



# COAA Software Gold Mine

## Part II: Radio Clock and BeaconSee

By John Catalano

As I wrote last month, I have found the Centro de Observação Astronômico no Algarve (COAA) website to be a “gold mine” filled with many interesting and unique radio programs. Last time, we explored just two COAA “veins”: OrbcommPlotter and PlanePlotter.

OrbcommPlotter easily qualifies as a unique label. It is the only program I know of that tracks and decodes signals from low earth orbiting satellites (LEO). And, if it has to do with tracking and plotting commercial aircraft, PlanePlotter is up to the job with its decoding and plotting of VHF ACARS and HF ACARS signals. Selcal decoding and direction finding and plotting are also part of the PlanePlotter package.

There is much more gold to be had on the COAA site ... if we keep digging.

### ❖ Simultaneity just a Phantom

Setting our PC clock to the “correct” time can be very important. It’s the difference between catching that rare scheduled DX or just hearing hiss. But one of the conclusions drawn from Einstein’s theory of relativity is that there is no such thing as an event occurring exactly simultaneously for two separated observers. Not even setting two clocks.

Why? Well, to start with, there is no preferred frame of reference. Wherever each of the observers is in space (x,y,z) and time(t) is the “correct” location, and light will have a constant speed at each location. That’s just the starting point for evolving the concept. But suffice it to say, simultaneity does not exist, and setting two clocks to exactly the same time is not possible.

The key word is “exactly.” In the space-parameter tolerances of our everyday lives, we can neglect the extremely small difference and call an event simultaneous. But remember, we are defining our own “reality,” which is different from the reality of the universe. (Perhaps you can use this fact of Einstein relativity on your boss next time you are late to a meeting ... that is, if he is not a physicist.)

Now having said all that, how would you like to have a free program that sets your PC’s clock to the “exact” time of a cesium atomic clock? OK, so it’s not quite exact, but it is really for free!

### A Radio Timepiece

Most of us remember, with nostalgia, our early days of radio monitoring when we first heard the rhythmic pips of a time standard station. In the USA it was WWV and its sister stations, although CHU Canada was my first logging. In Europe you probably listened to MSF from Rugby, England, or DCF77 Germany on longwave. In Asia you had RWM from Moscow and in Australia VNG. Just about anywhere on the globe you can receive a time standard station.

Feeding the audio signal from any of these time stations into COAA’s Radio Clock program will guarantee that your PC’s clock will be synchronized to an atomic time standard. Then all PC time-sensitive applications will be “on-the-money.”

### Tempus Fugit

Let’s get right into it. Download the free 500kB program from the COAA website [www.coaa.co.uk/radioclock.htm](http://www.coaa.co.uk/radioclock.htm). Running this self-extracting program will lead you through the simple and quick setup procedure. Connect the audio output of the receiver to the PC’s soundcard’s mic or line input. Using the soundcard mixer screen, ensure that the input is not muted and is set to mid level. The mixer screen can be accessed from the Control Panel or via a right mouse click of the speaker icon in the lower right program tray.

Soundcard calibration is a major part of the setup program. It all happens automatically with just a mouse click or two. One more setting and we’re done with set-up.

Time stations use Universal Time Coordinated (UTC) or Greenwich Mean Time (GMT) standard for their time “zone.” GMT is defined as the time at 0 degrees longitude, called the Prime Meridian. UTC is a similar standard, but uses terrestrial and celestial co-ordinates. For our purposes the two are equal.

Radio Clock automatically converts UTC/GMT to the PC’s local time zone once we enter how many hours our time zone is offset from GMT. We are now ready to go about the business of radio monitoring.

### Time to Tune

For our first attempt we’ll tune to a time station with a strong signal and minimal signal fading. From the Command menu under the “Transmitter” menu, select the time station you are monitoring. This automatically selects a decoder mode to match the station’s digital time encoding method.

Now look at the top right of Figure 1. There you will see a broken vertical line. Tune the receiver so that the horizontal white dashes pass through the line break. Radio Clock makes Setup and tuning very simple.

Going back to my listening roots, I used CHU Canada on 3330 kHz. Figure 1 shows Radio Clock displaying CHU audio. Using the PC’s mixer screen and receiver output (if variable), adjust the level of the source until it appears as in Figure 1. Too high a level and the pulse will not be cleanly formed and noise will fill the spaces between the pulses.

Once correctly tuned and the level set properly, allow the program to run for a minute or two. When the program synchronizes to the station’s data, the small windows at the bottom of Figure 1 will display some interesting data. First, the program’s last reset time, in our case, 10:03. Next are the synchronized time and our GMT offset, 10:03:30 [UT-05]. And finally we see our PC’s clock time, 10:03:28. Comparing the last two windows shows that the PC clock is 2 seconds behind real time.

We can use this info to manually set the PC’s clock to the “exact” second. If you want (or need) continuous automatic PC clock setting, you’ll have to pay 25 euros to register the program. This will enable the automatic PC clock setting function.

The program’s excellent Help file has a wealth of information. Here is what it says about CHU, “Unlike the other signals decoded by Radio Clock, CHU (Canada) uses a single sideband transmission with re-inserted carrier. As such, it can be received in AM mode as well as SSB. If SSB or CW mode is used, the tuning does not need to be offset in order to recover the correct data tones, which encode the time information. The date time code is contained within a 300 bps asynchronous data stream transmitted following

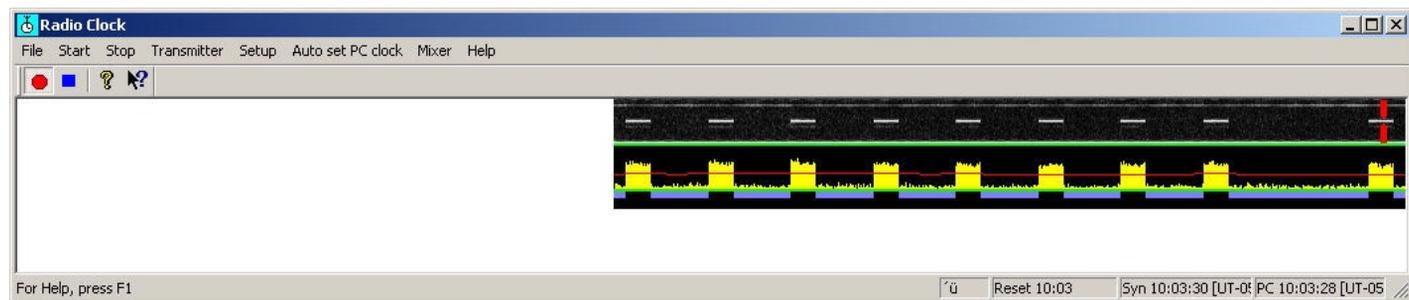


Figure 1 - Radio Clock’s one and only display.

the 1 kHz seconds pulses for each of the 31 to 39 seconds in each minute. The minute marker is a full second of 1 kHz tone.”

Don't miss exploring Radio Clock's Help file.

### Time's Up

I enjoyed using Radio Clock and decoding different time signals on short and long wave. The only problem I encountered was a displaced display as seen in Figure 1. No matter what program or PC display setting I tried, the result was the same. The spectrum display was pulled to the right and the lower right operation windows were not fully open. This was just a minor irritation in an excellent program.

Radio Clock is free, so give it a try. It's a nice meld of radio monitoring and useful computer application. Now let's dig for another nugget.

### ❖ “Seeing” Propagation in Real-time

The Northern California DX Foundation, NCDXF and the International Amateur Radio Union, IARU, have set up eighteen shortwave beacons at various locations around the Earth. The

purpose of these volunteer operated beacons is to “... help amateur and commercial high frequency radio users assess the current condition of the ionosphere.”

The NCDXF website [www.ncdxf.org/Beacon/BeaconSchedule.html](http://www.ncdxf.org/Beacon/BeaconSchedule.html) provides location, callsigns, sample audio files and current operational status for each beacon. This is their description of a beacon transmission, “A transmission consists of the callsign of the beacon sent at 22

words per minute followed by four one-second dashes. The callsign and the first dash are sent at 100 watts. The remaining dashes are sent at 10 watts, 1 watt and 100 milliwatts.” The decreasing power levels add another dimension to the resulting propagation information.

Each beacon transmits every three minutes, twenty-four hours a day on an exacting time schedule. However, this is done in a pre-determined sequential pattern with one beacon starting immediately after the other has finished. Each transmits for ten seconds during its allocated time period.

The beacons use four frequencies, 14.100, 18.110, 21.150 and 28.200 MHz, but not at the same time. For example, once all beacons have had their 10 second transmission on 14.100 MHz, they all move up to the next frequency, 18.110 MHz, and again start their sequential transmissions.

The key to utilizing this methodology is accurate timing. The PC which is controlling your receiver's frequency must have its time set accurately. If it is off, it will be “looking” on frequencies for transmissions that have long ago ended.

Hummm, accurate timing. Sound familiar? This is where COAA's Radio Clock can set your PC's time accurately so you will be on the right frequency at the right time.

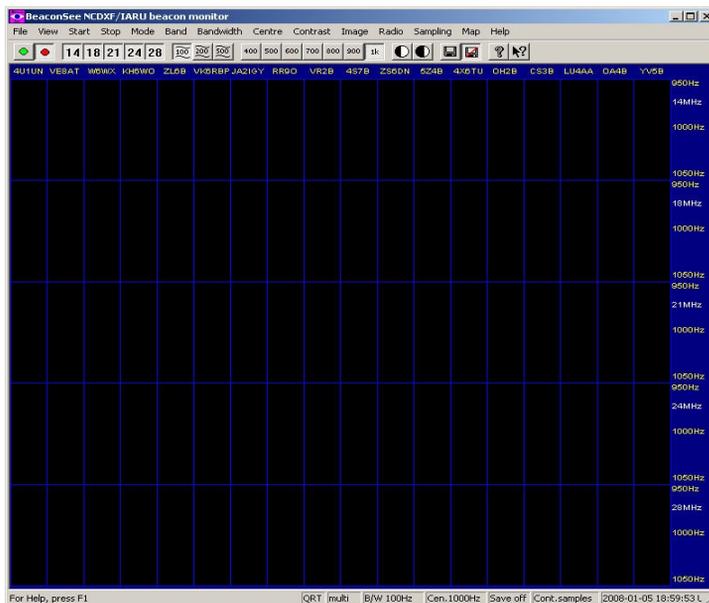


Figure 2 – BeaconSee's full screen during set-up.

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## Beacon Hopping

If you have one of the listed controllable receivers, COAA's program BeaconSee will keep step – in frequency and time – as the beacons “do their thing.” Using the receiver's audio and some fancy calculations (fast Fourier transforms), the program produces a spectrum display for each beacon. The received signal strengths are plotted for each beacon versus frequency and time. This gives the user an accurate, real-time, visual representation of ionospheric propagation conditions over the entire shortwave spectrum. Now what SWLer or ham couldn't use that? Let's see more about BeaconSee.

## “PSee” Requirements

As with other COAA programs, BeaconSee requires very little in the way of a PC. A PC running Windows 95/98/2000/XP, a free serial port and a 16-bit SoundBlaster-compatible sound card that supports audio capture at 8k samples is all the PC that you need.

For automatic operation, a serially controlled receiver is required. In my opinion, this is only way you should consider using this program. BeaconSee works with many serially controlled radios including: Icom, Kenwood, Winradio and Yaesu and the TenTec RX-320.

If your receiver can be controlled via a serial port but is not on the list, it would probably work using the “Generic” radio set-up menus. The details of the receiver's control command structure and some patience will be needed.

Even using listed receivers, you may be required to manually enter a few of the radio's interface parameters, such as baudrate, word-width, stop bits and parity setting, and for some models the radio's digital address may be required.

After downloading this 700kB program,

unzip and then install it. While you are at it, also download BeaconMap from the COAA website. This program produces a world map displaying the location of the beacon stations. Install it in the BeaconSee directory.

Trying to run the program on a Windows Vista PC gave me problems. (Thank you, Vista, yet again!) If you are using Vista, I suggest that you run the program under the Windows XP compatibility. Do this by right clicking on the BeaconSee, BeaconMap and Help files. Then choose “Compatibility,” Windows XP (Service Pack 2) and select “Apply.” After performing this, the programs worked fine under Vista.

## Seeing More

When BeaconSee is run, you'll be presented with the screen seen in Figure 2. As in Radio Clock, all program functions are accessed from one screen. The layout is also similar, with Command menus at the top, spectrum display in the middle, and small function indicators (telling us what the program is doing) at the bottom.

From the indicators in Figure 2, we can see that we have selected all frequencies sampled continuously, with a bandwidth of 100 Hz and a center frequency of 1000 kHz.

The spectrum display in the center of the screen looks like a checkerboard. Each of the eighteen vertical columns represents a beacon location. The four horizontal rows are the four transmit frequencies. This is where the signal strengths of the beacons will be displayed.

Using the excellent figure from the Help file, Figure 3, we focus on just the transmissions on 14 and 21 MHz from the last nine beacons in the chain.

Look at the column labeled OH2B, the Finland beacon. We can see that its 14 MHz signal is a visible bar of good size. However, OH2B's 21 MHz signal is almost nonexistent

as seen by the blank area. The Sri Lanka 4S7B beacon shows similar propagation conditions for these two bands.

This means that at this time, from this receiver location, frequencies around 14 MHz are the place to look for transmissions from Finland (Scandinavia) and Sri Lanka (South Asia). Conversely, right now, forget about 21 MHz for monitoring these areas of the world.

Now look under the LU4AA column. This Argentine beacon has just the opposite propagation results. LU4AA's 21 MHz signal is much stronger than its 14 MHz. Remember, propagation results will always be unique to the locations of the transmitters and receiver.

## Seeing the Difference

Over the years I've used quite a number of propagation prediction programs. The difference with BeaconSee is that it is the real thing, in real-time, not a prediction or guessimate.

Assimilating all the information on BeaconSee's spectrum screen takes a bit of finesse. There is a lot here. But after an hour or so of use you'll be surprised how much propagation information you can glean just from a quick look at BeaconSee.

BeaconSee is available for free at [www.coaa.co.uk/beaconsee.htm](http://www.coaa.co.uk/beaconsee.htm). If you register the program for US \$29, a number of added functions are enabled including sampling beacons at periodic interval to get a full 24 hours of history and unattended screen savings at user-defined times. These features will allow you to automatically build and save a history of actual propagation conditions from transmitter points around the Earth. Just sitting and watching BeaconSee is a fascinating activity.

## ❖ More Plotting

No, I'm not referring to plotting against Julius Caesar on the Ides of March. I'm talking about yet another COAA program, ShipPlotter. Made in the form of the other COAA plotter programs, ShipPlotter decodes and plots maritime AIS, automatic identification system transmissions. All it takes is the program and a radio capable of receiving 161.975 and 162.025 MHz.

## ❖ More Decoding

The DSCdecoder program decodes digital selective calling (DSC) signals used by ships in the MF, HF and VHF bands for distress, ship-to-ship and ship-to-coast station communications. It can also decode Navtex and Vessel Traffic Service (VTS) messages.

As for this article, we are out of time. But watch for coverage of COAA's ShipPlotter and DSCDecoder in future *Computers & Radio* columns.

I hope you'll now agree, the COAA site is a gold mine of unique radio programs. Try some of them and let me know what you think.

## CONTACT INFORMATION

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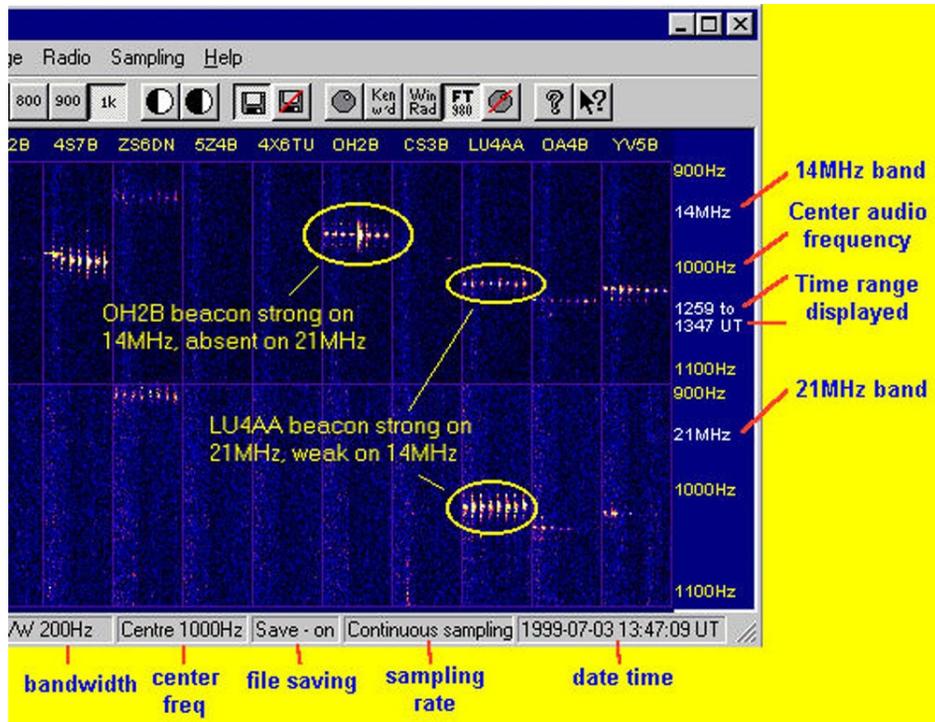


Figure 3 – Zooming in on part of a working BeaconSee spectrum screen