letter ident e.g. "----------AA".

Sometimes these will repeat at intervals of several minutes, but their appearances can be very erratic and they're often found 'accidentally', rather than through searching for them. There doesn't seem to be a definite Bandplan, but they have been heard on frequencies between 28032 and 28351 kHz. The best source of these can be found in a database produced by George Kehl, DJ7KG. George will mail this out monthly to interested parties, or alternatively, you can download a copy from his website at: http://www.mydarc.de/dj7kg

SECTION FOUR: HIFERS, MEDFERS & LOWFERS

These beacons tend to be more of a North American phenomenon, but recently there have been several operating from Europe, and thanks to some of the more exotic very slow CW decoding programmes some of these extremely low powered signals have even been received here in Europe in the past year. Very strict restrictions, low power levels and aerial restrictions have been placed upon them, but if you'd like to look out for them they can be found on small bands of frequencies which are allocated to experimenters on an unlicensed basis.

The best known of these is the 'LOWFER' Band, which is to be found between 160 and 190 kHz, but there is also a 'MEDFER' Band just above the Medium Wave broadcast band on frequencies between 1610 and 1710 kHz. Whether this band will survive the expansion of the AM band in North America remains to be seen.

The final one, and one, which may be the easiest to hear is the 'HIFER' Band, and this may well offer the best reception opportunity for DXers outside of North America to hear one of these signals (I have already heard several here in the UK). This small band of frequencies can be found on 13 MHz.

Lowfer Band: 160 to 190 kHz

Medfer Band: 1610 to 1710 kHz

Hifer Band: 13553 to 13567 kHz

A lot more information about these beacons can be found at the Longwave Club of America website, which you can reach from this link: http://www.lwca.org/sitepage/part15/index.htm

SECTION FIVE: VHF AERONAUTICAL NAVAID SYSTEMS

VOR / VORTAC / DME / TACAN / MARKER & ILS SYSTEMS:

Many listeners will have an airport or small airfield not too far away from their location, and these can also offer a few additional navaids that you can look out for. If you own a scanning receiver, or 2-metre transceiver with extended coverage which can receive the lower part of the VHF aircraft band from 108 to 118 MHz (many do have extended coverage nowadays) it's well worth giving it a try. Because of the different types of propagation at these higher frequencies (see the section of VHF Beacons for an idea of what it may be like) you aren't going to hear anything like the numbers heard on the LF, MF or HF bands, but you should hear some, and if you own a handheld scanner you can always take it with you on your travels and check out any airfields in the areas you may be passing through. Some of these will only be heard at very close

range, but it can still be interesting to hear just what they sound like, and if you happen to be visiting the airfield, often you can see what they look like as well.

At certain times of the year there may be enhanced propagation caused by slow moving high pressure areas producing a 'lift' or Tropospheric enhancement, these can be very interesting, and bring in reception of some of the navaids normally well outside your usual range. A number of years back we were just nearing the end of a period of enhancement which had lasted for the best part of a week, when the barometer which had rarely been below 1040mb during that time, produced one of the longest 'lifts' in propagation that I've heard in many years, and all throughout this period I was hearing the ILS (Instrument Landing System) ident at Hawarden Airfield (EGNR), which is on the Welsh border some 47 miles (75km) distant. That might not sound a long distance but when you consider that an ILS signal would normally only be used by aircraft as they line up with the centre of the runway, and is usually only running in the region of around 3 watts, and only heard within a short distance of the airfield, it certainly is bordering on being classed as a real 'DX' catch. A further explanation of what VOR, DME, ILS, TACAN and VORTAC systems are now follows:

THE DIFFERENT TYPES OF SYSTEMS THAT ARE CURRENTLY IN USE:

I briefly touched upon what an ILS system was in the previous section, and in this section I will expand on this a little, and look at which of these VHF Navaid systems might be of interest to beacon chasers:

VOR BEACONS:

VORs, or to give them their full name, VHF Omni-directional Ranges, are types of radio beacons that transmit a signal containing precise azimuthal information, so that upon receiving the signal, an aircraft can tell with great precision exactly what the bearing with respect to magnetic north the aircraft lies from the station, or vice versa. Equipment in the aircraft can use this and the course alignment is considered to be excellent, with accuracy generally within plus or minus one degree.

According to many sources, a VOR beacon is much easier for a pilot to use than a NDB, and a dial in the cockpit can be set so that any deviations from the course will be indicated on it, or an audible warning produced. Since this article is about beacon DXing I don't intend to go too deeply into this subject (of which I am most definitely NOT an expert), but if you are interested in finding out more about these systems a search engine query or local library will no doubt turn up many detailed articles.

For our DX purposes the bit we are most interested in is the Morse ident letters, and where we can find information that will tell us its location, and whilst the ident will be self explanatory to anyone interested in NDBs, the sources of such information may not be, and I will look at these in a later section. For anyone new to beacon chasing a VOR will generally use a three-letter ident sent in Morse code, and the letters will often have some bearing on its location. To give an example, my local 'major' airport at Manchester has a VOR with the ident of 'MCT', (the NDB ident is 'MCH') and the letters of course indicate that this is coming from Manchester International. An airline pilot flying to Manchester might well programme his flight path into his computer by using the various VOR systems, and this will recognise that a Morse ident of MCT on 113.55 MHz is located at Manchester. In controlled airspace pilots will often follow the flight paths from one VOR beacon to the next, and if you listen to ATC channels you might often hear the pilot or Air Traffic Controller mention these.

Not all VORs are located at airports though, and some 'waypoint' beacons are stuck out in the middle of nowhere. My most local VOR is located at Pole Hill, and has the Morse ident of 'POL' (112.100 MHz), and you will often hear pilots or ATC refer to this as "Heading for the Pole", or "Crossing the Pole" - in case you'd ever wondered about this it is most definitely Pole Hill in West Yorkshire, and not the North Pole they're referring to. Having walked to the top of this hill and spent a wet afternoon watching aircraft turning onto their new tracks directly overhead, I can definitely confirm that this one certainly does come into the 'remote' category!☺

VOR signals are generally thought of as line of sight, and unless you live at a good, high VHF friendly location, or like to operate portable from a local hilltop, you won't hear too many unless there is a big 'lift' in conditions. I would consider this to be a nice 'fill in' to complement NDB chasing rather than a hobby in its own right. Finally, VOR beacons operate on a channelised system, and for the benefit of anyone who might be interested, these are:

Channels: 1 (134.40 MHz to 16 (135.90 MHz) in 100 kHz steps.

Channels: 17 (108.00 MHz) to 126 (117.95 MHz) in 100 kHz steps.

Using this formula you can work out that my local VOR - 'MCT' on 113.55 MHz is on Channel 82.

TACAN – TACTICAL AIR NAVIGATION:

For reasons best known to the military the civil VOR / DME system was considered to be unsuitable for their use. A new navigational system called TACAN was developed by the military to fit in more readily with its military and naval requirements. The technical principles of operation of a TACAN system is considered to be quite different from those of VOR / DME facilities, but the end result as judged to be the same as far as pilot is concerned, the integrated facility is called a VORTAC.

According to the FAA (Federal Aviation Administration) Aeronautical Information Manual, a TACAN system is defined as:

b.) TACAN ground equipment consists of either a fixed or mobile transmitting unit. The airborne unit in conjunction with the ground unit reduces the transmitted signal to a visual presentation of both azimuth and distance information. TACAN is a pulse system and operates in the UHF band of frequencies. Its use requires TACAN airborne equipment and does not operate through conventional VOR equipment.

TACAN channels are listed as: Channel 18 (108.10 MHz) to Channel 119 (117.25 MHz)

ILS / DME – INSTRUMENT LANDING SYSTEMS / DISTANCE MEASURING EQUIPMENT:

To a pilot ILS / DME / Markers etc. are all a part of complex instrument approach, and I'm not even going to attempt to expand on how this works, that task is way beyond my capabilities, but a very basic description would be that it's the thing that aircraft use to line themselves up with the centre of the runway when on their approach to the airfield (the Glide Path sets the angle of descent). Since it's only the Morse idents we're interested in I'll just stick to what we should look out for, and we'll take a look at the signals which you might be fortunate enough to pick up if you're near to an airport, or lucky enough to hear one during an occasional 'lift' in propagation conditions. Let's once again take a look at some of the descriptions given in various articles on this subject:

A localiser transmitter operates on one of 40 ILS channels within the frequency range of 108.10 to 111.95 MHz, and is used to provide pilots with course guidance to the runway centreline. Idents are in Morse code, and usually consist of a three-letter identifier preceded by the letter I (..) this is transmitted on the localiser frequency. As an example, the ILS at Hawarden that I heard recently has the callsign I-HDN, and a look at the charts for Manchester International Airport (EGCC) shows that the main runway 24/06 (this means that the runway is built at an angle of 06/240 degrees), has an ILS/DME at each end, and both are listed as operating on 109.50 MHz. Since the winds are predominantly from the west or southwest Runway 24 is used the majority of the time, and when the winds are from the east Runway 06 is used. The charts show that for an approach to Runway 24 uses I-NN, and an approach to Runway 06 I-MM. These are situated near the centre of the main runway next to the MCT VOR, but unless you are very close to them or in a line with the ends of the runway you probably will have difficulty hearing them.

** IMPORTANT NOTICE IF YOU ARE PLANNING TO LOOK FOR NAVAIDS **

NOTE: If you are at, or near to an airport and you happen to have your scanner with you, then do take a listen for these, but do bear in mind that if you are wandering around in the vicinity of an airport or airfield, and you happen to be carrying a scanner in your hand, please be aware that with the current world situation as it is, any security staff who see you may view you with great suspicion. Many countries have strict laws about scanner usage, and at no time should you attempt to gain access to any private property without the owner's permission, safety and security (your own especially as well as the airfield's) should always be your major consideration at times like this. If you are at a designated aviation viewing point, which is something that many large airports often provide, there will very likely be a lot of other enthusiasts around with scanners (my local one even has a shop selling them), so no one is likely to bother very much and won't see you as any sort of threat. If you are out and about searching for navaids though please do take great care at all times not just for yourself, but for the benefit of other members of this hobby as well, who won't be too pleased if any irresponsible behaviour gets them barred from enjoying their hobby. NEVER under any circumstances set foot on this land without getting prior permission from the relevant authority first or you may live (if you're lucky) to regret it!

SECTION SIX: USEFUL INFORMATION SOURCES:

When looking for Ham Propagation Beacons you can of course just tune around to see what turns up, but it does make life much easier if you have some type of list showing ones that are active, and in this respect we are very fortunate, because there are some very good ones that are available on the Internet. IARU Region One Beacon Co-ordinator, Martin Harrison, G3USF, and Region Two Co-ordinator Bill Hays, WJ5O both produce excellent lists which are kept well up to date, and these are a very good starting place, and for listings of active beacons on all the other VHF and UHF Bands there are also very good sites such as the Beaconspot site, which covers all beacons from 50 MHz up to 76 GHz (Note: you may need to register with them to use this site, but that doesn't take very long and doesn't cost anything).

On the next page I have listed a few useful website addresses where you will be able to find out more:
G3USF's Worldwide List of HF Beacons:
http://www.keele.ac.uk/depts/por/28.htm

WJ5O 10 Meter Beacons List:
http://userpages.troycable.net/~wj5o/bcn.htm

G3USF's Worldwide List Of 50MHz Beacons:
http://www.keele.ac.uk/depts/por/50.htm

Beaconspots website:
http://www.beaconspot.eu/beacons.php

Once you've heard and identified your beacon you will likely want to get some sort of verification from it, and there are several ways of going about this. As I said earlier, some beacons will transmit an e-mail or website address in their message, but even if they don't all is not lost. Thanks to sites like QRZ.com and Hamcall, there are very useful online resources that list the contact details of many of the world's ham operators, and you should be able to find a method of contacting them from there. You may need to register to gain access to this information, but registration is free, and only takes a few minutes to do. Once you are registered you can then either send an e-mail report to the operator if he/she has an e-mail address listed, this is useful to the operator as they get instant feedback on their signal, or if you prefer to do things the good old way you can send a report direct to them via their postal address. The third option is to use a QSL Bureau, which if you happen to be a member of your national radio society is likely to be a free service that they offer, but if you aren't and don't want to go to the expense of joining one then you will have to use the first two options, or in the case of some stations that use the service, a fourth option is available in the form of online QSL service eQSL, where you can generate an electronic QSL card and send this to the operator, and receive one by the same method. You can find out more about all these from the links shown below:

QRZ.com:
http://www.qrz.com/

Hamcall:
http://hamcall.net/call

QRZCQ:
http://qrzcq.com/

eQSL:
http://www.eqsl.cc/qslcard/Index.cfm

Other useful sites are DX Maps, where you can sign up for alerts when the bands are reported as being open to your area, and sites like Beaconspots allow you to report beacons as soon as you hear them, and this will prove helpful to other listeners, who will be able to see that a particular band may be open to their location at that time:

DX Maps:
http://www.dxmaps.com/spots/map.php

Beaconspot Reports:
http://www.beaconspot.eu/beaconsp.php

These are just some of the more useful resources, you can also find many Ham 'DX Clusters' which will show reports of active beacons as they are logged and reported, and there are numerous ones to be found

on the Internet, just try Googling ‘DX Clusters’ and you’ll see what I mean. Reporting can be fun as well as useful, both for the listener and the Beacon operator as well.

VHF NAVAIDS:

If you are interested in the navaids that operate at VHF some type of listing or information source will be a great help to you. Fortunately for us, there are plenty of 'professional' sources, which, are produced for pilots, and these are often available from a number of aviation hobby sources, and can often be picked up at quite reasonable prices. Because a pilot must always have the latest and most up to date charts to ensure a safe landing and take off, and to comply with correct airport operation, charts and flight supplements can be issued on a monthly basis, and this means that there are always plenty of 2nd hand copies around which are less that a month out of date. For my own use I like to get copies of the Aerad Flight Supplements, these cover the whole world in four separate volumes, all of which I am usually able to pick up for a few pounds at the aviation shop at Manchester International Airport (EGCC):

Europe & Middle East Supplement
Africa Supplement
Western Hemisphere Supplement
Asia, Australasia and Pacific Supplement

They also publish a wide range of high level, low level, and aerodrome charts and booklets, and these are a wonderful source of information for the beacon enthusiast, since they not only list the VHF navaids, but also Non Directional Beacons as well! Other very good sources are Jeppesen, who publish a wide range of similar publications, and also the United States Department of Defense, who have a mail order service, which is second to none, and offer very reasonable prices even to overseas customers. My other favourite source is the RAF AIDU, which publishes its own books and charts, and unlike most of the others actually lists many of the North Sea oil platform NDBs too. Buying new can be expensive, but unlike pilots we don't need to update these quite so often, so they can be quite a good investment and give the user plenty of usage. One publication I like very much is "The Pilot's Free Flight Atlas of Europe"; this doesn't list all of the navaids, but is basically an atlas which shows the location of many of the airfields and reporting points, VOR beacons etc. There is also a version covering North America, and this can be obtained from pilot suppliers such as Transair.

Aerodrome Booklets are very useful for finding out which navaids are used, and these usually show maps of the airfield, and actual locations of the navaids - very useful if you are planning to visit the airfield. Annual publications such as the 'UK VFR Flight Guide', and 'Pooley's Flight Guide' also contain maps of the airfields, and similar publications should be available in most other countries too. The ones listed above can be obtained from the sites shown later in this section. I usually buy my copies of charts and Aerad Supplements from the aviation shop at Manchester Airport, but if you have an airport near you it's always worth checking to see if they have a shop of their own.

AERAD:
http://www.afeonline.com/shop/index.php?cPath=28_60

JEPPESEN:
http://ww1.jeppesen.com/index.jsp

US DoD:
http://www.aviation.dla.mil/rmf/programs_flip.htm

UK MIL AIPS:
www.aidu.mod.uk/AIDU_Cat/AIDU_Products_and_services.pdf

AIRNAV:
http://www.airnav.com/

Pilot’s Free Flight Atlas:
http://www.absolutezero.de/

For VOR Beacon listings, there is one really useful site run by DK3XT, and on this page and amongst all the other goodies on there, you will find a list of the VOR Beacons in Europe by I8TWK, and this can be downloaded in Frequency, Alphabetical and Location order in several separate text files:

http://www.qsl.net/dk3xt/traf.htm

Those are just a few of the many information sources that you can find, there are many more, but I've just listed the more common ones here, a Google search will turn up many more, often in your own countries or localities.

SECTION SEVEN: ABBREVIATIONS IN USE ON THESE PAGES:

As is often the case with any aspect of utility DXing, you are likely to encounter a lot of jargon or abbreviations, a great many of which may not initially mean anything to you. To help you quickly identify some of the terms which you are likely to come across whilst beacon DXing, I have included a list of some of the more common ones used in Part Two of this publication below. A more comprehensive abbreviation list can be found on the NDB List website.

CAA	Civil Aviation Authority (UK)
CW	Continuous Wave (Morse Code)
DF	Direction Finding
DME	Distance Measuring Equipment
FAA	Federal Aviation Authority (USA)
GP	Glide Path
H24	Beacon Operational 24 Hours a day
HF	HIGH FREQUENCY (Shortwave)
IARU	International Amateur Radio Union
IBP	International Beacon Project
IDENT	Identification signal /Callsign
ILS	Instrument Landing System
LF	Low Frequency (30 to 300 kHz)
LIM	Locator Inner Marker
LLZ	ILS Localiser
NCDXF	North California DX Foundation
MF	Medium Frequency (300 to 3000 kHz)
MKR	Marker
OM	Outer Marker
QRP	Low Power
QRPP	Extremely Low Power
QSL	Verification of Reception.
RST	Readibility, Signal Tone
SHF	Super High Frequency (3 GHz to 30 GHz)
SLB	Single Letter Beacon
SLHFM	Single Letter HF Marker
SSB	Single Sideband
TACAN	Tactical Air Navigation
UHF	Ultra High Frequency (300 to 3000 MHz)
UK	United Kingdom
USB	Upper Side Band
VHF	Very High Frequency (30 to 300 MHz)
VOR	VHF Omni-directional Range
VORTAC	A co-located VOR and TACAN beacon
WARC	World Administrative Radio Conference

PART THREE: EQUIPMENT REQUIRED FOR BEACON RECEPTION

Trying to list all of the equipment you might need for receiving beacons would be a bit like trying to work out how long a piece of string is, but I'm not even going to try to do that, and in this short chapter will instead will just offer a few tips about the sort of things than many of the current Beacon DXers are using, such a receivers, filters and antennas.

SECTION ONE: RECEIVERS FOR BEACON RECEPTION

There are all sorts of radio receivers in use today, from elderly valve powered vintage receivers, to modern solid state types, and the newer and increasingly popular Software Defined Radios (SDRs). Many of these will cover most of if not all of the frequencies that you can find beacons on, though on many older sets the convention was that Shortwave ended at 30 MHz and so did their coverage. There were many good reasons for this, mainly related to the design of the circuits used, and their sensitivity etc. but on more recent and newer designs we are now starting to see many more radios that cover Longwave, Mediumwave, Shortwave and even the VHF and UHF Bands as well, and this is often the case with modern ham transceivers too, which often include general Coverage as well as the usual Ham Bands. I don't intend to tell you what sort of receiver you should buy, but rather point out some of the things to look out for when choosing one.

Most radios will receive beacons without too much difficulty, but for the serious DXer there are certain things to look out for, and if the NDBs on the Lower Frequencies are your main interest then you'll want a receiver that is reasonably sensitive on this band. With many General Coverage Receivers, especially the ones included with Ham transceivers, you can often find that the sensitivity has been deliberately lowered below 500 kHz, often due to problems with the design of the receiver suffering with breakthrough from the higher powered Medium Wave powerhouse broadcast stations, and when trying one of these you might find that it is a bit 'deaf' when used at Longwave. With some receivers it is possible to remove the components that are attenuating the signals, but this is something that you should beware of before buying one. Many enthusiasts have had great results using receivers such as the Icom R-75 and the AOR AR-7030, and many NDB enthusiasts will have one of these in their radio shack. Sadly though, with the decline in the hobby in recent years, very few new 'hardware' receivers like these have appeared on the market, and you would only be able to pick up one of those on the second hand market these days. That's not to say that there aren't many other alternatives, but in the past few years a new development has taken place, and we are now seeing a whole new generation of Software Defined Radios appearing on the market, and these are proving to be very popular, not only with NDB enthusiast, but also HF and VHF / UHF Beacon chasers as well, and more about these later.

A good receiver for winkling out beacons will be one that preferably has good 'Selectivity'. By this I mean one that has a good selection of IF (Intermediate Frequency) Filters installed, hopefully with one of these being a good quality 'narrow' filter, of less than 1 kHz - preferably 500 Hz, or 250 Hz (or even less if you have that capability). This will help you greatly when it comes to separating the signal idents, since on this band channel bandwidths are usually only 500 Hz wide. Many 'old' or near vintage sets such as the AR88LF or other ex-military receivers of that ilk, can provide good selectivity for not too great a price, unfortunately, they do suffer from other drawbacks such as size, serviceability, and the lack of a digital readout to help make channel identification easier.

I'm pleased to say though that many modern receivers - the Ten Tec RX-340 HF DSP Receiver and the NRD 545 being ones that immediately come to mind - do now offer the DXer a digital IF filter stage which can be continuously varied down to a very low bandwidth - often with a choice of over 50 different positions or more, going right down to 50 Hz or less. Do remember that if you are really serious about chasing very weak and distant beacons, choosing a receiver with very good IF filtering will greatly assist your efforts.

SOFTWARE DEFINED RADIOS

As I mentioned previously, the biggest and most exciting development in recent years has been the growth in the number of new Software Defined Radios that have appeared on the market, and the choice of these seems to grow greater by the day, they can offer the DXer capabilities that even the best of conventional receivers may not be able to, but they do have some drawbacks as well which the user or potential buyer should be aware of. On the positive side, you get a lot for a very reasonable price since the power of your PC is utilised and you are not having to pay again to have all the processors duplicated inside your radio,

you also get (in most cases) a waterfall display, which allows you to see a large portion of the band, and the signal traces from each beacon, you can then just click on the trace to bring up the beacon's signal, which on many units will also be displayed graphically on your screen (users of digital modes like psk31 will be well aware of how waterfall displays work). Another, and perhaps, at least for many listeners who aren't able to stay up half the night, very useful feature is the ability to record a large chunk of the required radio spectrum and play it back in 'real time' at a more convenient hour, those of us who have had to stay up until near Dawn awaiting a ten or twenty minute Greyline opening, and have only had to option of listening to several signals before the band faded out will appreciate just how useful this may be. I am sure that there are a great many other advantages as well, but not owning one of these (other than the older and much earlier Icom PCR-1000, which has no waterfall display or the flexibility of the adjustable bandwidths of the modern variety, but at least it has enabled me to listen to many of the VHF/UHF Beacons with it). One model that has proved to be very popular amongst the NDB chasing community is the Perseus SDR, and if the results I've seen from users who own these are anything to go by this must be one of the best available, though coverage only goes from 10 kHz to 40 MHz.

There are some downsides with these types of radio, and amongst these are: limited frequency coverage on some models, e.g. they only cover frequencies up to 30 MHz, or only frequencies above 30 MHz, so if you want to receive all of the beacons frequencies from DC to Daylight then you might need several of these units, or one of the more expensive varieties like the WinRadio Excelsior, which covers from 9 kHz to 3,500 MHz, but costs around $5,000 US, so is not a cheap option. One other big problem can be that you require a PC or laptop to run the unit, which itself may prove to be a source of interference in your radio shack, especially if it happens to contain one of the cheap and nasty Chinese Power Supplies with all the filtering components omitted (this is illegal under EU EMC regulations, but that hasn't stopped them from completely ignoring the laws and shipping boatloads of this garbage to us). Thankfully I saved some of my older and better filtered PSUs and have had some success in transplanting the filter components into the newer ones, but this is not a job for anyone who doesn't know what they are doing.

More recent developments though such as the 'FunCube Dongle Pro+' promise to make life easier and cheaper for us, and these sell at the very reasonable price of around £150 (UK price) and coverage is from 150kHz to 1.9GHz on this small unit, which looks just like a USB stick and plugs into a spare USB port (note, there is a gap in coverage between 240MHz and 420MHz on this unit). With a laptop you could make a very nice portable setup for use at the local high spots without needing to carry a lot of equipment around with you. These are just a few of the units now available, and a search around the Internet will find many more types, some of which may take your fancy.

LF CONVERTERS:

A number of equipment manufacturers used to make VLF converters – these would convert the frequency range of 0 to 500 kHz to a much higher range – usually 28 to 28.5 MHz, or 4 to 4.5 MHz, sadly the only company that still seems to manufacture these now is LF engineering in the USA. Converters are very useful for listeners with deaf receivers, or who don't have sufficient LF or VLF coverage on their existing unit, and those listeners who know how to handle a soldering iron should be able to find circuits for simple to make ones on the Internet.

SECTION TWO: ANTENNAS FOR BEACON RECEPTION

AERIALS:

When it comes to aerials for NDB DXing, a directional aerial such as a 'Loop' or 'Frame' type antenna is a very useful thing to have, especially because this will enable you to 'null out' some of those unwanted signals by rotating it away from the direction of the interfering beacon. Many NDB enthusiasts use the antennas made by UK company Wellbrook Communications, who produce both small one metre diameter metal loops like the ALA1530 or LFL1010 which can be mounted on a rotator at ground level, and take up very little space (and aren't quite so noticeable if you happen to live in an area where aerials are frowned upon), and larger large aperture wire loops such as the ALA100. You can find out more about these on the Wellbrook website at: http://www.wellbrook.uk.com

Of course you can always build your own loops, this can be great fun and you can come up with all sorts of interesting designs for indoor or outdoor use. Many people do this, and have great results with an indoor 'tuned' loop, but beware of having these anywhere near to your PC if you are using one, or you may find that you drown out all the signals you are trying to hear with all the interference that it picks up from the PC's base unit and monitor.

Active whips are another good option and good results can be obtained using one of the many types of 'active' antenna, which are readily available on the radio market. A number of US companies specialise in making active vertical aerials especially for the LF enthusiast, and these are reported to give excellent results. US DXer Steve Ratzlaff, AA7U has designed a superb active whip and details of this can be found here: http://www.arrl.org/files/file/Technology/tis/info/pdf/0109031.pdf

Another excellent active antenna which has proved to be a godsend for those who are badly lacking the space to put up larger aerials, is the "PA0RDT MINI-WHIP", which was designed and is produced by top Dutch NDB DXer Roelof Bakker, PA0RDT. This tiny antenna has been developed to work in a package that is barely more than about 4 inches (10cm) in length, and because it is so small it can be easily mounted in all sorts of hidden places where it won't be seen by any of your neighbours. It is also very useful for portable and mobile operations too. I have tried my unit in a number of different places, and at the moment it is sitting quite happily (and unnoticed) at the top of the wooden pole used to support my wild bird feeders. Versatile it most certainly is, and if space is a problem for you, or neighbours are a problem, then this may be just what you need. Roelof is currently willing to build these for anyone wanting to get their hands on one, and you can contact him for more information at: pa0rdt at amsat.org (Note: replace the 'at' with @).

The antennas mentioned are just a few of the ones in use by many NDB enthusiasts, many other use Longwires, Beverages, K9AYs, EWEs and numerous other designs, your choice tends to be largely dependent on how much space you have available, and what you are trying to do with it, and if you happen to be a home brewer or experimenter then there are lots of other designs that you might want to try out.

ANTENNAS FOR HF

If you are interested in monitoring the beacons on 28 MHz, or any of the other Bands on Shortwave, then many of the antennas mentioned in the previous section will also work on these frequencies as well, but if you happen to be a radio ham, as many beacon enthusiasts seem to be for some reason, then many of your existing HF antennas will be more than adequate for the job. Easy to make designs like the G5RV, or Centre Fed Doublet, or just a simple dipole cut for the 28 MHz Band will all give very good results, though do bear in mind that many of the HF beacon operators use Vertical antennas to transmit their signals, so I always like to have the option of being able to switch to one of these sometimes as reception will be better on one of these than on an horizontal antenna. The more antennas you have the better, sometimes one will favour a particular part of the world and it's nice to have the option of being able to try different ones.

ANTENNAS FOR VHF, UHF and UPWARDS

For those who like to monitor the beacons on 50 and 70 MHz Bands you may well find that a simple dipole cut for those frequencies works very well, because when the signals are coming in via Sporadic E they can be very strong, so don't always require high gain antenna systems. Some enthusiasts will use a rotatable beam antenna, but as with anything else, what you can afford and what you are able or permitted to put up at your home location will vary greatly, so it's worth checking a number of the ham radio dealers' websites to see what sort of antennas they have on offer for these bands. Likewise with the 144 and 430 MHz Bands (440 MHz in North America), many hams will have a dual or tri-Band vertical collinear antenna, and possibly also a horizontal or vertically polarised beam antenna mounted on a rotator as well, so these are ideal for checking the beacon allocations. I personally use a Tri-Band vertical collinear and this covers 50, 144, and 430 MHz, and allows me to monitor all three bands with it, it does have reasonable gain on the latter two bands, and also offers omni-directional coverage, so it makes a useful starting point. The problem with beam antennas is that they tend to only pick up in one direction, which is a great asset when you know which direction the signal is coming from, but you won't hear very much from other directions unless you know where to point it, so having a vertical to find the signal and then being able to identify the direction the signal is coming from and then turning your beam in that direction offers the best of both worlds.

Many ham dealers will stock beam antennas for 1296 MHz, but the big problem with this band can be losses in the feeder system, which can get quite severe if you happen to have a long run of feeder connected to it. A short feeder and a small beam taken to a local high spot may give the best results, but with the antenna elements being relatively small at these high frequencies (23cms), you can get antennas giving very high gain figures without requiring an articulated lorry to carry it around with you.

For antennas at frequencies above this band you will likely be having to home brew them, and I don't have sufficient knowledge of these to offer any advice here I'm afraid. As with all antennas there is great scope for experimentation, so try things out and see what works best for you and at your chosen location is the best bet, you may be surprised at just what you do manage to hear, and I'm sure any Beacon ops will be only too happy to hear that you have heard them in these specialist bands.

SECTION THREE: AUDIO FILTERS

DSP AND ANALOGUE AUDIO FILTERS:

If you are stuck with a set which doesn't have particularly good IF Filters (and unfortunately many of us are), then a useful tip is to use an outboard 'Audio Filter' (like the Datong FL3, Timewave DSP-599zx and MFJ-784B DSP Filters etc.). This will enable you to achieve very narrow audio bandwidths, often as low as just 15 Hertz. These can aid you greatly when it comes to 'digging out' many of the weaker signals, which may be masked by the carriers from other beacons or nearby signals. Another advantage of these filters is that they often also include a 'Peak & Notch' facility, and this can help with the removal of unwanted audio tones or interfering carriers. Even if you do have good IF Filters installed in your radio it is still worth adding one of these to your listening setup anyway, since it will be yet another tool in the fight to aid you in the search for weaker 'DX' beacons. 'Noise Reduction' is yet another option offered by many DSP filters, and this can also prove useful for the weak signal chaser under certain conditions.

I have been fortunate enough to have both a Timewave DSP-599zx DSP Filter and a MFJ-784B DSP Filter in my shack, and this has proved a real asset Beacon DXing. As I mentioned in an earlier part of this publication, many channels will have a French 'A1A' beacon operating on the same channel as an A2A or Non A2A beacon's carrier signal, and this can result in a very loud whistle from the heterodyne shattering your eardrums (very painful if you wear headphones for your DXing), and a rare catch might well be being obscured by this whistle, so without the use of a notch filter you probably wouldn't even be aware that it was there. Short of waiting for months (or even years) for the beacon to go off air for servicing and leave the channel clear, you may never get a chance to hear it unless you can employ some other tactic, and this is where the DSP filter's many functions may start to come in useful.

On my filters an 'auto notch' facility is included, and this has proved to be very effective at notching out these large carriers, and leaving the French NDB idents just audible underneath them. In just the first 6 months of usage this technique had netted somewhere in the region of 30 first time catches. Not only has this worked with the French A1A beacons, but has also proved very effective at sorting out the 1020 Hz offset idents from the carriers frequencies just 20 Hz away as well. With the audio bandwidth set to around 10 Hz and the auto notch switched in, I've been able to hear a lot of very weak and distant idents that were previously masked by these carriers. I don't want to sound like a salesman for Timewave and MFJ, and I'm sure that all the other makes of DSP filter are probably just as effective (if not more so), but I'm just trying to point out that the large outlay of cash required for buying one of these devices can be well worth making if these are the sorts of results that you are looking for. My DSP filters are now an essential part of all my current beacon DXing sessions, irrespective of which Band or type I am listening too.

One piece of advice for users of the MFJ-784B - I discovered that my 'auto notch' didn't work when the filter was switched into the 'CW' position, though the 'manual notch' did. I found this could be overcome by switching to the 'BP' position on the mode switch, and setting the bandwidth using the 'low' and 'high' knobs. The downside of the DSP notch is that it is so good that it can be 'too effective', and completely remove everything. This is useful when you are listening to SSB, but counter productive when digging beacons out from underneath a carrier. I discovered that I could deal with this problem in one of several different ways - firstly by using the DSP Filter in the 'CW' position and switching in the 'noise reduction' button instead of the notch filter - this didn't remove all of the heterodyne, but did get rid of enough to make hearing anything left underneath still possible, and the second method, and the one that I ultimately chose, was to connect my Datong FL3 analogue filter in series with the MFJ (output of the FL3 to Input of the MFJ) filter. By using a combination of the 'by-pass' buttons, and the Datong's analogue 'auto notch', I was able to reduce the carrier enough to hear what was left underneath, and then use the MFJ's 'noise reduction' to clean up some of the remaining noise.

On rare occasions and under really desperate conditions both filters have been used at the same time, usually with both 'peaked' for maximum, though this can of course get very complicated. Nevertheless, if you have just purchased a DSP filter and don't know what to do with your old analogue filter, the above solution is well worth trying. Don't throw your old filter away or mothball it, analogue filters do still have some advantages over the newer DSP variety. This method should also work well with other types of DSP filter as well as the Timewave and MFJ varieties, though not having had any personal experience with all of them I can't give any assurances that they will definitely work.

I hope this publication has helped to point you in the right direction, and if you have any problems then I recommend joining a group such as the NDB List, where you will find many members only too willing to offer you advice and help you to get started, beacon DXing is great fun.