

# CAMBRIDGESHIRE REPEATER GROUP



Newsletter Number 38

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# Editorial

I have to apologise – the intention was to produce another two newsletters before the AGM on November 18<sup>th</sup>. Sadly, computer problems (Self inflicted!) and other more pressing activities caused an unavoidable delay. Still, here it is at last, and the delay has helped in one way – I went to Eire for a weeks holiday, and while there visited the Mizen Head Signal Station. Commissioned in 1906, it only became automated in 1993. I found it fascinating (not least the aerial masts), and if my photographs come out well I hope to put together an article for the next issue.

I thought I'd try something a bit different this time for the competition, which whilst not exactly radio-related, should appeal to all the family and make us slightly less 'anorak' in their eyes. Certainly, it has been tested on three generations of the same family and met with complete approval. Your feedback would be appreciated!

Once again, I'm sorry about the unavoidable delay, but I hope you feel it was worth the wait.

73 de Terry Bickell G0UIO



*Some equipment at  
Barkway*

**Just some of  
our repeater  
equipment**

*And some at  
Madingley*



In view of the recent changes to the UK licensing conditions, I thought the following article from the November 1968 QST magazine (The journal of the ARRL) would be of interest to our members.

*[Very many thanks to the ARRL for their kind permission to reproduce the article]*

## **“It Seems to Us...”**

### **NOVEMBER TWENTY-SECOND**

THIS is an important date for you to remember.

On this date in 1880, Lillian Russell made her debut.

On this date in 1906, the International Radio Conference meeting in Berlin adopted “SOS” as the international distress signal.

On this date in 1930 radio fans in England heard their first football game by means of a transatlantic broadcast.

On this date in 1935 the China Clipper left on the first official transpacific airmail flight.

And on this date in 1968 amateur radio returns to a system of incentive licensing which was abandoned some fifteen years ago.

We’re sure that none of the November 22 historical events occurred without a lot of work and perhaps a few false starts. There certainly has been a lot of work expended in getting incentive licensing back into the amateur radio picture, but let’s hope that there are as few false starts as possible when November 22 rolls around.

We must emphasize again that incentive licensing is not new to amateur radio, but because it was in limbo so long it is new to many present-day amateurs. Thus, in effect, we are entering a new era. We are entering an era where there will be divided bands. Small segments are being set aside, in the first step, for exclusive use by holders of the higher classes of license. The basic philosophy behind this system of incentive licensing is to provide a challenge, and added satisfaction for the individual amateur.

With greater skills, the amateur service as a whole will better demonstrate its

worth as one of the thirty-eight services competing for spectrum space, and will thus have a better chance of continuing government support for retention of present amateur frequency allocations at any future frequency conference.

Incentive licensing will work best if, in the months ahead, the segments reserved for the Extra and Advanced Class operators show greater and greater occupancy. You can bet that the amateur fraternity as a whole and the FCC staff will be keeping a watchful eye on those segments to see what activity takes place, and to note the growth trends.

You can also bet that the FCC's monitoring stations will be keeping an ear on these new band segments to check unauthorized operation. As originally proposed, the various classes of license were to have distinctive call signs, and it would have been easy to spot a non-Extra working in an Extra segment. But the Commission abandoned the concept of distinctive call signs, and such transgressions, whether deliberate or accidental, will be slightly more difficult to spot. However, each FCC monitoring station has access to central FCC records giving the operator class of each licensee. In addition there is the wide availability of the *Radio Amateur Call Book Magazine*, which shows the license class of each listed amateur. We can thus accomplish a considerable amount of "policing" on our own—remembering, of course, that there *can* be errors in the *Call book*.

What happens on November 22 will not, alone and of itself, be the basis for judging the wisdom of returning to the tried-and-true course; it will take some months of experience and evaluation to conclude with any assurance that the program is or is not working. But it is the kickoff date—as notable as the happy November 15, 1945, postwar return of the first ham bands.

We have returned to incentive licensing as one of a number of ways to strengthen amateur radio and give a renewed sense of accomplishment. November 22, 1968, is an important date—we believe it will become in retrospect a good day for us all.

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## **THOSE HAPPY DAYS IN THE FORCES**

In the early 1950's I was a radar fitter stationed at RAF Upwood in Huntingdonshire.

One Sunday morning when I was the duty mechanic in the radio servicing department I received a telephone call from the Guard Room saying they had received a message from RAF Wyton to say that someone was broadcasting 'Family Favourites' on one of the VHF channels and had D.F.'d it to be coming from our station.

The Control Tower supervisor then contacted me to find out what was going on and M.P.s came round to check on me.

By then I had turned on the in house VHF and sure enough the BBC programme was belting out at full strength.

While I was being quizzed to see if I was the culprit the transmission ceased abruptly in front of them. I was not touching anything, so was therefore guiltless in their eyes.

Fortunately a friend was in the section when the first call came through and I had sent him out to check the parked aircraft outside.

What would happen sometimes was when a wireless mechanic had finished an inspection and was filling in the time waiting for the NAAFI van to come round he would settle down in the navigators seat and tune in the 1155 receiver to his favourite station. What had happened this time was that someone had left the aircraft intercomm on and the VHF on transmit. The lad had switched the ground/flight switch back onto flight (naughty people these wireless mechanics running things off of the aircraft batteries) powering up everything.

As Snowdrops had no insight about such technical matters they went away clueless, wondering who could be the pirate.

# RADIOLOCATION IN A DEEP UNDERWATER SPRING

*John Buxton G7JSP*

## THE PROJECT:



For three months this past winter, the US Deep Caving Team (a non-profit group) led a diving expedition to Wakulla Springs State Park, which is located on the Woodville Karst Plain in northern Florida just south of Tallahassee. A total of about 150 divers and support personnel were involved for all or part of the time. The purpose was to create a 3-dimensional map of the extensive underwater cave system feeding the Spring allowing Park visitors to see more than just the huge entrance in the spring pool. Most of these large passages are 300 feet (90 meters) below the surface (and nearly 300 feet

underwater), and require world class diving to visit. Eventually, it will be possible for Park visitors to “fly” thru the passages (and over the surface features) in a manner similar to a video game. To accomplish this task, a formidable device called the Digital Wall Mapper was designed and built to collect the data. The Wall Mapper attaches to the front of a long range battery-powered “scooter” which is “flown” thru the passages by a diver . The resulting assembly is nearly as large as a torpedo. This device contains a sonar array

which creates 4 cross-sectional “images” each second. A modified Inertial Guidance System from an aircraft gives roll, pitch, yaw, true heading, and “X” and “Y” positions. The “Z” position (depth) is obtained from depth sensors. The data is downloaded from the Wall Mapper with a laptop PC and transferred to a powerful graphics workstation. Complex software was written to create a 3-dimensional image of the cave passages from the raw data. The resulting cross-sections are very accurate, but the track created by the Inertial Navigator (equivalent to the line plotted with compass, inclinometer, and tape, in dry cave surveying) contains random errors that increase with time (i.e. drift). Inertial Navigators use a gyroscopic-stabilized platform with x, y, and z sensors that detect acceleration. At the start of each run, the platform is told where it is located (x, y, z). Velocity and position can be calculated from the acceleration data, but even small acceleration errors will result in large position errors after a few minutes.

The solution to the drift problem was to place markers throughout the cave, whose location on the surface was determined by the use of so-called “Cave Radio”. . Low Frequency Magnetic Induction Beacons placed in the cave during exploration were precisely located on the surface using special receivers. These new points were tied into the growing cave map by a combination of Survey-grade GPS and precise overland survey back to a reference marker at the Spring Pool. The diver pressed a button as the Wall Mapper “flew” over each marker

## **HISTORY OF CAVE RADIO:**

Low Frequency Magnetic Induction “Cave Radios” have been used for more than half a century to precisely Radiolocate “Ground Zero” points on the earth’s surface lying directly above Beacons placed at key spots in dry cave passages. The main use of Cave Radios is to doublecheck/correct the in-cave survey and to precisely align the survey with the surface Topographic map. Specific Ground Zero points have been used to create new cave entrances; by tourist cave operators to drill elevator shafts; and by farmers to drill wells to tap the water in underground

pools.

## **HOW MAGNETIC INDUCTION WORKS:**

At Wakulla Springs, the antenna of the underwater Beacon consisted of a ring-shaped loop of wire 2 feet (0.7 mtrs) in diameter lying flat on the floor of the passage and precisely leveled. A simple battery powered circuit forces

several amperes of alternating current through the loop at a frequency of about 3500 cycles per second (Hz). The magnetic field looks like the field produced by a classic “bar” magnet standing on one end. The field directly above the Beacon is exactly vertical.

The Receiver uses a similar sized loop to detect the magnetic field which reaches the earth’s surface. In use, the Receive loop is held vertically and slowly rotated to find the direction of weakest signal (the null). Ground Zero lies along the Line Of Position (LOP) passing thru the plane of the loop. If the operator moves some distance perpendicular to this LOP, a second LOP will be obtained which crosses the first directly over the underground Beacon. As he approaches this intersection, the operator will soon arrive at a point where the Beacon signal nulls in all directions with the Receive loop held precisely vertical with a bubble level. This is Ground Zero.

The receiver has a calibrated digital readout of signal strength which allows approximate determination of the depth of the Beacon by any of three different methods. This feature is very useful in dry caves with rugged surface terrain but the diver’s digital depth gauges were all that were needed at Wakulla.

## **GEOPHYSICS:**

The electrical conductivity of the limestone affects the strength and shape of the magnetic field generated by the Beacon in the cave, therefore knowledge of conductivity can help in the design of the

## Radiolocation gear.

The electrical conductivity of the water at Wakulla Springs is reported to be .028 S/m (mhos/mtr). The Radiolocation gear was used at Wakulla to obtain a rough estimate of the conductivity of the limestone at various depths by using a Beacon on the surface. The technique consists of measuring the relative strengths of the primary and secondary magnetic fields at measured distances from the Beacon corresponding to the depth for which one wishes to know the conductivity. Only simple calculations are needed. The few measurements done so far give about .01 S/m (mhos/mtr) down to about 10 meters and .014 S/m from 20-100 meters. The passages at Wakulla are mostly formed in the soft and porous upper Suwannee limestone. The high measured conductivity should be expected with this soft limestone saturated with water. For comparison, measurements over typical dry caves in the US have yielded conductivities of .003-.005 S/m.

An experimental technique was used to derive a crude “bulk” , or average, conductivity for the limestone both above and below the cave passages. Signal strength data was taken with the Beacon on the passage floor at a depth of about 300 feet and reduced with a magnetic field simulation program to yield an average conductivity of .019 S/m. Note that the “measurement includes the limestone up to 300 feet below the cave passage and not just the rock above.

While doing the Ground Zero locations at Wakulla, it was observed that some LOP's gave much sharper nulls than others. That is (in the absence of electrical interference), there were always two directions (180 degrees apart) which gave a very sharp null as the operator approached ground zero. The same effect was observed while doing the conductivity measurements with both loops on the surface, although conductivity in different directions seemed to be the same. The cause of this assymetric behavior (called anisotropy) is not known, but has been observed elsewhere when doing deep measurements and could be related to vertical jointing in the rock in a particular direction.

The deepest null always seems to occur at right angles to the poorest null. This effect was studied during the expedition by recording the magnetic bearing of the sharpest nulls over selected ground zero locations when power line and atmospheric noise were low.

The geophysics (including depth measurements) is a personal interest of the author, and was carried out only on a “not to interfere” basis during the actual expedition.

## **RESULTS:**

The Wall Mapper was used to collect data in nearly all of the passages under the State Park and for nearly 2 miles (3 km) to the south outside the park. I was able to successfully locate 35 beacons placed in the cave, all of which were eventually precisely located by GPS/surveying. We also did 7 locations in another cave in the Park. Early on, I had the only total flooding of a beacon/battery case. I revived the electronics, which lasted for a couple more dives. I also had two cases where the toggle switch shut itself off after deployment by the divers. I added a locking bar to each switch. I had one case where moisture actually stopped a beacon by stopping oscillation of the quartz crystal and a couple of failures attributed to diver errors. This is only 6 failures to 42 successes which is pretty good given the high task loading of the divers, who often had a 4 hour (or longer) bottom time at 300 feet (90 mtrs). It is possible that some of the locations will be used in the future to drill water quality monitoring wells into the cave passages. The virtual reality map is still being created.

Lessons learned: (which could be a separate article! It was written separately)

### **RADIOLOCATING AT WAKULLA SPRINGS, FLORIDA Lessons Learned**

1) My 3496 Hz gear was adequate for the task, despite the 300 foot (90

mtr) depth and very high electrical conductivity of the soft water saturated limestone. I measured a 2000 foot (600 mtr) ultimate range in a quiet location with a beacon at 90 meter depth. This was during a very quiet morning in winter. 300-400 meters range was more usual. Powerline interference was a significant problem. More poles of filtering in the receiver might help.

2) Using the known depth of the beacons and the absolute signal strength at ground zero, I calculated an average “bulk” conductivity of .019 Siemens/mtr. In my experience, typical “dry” cave limestone conductivity is 5 times less at about .004 S/m

3) Anisotropy was observed at most locations, sometimes completely filling in the null at long ranges. At every location, there was always one direction (LOP) with a sharp null, with the poorest null on an LOP 90 degrees away. The field caused by the anisotropy is a horizontal magnetic field perpendicular to the LOP, just like the far (radiated) field, which it probably is. At maximum range it is the *only* field that can be heard!

4) Even double o-rings (on the underwater beacon/battery cases) can leak. Rubber covered toggle switches can turn themselves OFF underwater *if* they were first turned ON at depth.

5) One needs twice as many beacon/battery cases as loop antennas. The 12V/7AH batteries had to be recharged on the surface before the next use. The loop antennas remained underwater throughout the project, often stuck for days with a dead beacon/battery case.

6) Electrostatic shielding on the receiver loop antennas gave slightly better results by eliminating any electric field pickup.

7) Built-in beacon self-tests, used both on the surface and by the divers, proved very useful. Most of the beacons had delayed turn-on, mostly 20 hour delay to turn on at the quietest time the next day (9AM-1PM

local). When first switched on by the diver there was a red flash and a chirp if the loop antenna was properly connected. This was an actual momentary transmission. A green LED would slowly blink to show that the delay timer was running. The actual delay setting was visible thru the plexiglass case.

8) The most effective method to locate ground zero was to walk along an LOP until the signal became quite strong, then turn the receiver loop perpendicular to the LOP and check how close the field was to vertical. At times near buildings or ground zero, ground zero was very noisy, so the crossed LOP method was used from two quieter locations.

9) An older handheld GPS with US Coast Guard differential corrections (from ~300 kHz beacons) gave very good results in getting the coordinates of ground zero locations even in the old growth forest in the State Park. I simply recorded 350 or more track points in the GPS-45 which were later downloaded to a laptop using the freeware program Waypoint+. I simply “eyeball averaged” the displayed track plot and read out the UTM coordinates (in meters) in the desired datum with the cursor. A modern GPS with built-in averaging should give similar results without downloading, but there is no way to ignore the occasional very large excursions, and no way to learn how the tree cover affects the size of the plot, etc. The average error over 38 ground zero locations, mostly in old growth forest, was 3.8 meters, which was an excellent reality check for the later precision surveying done with a Trimble centimeter level GPS receiver and/or Leica Totalstation.

10) The Trimble GPS receiver would not work in the forest. In most cases it was successful only in open fields, roads, or light brush. The 25 watt UHF radio link to the reference station worked everywhere. It required 5 satellites, *both* civilian and military frequencies, and very little multipath (signal delays caused by trees or reflections). It measures signal phase. The multipath and poorer signal to noise ratio on the military frequency usually prevented a solution in the forest.

11) The 35 precision points installed in the cave with the radiolocation gear proved to be essential for correcting the drift of the Digital Wall Mapper. The weakest point in the whole process was getting the divers to record the number of each beacon point as they flew over it. They pressed a button as they flew over each point, but there was often no Log for sorting out points. There were often false points even though there was a 30 second “debounce” on the button.

12) This project was perfect for testing my ability to measure the depth of the beacons. The geology of the area is simple with flat lying limestone from the surface to well below the flooded cave passages, with the water table just below the surface. The topographic map gave the elevation of the ground zero points above the spring pool in the rather flat terrain. The diver’s digital depth gauges gave depth below the spring pool. The average of the Ratiometric and Absolute methods gave depths within a few feet of actual.

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*The Barkway site*

# **Amateur Radio in Canada**

*Gerald Gardner G0HEM*

The season of rallies is with us, that, coupled with the timeless request of “articles please” has provoked memories of two visits to the North Okanagan Radio Amateur Club (NORAC) “Sky High” Hamfest in Canada.

This particular “rally” was held at the “Sky High” ski resort - about 5000 ft up a mountain 6 miles from Vernon (roughly midway between Vancouver and Calgary - that’s 500 miles each way!). Note that distances come into this straight away!

The event starts on a Friday evening with an “Pot Luck” barbecue - everyone brings something and shares. Delegates came from about a 500 mile radius, are charged about £10 for the weekend and can either stay in Camper Vans “RV’s” or book into one of the resort hotels for about £20/room/night.

The Friday evening lecture, on our first visit, on Optical Astronomy was followed by practical demonstrations on several DIY telescopes in the car park. The view of the sky from that altitude, remote from light and atmospheric pollution, was incredible.

Saturdays lecture series included any equally memorable presentation on radio astronomy by a research worker from the local (100 miles away) radio astronomy group.

Amateur Radio discussion sessions included the usual reports (and moans) about repeater performance- but the Canadians problems are very different! Several of their repeaters are on mountain tops - completely cut off for about half the year by snow. Some can only be reached by begging a helicopter ride and others are in areas protected by very strict environmental pollution laws that severely restrict motorised ac-

cess.

The other surprise was the way in which repeater are linked *across the continent* - not only by conventional local linking but also by a satellite system known as IPARN (Inter Provincial Amateur Radio Network). This system allows the amateurs to connect to local links, then hubs to the geostationary satellite then to remote provinces - at least a 3000 mile footprint linking east and west Canada. Needless to say procedural discipline and responsible use are vital since it is all in the hands of the individual operators working with touch contact keypads from “handy talkies”.

Another highlight in 1997 was the launch of a balloon 70cm/2m crossband repeater. This beastie was supported by 3 helium filled meteorological research balloons, which carried the batteries and repeater components - its output was on the 2m calling frequency to make sure it was heard. It was tracked for about 12 hours reaching over 20,000 feet and about 500 miles down into America. The control station nearly swallowed his microphone when he got a call from a “G” station 10 minutes after launch - he was not impressed to hear the location was the launch car park! (We are still on speaking (email) terms). This year’s experiment will have on board GPS so position and altitude are continuously reported.

There were about 120 registrations for this major event and the two major traders thought it well worth their while to travel 500/600 miles to attend! There were about 12 other stallholders and a car boot sale that ran for about 3 hours on the Saturday morning. Saturday evening was fun time! - Including a very long and accomplished solo musical event by a very talented local amateur who played and sang on an enormous range of instruments including banjo and violin with the aid of a plastic coated clothes hanger.

If you ever have the chance of sampling the Okanagan hospitality - take it. The experience was enough to make Mary seriously think about getting a licence! The Okanagan is also one of the major fruit and wine

centres of Canada is hot in summer and boasts at least two desert regions! More details of this years balloon experiment can be found on their web page <http://www.junction.net/norac/>

Thanks are due to NORAC for their hospitality and to Wilf, VE7OHM, who has edited this for factual accuracy.

Our challenge is how to offer similar hospitality and interest if/when they take up the offer the visit this corner of the world. (Finances and multiple weddings prevent us returning yet again to a fascinating place)



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*This message carries a health warning!*

# **Reflections from the E layer - or how to enjoy Sporadic E without the frustration**

*John Worsnop G4BAO*

I was moved in June to respond to a mail on the VHF- DX mail reflector about someone who was complaining about the “competitiveness” and general operating standards of people in 2m Sporadic E openings. I like DXing on both HF and VHF but am frankly AMAZED by some people who call the DX as if their lives depended on it. But.... if that’s what turns them on, I say live and let live.

I just want to reflect for a few minutes why we do this strange thing, because lets face it, DXing is a bit like train spotting with aerials.

I got a huge kick out of one of the Es openings this June, despite the fact that I’ve been working Es on 6,4 and 2 for 25 - plus years, and I thought I was getting old and cynical.

I was working “the usual suspects” on Six metres (Poles, Yugoslavs, Latvians) and watching the DX cluster when I saw the 2m spots pop up. “Just for a laugh” I connected my scanning receiver to my 2m vertical (the 2m beam came down a few years ago to make way for the HF minibeam), tuned to 144.3 and was gobsmacked when I heard one of the Romanian (YO) stations. With a frantic patching of antennas and a big grin on my face, I connected the 2m rig and my 100W linear to the vertical and piled in. To my amazement I got YO2JW and YO2FRJ/P in the log, but quite frankly I would have been just as happy to have been able to say I’d heard them on the “wrong” antenna.

(My XYL commented later ‘you were doing a lot of “Alpha Oscar” this evening’)

Anyway, the point of my ramblings. Temperate zone Es propagation is a big leveller, that’s why its so much FUN especially at 2m. You

don't need a big ERP, the "footprint" over which you can hear the DX is relatively small, if its over your house for the seconds you call, you'll get in. The guy with the 1kW to 14 elements 10 miles away may not even be hearing the DX at the same time as you. There's no "correct procedure" its 75% luck and 25% timing of your call, and importantly, LISTENING to the DX station and calling when they are listening. The biggest reason people do not work stuff in Es openings is not operating technique or equipment that they are not there at the right time! No one can (or wants to I hope) watch packet clusters and listen to white noise all day, so get a group of like minded friends to agree to phone each other if it happens, and don't get frustrated if you miss a few.

If you are there and miss the DX, so what? there WILL be some more Es openings ("you cannae change the Laws of Physics Captain"), but most of all ENJOY the openings you are lucky enough to hit, HAVE FUN. Even if you work nothing, you are seeing the most fascinating example of Ionospheric Physics in action, and witnessing the effect of a natural phenomena that the best scientists in the world can't predict to save their lives!

73

John G4BAO

(self-confessed Es junkie)

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Just to set the record straight – G6KJR has done wonders reconstructing this old heap (the house, not the cat!) But it's been the best wind-up I've had on 2M ever... Catch you all soon.

Terry G0UIO

# Competition

Simply solve the clues (all answers in 'old' money), and add them up to give a total sum. Should be no problem for a G3 or a wrinkly G0 like me, but let's see who else comes up with the correct solution. Answers to me, please, before the AGM, but Roger (G7SRK) will be responsible for the prize. Good luck!

- 1) A stone
- 2) A bicycle
- 3) A man's name
- 4) A type of singer
- 5) A monkey's leg joint
- 6) Sun, Moon, & Mars
- 7) A leather worker
- 8) 50% of ladies undergarment
- 9) A kind of pig
- 10) A royal head-dress
- 11) Hit repeatedly
- 12) Poorly sea creature

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