MIDWEST VHF-UHF SOCIETY

Vol. 21 No. 8 **www.mvus.org** **October 2007**

MVUS Sunday Net at 14:30 UT **(currently 10:30** AM **local time, EDT).**

The net frequencies are primarily 144.280 Mc and 28.960 Mc.

Meeting Friday 26th of Oct. at the Hometown Buffet near SR 725 and Yankee Rd. in Centerville

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Upcoming Events

AMSAT Symposium: Oct 26,27,28 Pitsburgh, PA… www.AMSAT.org

ARRL Frequency Measuring Test (FMT) : Wed Nov 14 *

Fort Wayne, Indiana: Hamfest and Computer Expo Nov 17/18

*) **The 2007 FMT will run Nov 15 at 0245 UTC (November 14 at 9:45 PM EST). It will replace the W1AW normally scheduled phone bulletin.**

We are inviting Papers/Presentastions for the **2008 Dayton Hamvention** to be presented at the VHF Forum on Sat, 17 May 2008. Submit Abstract & Bio to: Red Dakin, W8ULC 4519 N Rt 123, Franklin, OH, 45005

2006 Proceedings still available

We have a few 2006 Microwave Update Proceedings left. Available for $ 15 (including postage) or at the meetings for $ 10.50. Send check to Gerd Schrick, 4741 Harlou Dr, Dayton, OH, 45432-1618

De N8ZM.

The big news in this month's edition of Anom Prop is that our MVUS sponsored Frequency Measurement Test appears to have been a popular event. As I write this just a few days afterwards, we have received seventeen submissions. I had figured that we might see a dozen, tops. From the comments that accompanied many of the submissions, our long key-down format and day + evening runs was well received (pun intended; you know I can't resist such an easy one!). Almost every one encouraged us to 'do it again, please'.

Submissions came from as far away as California and Arizona, at least two from each state. Other states represented included VA, NY, NJ, OH, RI, not to mention three from Canada!

Not surprisingly, this event was the brain-child of John, N8UR, but it was the efforts of not only John, but Bruce, ND8I, and Mike, W8RKO, that made it a reality. John provided a lot of the equipment such as synthesizers and the TS-520's we used as transmitters. Bruce modified the '520s so that we could drive them from the synthesizers. And Mike set it all up at his place, including installing a new 80 M antenna just for this event, as well as building the keyer used to synchronously key all three bands form a computer program he wrote as well. My role was to send out the PR info to the major magazines, and consulting and operations support was supplied by Daun, N8ASB, Tom, W9NBS, and John, N8VZW.

I also need to thank Ed Hare, W1 RFI, of the ARRL for his support and encouragement, and ARRL directly for their prize donation. One the subject of prizes, we are still working out the criteria for the awards, and will announce them as soon as we can on the FMT web site that John has set up at http://www.febo.com/pages/mvus-fmt/index.html.

If you want to hear the really scary details of how the day went, be at the meeting on the 26th to hear it from those who lived through it! Naturally, a good time was had by all, because that is what MVUS is all about. Thanks guys!

After all of that excitement, I've almost run out of things to talk about, but one other item does come to mind. By the time you read this, Microwave Update 2007 will be history, and MVUS will have partnered with the Mid-America Microwave Society to sponsor the Earl Price, W8MGJ, award. This award goes annually (OK this is its 2nd year, but we are on our way) to a ham who exemplifies the spirit of Earl in 'Elmering' budding microwave operators. This year it was awarded to Paul Drexler, W2PED. Congratulations, Paul! It's too bad that Paul doesn't live in Dayton, as he would be a terrific addition to our MVUS activities. Also, I need to recognize Bob, K8TQK, for his leadership of the award selection committee, as he is the ramrod who sees to it that it all comes together.

SO, with that I will end by simply reminding all of you that the meeting will be on Friday, the 26th, at the Home Town Buffet on 725 near I-675. Dinner starts at about 7:00, and the formal (?) meeting starts when I finish my dinner. See you there!

Tom. N8ZM

This and That 10-07

Capture Area. There is truth in that: "As an example, what would you rather be holding during a lightning storm – a 2-meter rubber duck or the feed line to a 272-foot antenna? [Vernon Lee Gibbs, W4JTL]

Action at a Distance. No matter how much we know, or think we know about electromagnetics, propagation and so on, it is still simply amazing to talk into a microphone and hear the voice come out of a speaker a thousand miles away with radio waves going through thin air.

Antenna Gain. Here is another relationship explaining antenna gain. We all learned the impedance of space to be 377 Ohms. Now if you had an isotropic radiator this would be the impedance you had to connect your transmitter to. A dipole has an impedance of 72 Ohms, which comes about because the doughnut pattern created in space illuminates less than the "isotropic" radiator and so has that 2 db gain, so much loved by the antenna manufacturer. A Yagi antenna may have much lower feed impedance yet and therefore indicates a higher gain.

[Vincent W Greb]

Rapid Burn. Americas first attempt to launch a satellite back on Dec 6 50 years ago was a failure. "The rocket flew a total of 2 seconds –and traveled 4 ft (1.2m)- before eating itself in a fiery explosion. … Asked to explain the cause of the explosion, a spokesman denied one had taken place, Asked what had occurred on the pad, he answered, 'Rapid burning' " [Jeffrey Kluger, Time/ Oct 2007]

Glass Fiber. "At the Polytechnic Institution is exhibited one pound of glass, spun by steam into four thousand miles. And woven with silk into beautiful dresses and tapestry." [Scientific American, June 1849]

Electric Vehicle Batteries. In the US in the order of decreasing interest the choices are rechargeable lithium, nickel-zinc, nickel metal hydrid, and lead acid. [Defense Tech Briefs, Oct 2007]

Hydrogen Fuel Cell. The fuel cell is the preferred electrical energy source for the car of the future. There is, however, the problem of storing sufficient fuel on board to provide travel for several hundred miles. One approach is storing hydrogen under extremely high pressure. Also looked into is employing some type of solid hydrogen storage system. [Desense Tech Briefs, Oct 2007]

Sandbank. "With approximately two tablespoonfuls of dirt removed from Florida soil, you automatically have a lake. Our water table is nearly zero." [Colleen Sharp Murray]

Eating Made Simple. "The simplest message may be the best: do not overeat, exercise more, consume mostly fruit, vegetables, and whole grains, and avoid junk food." [The Editors of the Scientific American, Sep-2007]

Dietary Disaster. For most of our evolutionary history, the only beverages humans consumed were breast milk after birth and water after weaning. Because water has no calories, the human body did not evolve to reduce food intake to compensate for beverage consumption. As a result, when people drink any beverage except water their total calorie consumption rises, because they usually continue to eat the same amount of food.

[Barry M Popkin, in S/A]

Job Experience. Summer jobs are a pretty good education for a teenager. They teach them to deal with bosses who are jerks, customers who are jerks, and co-workers who are jerks. And how clearly they can let them know you think they are jerks without losing their jobs.

[D L Stewart]

Precision versus Accuracy (Gerd, WB8IFM)

How do you interpret a statement like: My frequency readout is always 200 Hz lower than the correct frequency? What this means is, that the readout is very precise but not accurate.

Most sensors/instruments fall into the above category. The deficit is easy to correct, you could do it in your head, or could use a table. More elegantly, a programmable counter could set the numbers anywhere you want to.

Calibration used to be the big thing in the old days, all important and expensive instruments had sometimes elaborate calibration requirements.

S-meters, of course were never accurate, they fall into the category of "ballpark8' measurements. I tried to change that with my Drake TR-7 and spent one entire afternoon many years ago with the help of an accurate signal generator to adjust 3 potentiometers until a got the best fit.

As with other terminology, like severe weather watch versus warning, one has difficulty keeping the two terms apart. When hearing the term "precise" I think reproducible and that helps me understand.

Just recently I came on a good picturial representation of the two terms from NASA, which is reproduced below. They are using the term "absolute-accuracy" to distinguish against precision

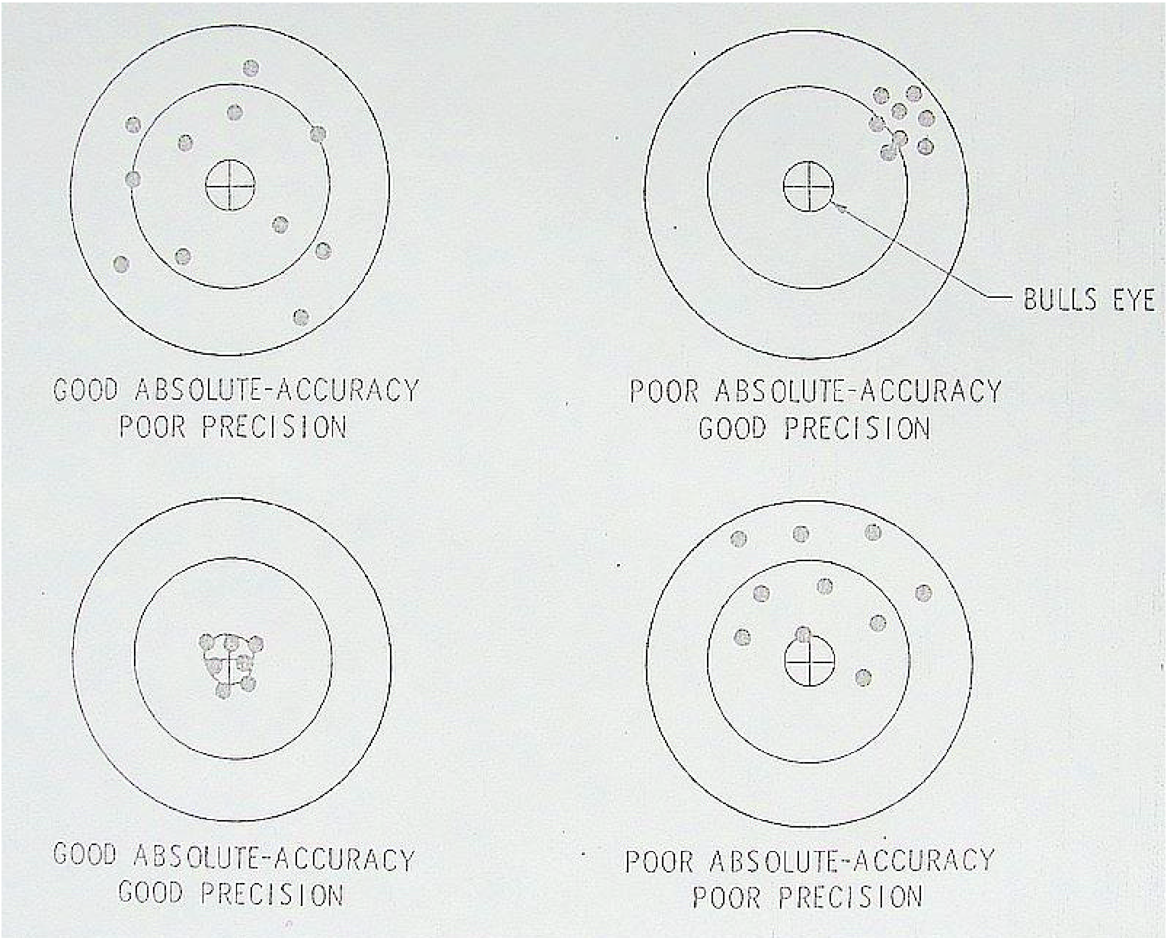


Fig. 3. Dart-board model of accuracy and precision

WWVB (60 kHz Time Signal)

Radio station WWVB is located on the same site as WWV near Fort Collins, Colorado. The WWVB broadcasts are used by millions of people throughout North America to synchronize consumer electronic products like wall clocks, clock radios, and wristwatches. In addition, WWVB is used for high level applications such as network time synchronization and frequency calibrations.

Signal Description

WWVB continuously broadcasts time and frequency signals at 60 kHz. The carrier frequency provides a stable frequency reference traceable to the national standard. There are no voice announcements on the station, but a time code is synchronized with the 60 kHz carrier and is broadcast continuously at a rate of 1 bit per second using pulse width modulation. The carrier power is reduced and restored to produce the time code bits. The carrier power is reduced by 17 dB at the start of each second, so that the leading edge of every negative going pulse is on time. Full power is restored 0.2 s later for a binary "0", 0.5 s later for a binary "1", or 0.8 s later to convey a position marker. The binary coded decimal (BCD) format is used so that binary digits are combined to represent decimal numbers.

The time code contains the year, day of year, hour, minute, second, and flags that indicate the status of Daylight Saving Time, leap years, and leap seconds. For more details, view the WWVB time code format.

WWVB identifies itself by advancing its carrier phase 45° at 10 minutes after the hour and returning to normal phase at 15 minutes after the hour. If you plot WWVB phase, this results in a phase step of approximately 2.08 microseconds.

Antenna and Transmitters

WWVB uses two identical antennas that were originally constructed in 1962, and refurbished in 1999. The north antenna was originally built for the WWVL 20 kHz broadcast (discontinued in 1972), and the south antenna was built for the WWVB 60 kHz broadcast. The antennas are spaced 857 m apart. Each antenna is a top loaded monopole consisting of four 122-m towers arranged in a diamond shape. A system of cables, often called a capacitance hat or top hat, is suspended between the four towers. This top hat is electrically isolated from the towers, and is electrically connected to a downlead suspended from the center of the top hat. The downlead serves as the radiating element.

Ideally, an efficient antenna system requires a radiating element that is at least one-quarter wavelength long. At 60 kHz, this becomes difficult. The wavelength is 5000 m, so a one-quarter wavelength antenna would be 1250 m tall, or about 10 times the height of the WWVB antenna towers.

As a compromise, some of the missing length was added horizontally to the top hats of this vertical dipole, and the downlead of each antenna is terminated at its own helix house under the top hats. Each helix house contains a large inductor to cancel the capacitance of the short antenna and a variometer (variable inductor) to tune the antenna system. Energy is fed from the transmitters to the helix houses using underground cables housed in two concrete trenches. Each trench is about 435 m long.

A computer is used to automatically tune the antennas during icy and/or windy conditions. This automatic tuning provides a dynamic match between the transmitter and the antenna system. The computer looks for a phase difference between voltage and current at the transmitter. If one is detected, an error signal is sent to a 3-phase motor in the helix house that rotates the rotor inside the variometer. This retunes the antenna and restores the match between the antenna and transmitter.

There are three transmitters at the WWVB site. Two are in constant operation and one serves as a standby transmitter that is activated if one of the primary transmitters fail. Each transmitter consists of two identical power amplifiers which are combined to produce the greatly amplified signal sent to the antenna. One transmitter delivering an amplified time code signal into the north antenna system, and one transmitter feeds the south antenna system. The time code is fed to a console where it passes through a control system and then is delivered to the transmitters.

Using two transmitters and two antennas allows the station to be more efficient. As mentioned earlier, the WWVB antennas are physically much smaller than one quarter wavelength. As the length of a vertical radiator becomes shorter compared to wavelength, the efficiency of the antenna goes down. In other words, it requires more and more transmitter power to increase the effective radiated power. The north antenna system at WWVB has an efficiency of about 50.6%, and the south antenna has an efficiency of about 57.5%. However, the combined efficiency of the two antennas is about 65%. As a result, each transmitter only has to produce a forward power of about 38 kW for WWVB to produce its effective radiated power of 50 kW.

Performance

The frequency uncertainty of the WWVB signal as transmitted is less than 1 part in 10^{12}. If the path delay is removed, WWVB can provide UTC with an uncertainty of less than 100 microseconds. The variations in path delay are minor compared to those of WWV and WWVH. When proper receiving and averaging techniques are used, the uncertainty of the received signal should be nearly as small as the uncertainty of the transmitted signal.

Microwave Activity Day. Oct 6, 2007 (NE8i)

A tradition started by Bill W3IY. Carried on by the Pac Rats and many others. First Saturday morning of the month, Time, well 7AM to 1PM, or 6AM to 1 PM. Not limited to 1PM either.

Lloyd's Thoughts: Preparation during the week: A time to check microwave stations (above 902 MHz). Examine rover stations. See if that duct tape is still holding, see what equipment works, what needs fixing. Look for, try out new rover locations. Fire up the Microwave station and make some activity happen. Microwave activity is always fun. 144.260 USB simplex is the usual starting point, but it is not limited to that. 432.120 also. Whatever works. Trust your kitchen pass is in order.

Southeast Michigan Activity. By Lloyd NE8I EN82jm

Stations that participated: K8MD, EN82; K8TVD, EN91; KD0AR, EN91; AA2LY, EN82; KB8U, EN71; WA8VPD, EN82; K8JA, EN82. and myself NE8I, EN82.

A number of bands were tried and contacts made from 903 through 10 GHz.

After a couple hours, I joined AA2LY and WA8VPD on GP Hill, EN82em, New Hudson Mi and rovered with them. Worked KD0AR rover at Lake Geneva Ohio State Park, EN91mu, on 10 GHz.

Conditions were a challenge. WX was sunny, hot and sticky. KB8U had problems with his station, but managed to work us and KD0AR on 10 GHz. Microwave fun had by all.

SW Ohio Activity

Rover set up on the roof of the "Green's" parking garage just East of Dayton EM79wq with a pretty clear view towards the South and South West

John, N8VZW, checking the direction and Mike, W8RKO, conducting a QSO

Although the wx was nice conditions for 10GHz were much poorer than they had been in Juli.

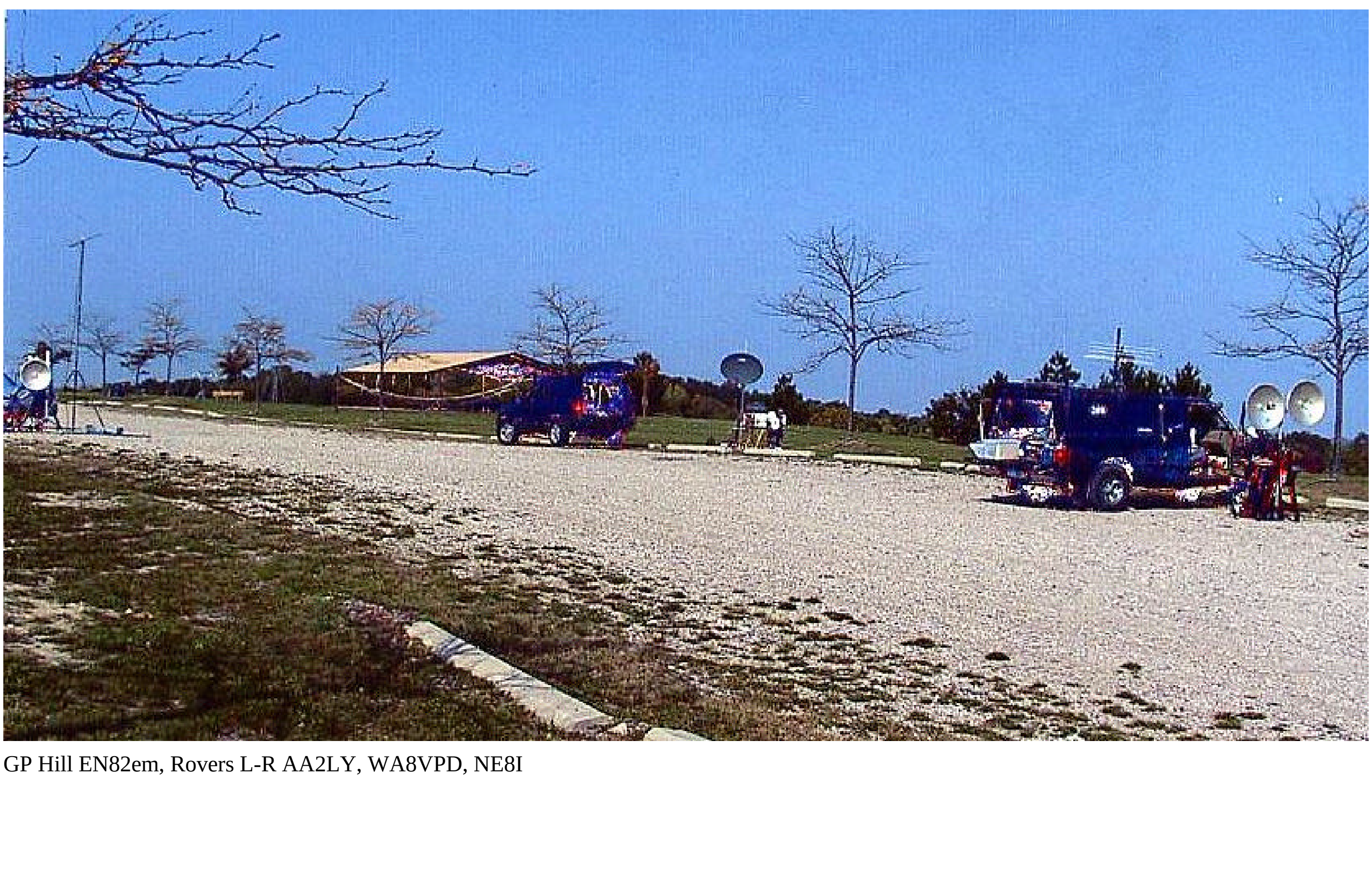
Mike was unable to work W2RG only 20 miles away. The LO frequency could have been off, the compass needle could have been influenced by the rebar in the concrete roof.

Mike finally tuned in the 10 GHz beacon in Hamilton to get a fix on the LO frequency. A contact with Brad, K4EFD, about 150 miles away, was one sided; Mike and John could hear him, although quite weak, but Brad could not pick them.up at all. In John's case, his low power (80 mW) prevented him from being heard.

While we where there mall security came by several times to see what we were up to. One of them had a Segway scooter. As we had cleared our presence there months ago with management it took just a little friendly explanation to calm the waters.

Microwave Activity Day Oct 6, 2007 / Pictures From Michigan (NE8i)

47 GHz set up. DB6NT, aimed at the Glen Arbor Cannery EN64xu from Miller Hill EN74at Lloyd NE8I



GP Hill EN82em, Rovers L-R AA2LY, WA8VPD, NE8I

Ni-MH Update 7-14-07 (Gerd, WB8IFM)

My first digital camera (1990s) was using two AA cells in series, and as they say: it was eating up these cells with a ferocious appetite. You always had to have spare cells with you ore "else." And it made not much difference whether you were using rechargeables or not. (NiCd or later Ni-MH, or Alkalines) This situation had a lot to do with the high power consumption of the camera and the sorry state of the rechargeable cell quality and the recharging process. Cell capacity was uneven which lead after relatively few cycles to battery deterioration. The only way to improve this situation was to cycle individual cells, determine their capacity, and then select matching cells for a battery. Since this is cumbersome, time consuming and therefore expensive it is only done for satellites, as it is impossible to fix a bad battery in space. Also for that reason, usually the only redundant item on board a satellite is a spare battery. Ironically, when the first battery failed on AO-40, we waited too long to switch to the spare battery, the voltage got too low to move the switchover relay!

So, when I got my second digital camera I went with Sony, who was using then a lithium-ion "battery pack" with a charging system that kept track of the condition and calculated the capacity down to the last minute. It is really a single lithium-ion cell with a nominal voltage of 3.6V. Right there is the main advantage; you eliminate the matching problem that you have with two AA cells. Also lithium ion cells act much better as "storing devices" with "What goes in is what comes out". After using this camera for a short period of time I felt confident that I didn't need a costly ($50) spare.

My third camera, another Sony, also had a lithium-ion battery, which was much smaller, but permitted to shoot as many pictures as before. What had happened? Studying the manual and the specifications I found the power required as one watt. Before that time I had never been able to find any manufactures numbers on the power. I guess they were too bashful, anyhow, projecting backwards; the older digitals really must have been "power hogs".

Well, camera three developed "dust on the sensor" problems (forget about getting in there for cleaning) and I started thinking of getting a new camera. In the meantime I was using another Sony camera (the xyl's), which was powered by two AAs. I had selected (with my intelligent LaCross charger) a few well-matched pairs of Ni-MH cells, and was doing extremely well, although I always had extra cells in my pocket. As it turned out the weak point of this system was the battery condition indicator. It reminded me of the automotive clocks some 40 years ago, you could never depend on them and they became a joke but companies kept putting them in year after year, also charging extra for it. That is why you have to carry spares.

"Consumer Report" just came out with an issue (7-07) comparing 71 digital cameras and as I started to look at the numbers, one Sony camera stuck out with all the desirable features but it was using two AA cells. A year ago I'd say, "no way am I going back to AA cells for a camera" but after my good experience with the xyl's camera, I said "why not?" Sony provided two Ni-MH cells and a charger with it and my thinking was: well they probably finally figured out how to do it right.

Well, I was wrong, Here is what I found out: First the two cells labeled "typically 2500 mAh" checked out on my LaCross charger to have 2220 and 2290 mAh resp. That is a 3% difference, which is acceptable. The capacity, of course, is 10% off, which is what you would expect when you read how the industry measures it. I have never yet found a cell that reached, leave alone exceeded the stated capacity. So using the word typical is a joke. How about the battery condition indicator, it has three bars indicating: full, medium and almost empty. Inserting fully charged cells will give you for a very short time the full indication, then for a long period it will show two bars. Eventually, I felt too soon, it goes to a single bar and starts to flash, reminding you to recharge the cells.

Sony recommends (good) to discharge the cells completely by leaving them in the camera and turning on the slideshow which cycles through all the pictures in the camera in a continuous fashion running the cells down to empty. Well, it took me about 45 minutes before the camera finally turned itself off. This would be enough to shoot maybe 100 more pictures. But, here came the surprise. When I took the cells out at this point and measured the voltage I found both cells still had 1.187 and 1.135 V resp. The normal operating voltage of a Ni-MH cell is between 1.4 and .95 V. This meant the cells still had a decent portion of operating left in them. But it was the procedure Sony recommended for discharge and I assumed the magic must be in the recharging process.

Using the Sony charger, I charged the cells overnight. When I took them out I measured 1.406 and 1.397 V. Putting those two cells in my intelligent La-Cross charger, the first cell indicated full, but the second cell needed additional charging. Conclusion, you cannot depend on the battery indicator and the charger is doing a lousy job! You can buy similar chargers in stores for less than $ 10, while the La Cross cost you $ 50.

The La Cross charger normally uses 200 mA for charging (this can be set higher). That takes a little longer for a charge but the capacity is not compromised. I wonder about these "fast chargers" that promise you a recharge in a matter of minutes. I am not spending money on them as the sound good but don't make much sense.

Comparison table of the most common batteries types

Chemistry Type	Ni-Cd	Ni-MH	Lead acid	Li-ion Cylindrical	Li-ion Prismatic	Li-Po
Nominal Voltage V	1.2	1.2	2,1	3.6	3.6 / 3.7	3.6
Specific Energy Wh/kg	50	70	30	80	100-160	140
Specific Energy Wh/l	150	200	-	-	250-360	-
Cycle Life (Times)	500	560	-	1000	1000	-
Environmental hazard	low	medium	medium	high	high	high
Safety	high	high	medium	low	low	low
Cost	low	medium	low	high	high	high
Self-Discharge %/month	25-30	30-35	-	6-9	6-9	-
(Memory Effect?)	yes	yes	yes	no	no	no

l = liter = 61 $inch^3$ ~ Quart

The Sun as Signal Generator.

By Gerd, WB8IFM

We are very lucky our sun is not a radio star. It puts out most of its radiation in the visible light range. Now, this doesn't mean there is no other radiation, but at radio and microwave frequencies it is only of a level that makes it a convenient signal source to give receivers a quick sensitivity check.

Here is a check anybody with a short-wave receiver and a rotary beam can perform. Wait for a sunrise or sunset. Pick a free 10m frequency; adjust the volume so you hear the normal noise. Then rotate the beam into the sun. You will hear a distinct increase in the noise level. The more this increases the better your antenna and more sensitive your receiver is.

You can do the same type comparisons at the higher VHF/UHF and microwave frequencies. As there are often no signals at microwave frequencies, the sun noise provides an excellent source to check your reception. The sun noise is relatively constant. The table below is from NIST (Colorado, measured on 7-10-90).

Twice a year the sun lines up with the geosynchronous satellites and blots out their signal for approximately 10 minutes.

200 MHz	400 MHz	600 MHz	1.5 GHz	4 GHz	9 GHz	11 GHz	14 GHz
60	85	110	175	230	300	360	440
W 10^{-22} / Hz / m^2 For a 3 kHz bandwidth,one mW, and a one m^2 antenna: **mW x 3 x 10^{-16} / m**							

As an example for 400Mhz we have 85 mW multiplied by 3 10^{-16} = 255 10^{-16} = + 24 –160 dBm= - 136 dBm

Why the Sun Feels so Hot. 56% of the radiation is IR (Infra Red, Heat), 39% is Visible Light, and 5% is UV (Ultra Violet).

Solar Constant (power that hits the earth at the upper atmosphere) 1366 W/ m^2

Total emitted power by the sun: 3.86 x 10^{26} W