Vol. 13 No. 3 **www.ceitron.com/mvus/mvus.html/** Mar 1999

March Meeting: Friday, the **26th**, **Tour of the Gray Wireless Museum** in Cincinnati.
Meet there at 6:45PM. **Details: see "De N8ZM" para 4 & 5 (next page)**

Contents

Upcoming Events

Southeastern VHF Conference Apr. 9 & 10 1999
Atlanta, GA www.akorn.net/~ ae6e/svhfs

Second North American High Speed Meteor Scatter (HSMS) Contest
Period: 0000Z, 1 May to 2400Z, 9 May 1999
see page 10 for details

Dayton Hamvention May 14, 15, 16 1999

Central States VHF Conference at Cedar Rapids Iowa July 22-25
www.csvhfs.org
Proceedings WA0RJT@rf.org
Membership($5.-): Denise Hagedorn, AJ0E, 2318 NE 37th St. Kansas City MO 64116

Achtung !

We are **updating** the membership list to be published with the next issue. If you paid through 12-98 and have **not** sent in your dues for this year, this will be your last newsletter. Membership is still $ 8.-per year. Check to be sent to

G. Schrick, 4741 Harlou Dr. Dayton, OH 45432 (make check out to MVUS or Gerd Schrick)
Also, if there are any recent changes in address or tel. no. drop me a **postcard** or **e-mail** to: **WB8IFM@AMSAT.org**

Slowly but Surely… (de N8ZM)

Our beacon project is coming together. Sam has come up with the basic architecture, and Bruce is building up the subassemblies needed to generate a signal. So far, we've spent about $250 on parts, the most expensive being the power bricks to put us in the +40 to +45 dBm power range. There is also a potential site being looked at near Caesar's Creek Lake. The design is such that the hardware will be mounted at the antenna so that feedline and the associated losses will not be necessary.

There have been some recent inquiries into our stock of radar detectors and 800 MHz radios, but no solid action to report yet. Here's hoping!

Don't forget that Hamvention will be here soon, and we could use a few more MVUS members to help out with staffing our booth in the exhibits area. By the way, if any one has a flea market space, let us know the number and we can post it in the booth so people can find you.

Finally, here's the scoop in the March meeting. We are going to tour Gray's Wireless Museum in Cincinnati. It is filled with displays showing the history of radio, and should be quite fascinating. I'm excited because I've never been there and I've heard many good reports about the place. We have an appointment for 7:00 PM on Friday March 26th. I strongly suggest that you try to arrive by 6:45 to allow for finding a place to park. I'd also suggest that you make plans to car pool.

The museum is located in the same building which houses TV channel 48's studios. From I75 southbound, get off at the Ezzard Charles exit, and turn left (east) at the light. Go 5-6 blocks until you literally run into Cincinnati's music Hall (Central Parkway). Take a right into the parking lot (there is also parking under the building) for WCET/WGUC. There is planned to be someone in the area to guide you to the door. Talk-in, for when you get close, will be on 146.52 MHz. If you miss the Ezzard Charles exit, you will have to go to Kentucky to get turned around! Thanks to Ed Garner, WR8A, for making the arrangements for the tour.

See you all in Cinci on Friday night! Tom, N8ZM.

Further Information about HSMS (Steve, KO0U)

The following Internet web sites contain a wealth of information about High-Speed-Meteor-Scatter. Please note that there are several minor operating practice differences between North America and European techniques; for example, in North America, the northern- or eastern-most station normally transmits during the odd minutes (those minutes beginning with odd numbers: 1231Z, 1415Z; etc.). Also, North American sked speeds (and sometimes CQ speeds) tend to be somewhat higher than in Europe because most North American HSMSers are using computers to record and playback recorded reflections. Suggested HSMS operating practices are described in HSCW Procedures (v. 7), available at <**http://www.nitehawk.com/rasmit/hscw-sop22.html**>. Information regarding calculating station ERP can

be obtained from W5UN's website <http://web.wt.net/~w5un/>. Other information, including hardware modification tips, software, and HSMS articles may be found at these URLs:
http://www.nitehawk.com/rasmit/ws1_15.html http://www.ilk.de/sites/gap http://www.mint.net/~n1bug/
http://www.qsl.net/k0sm/ http://www.sci.fi/~oh5iy/ http://www.cannon.net/~mattmc/kb0vuk/hsms/hsms.html
http://www.qsl.net/kd5bur/ http://www.qsl.net/n7stu/hscw.html
Many more links covering other HSMS topics may be found on most of the above web sites.

HSMS home page: http://www.nitehawk.com/rasmit/ws1_15.html
N.A. list directory http://www.umecut.maine.edu/~baack/hsms/
Online skeds: http://raven.cybercomm.net/~slapshot/dxing/hsms.html

This and That 3-99

- **Hang Tags.** Thinking of planting a tree anywhere close to the power lines **or the antenna**? You definitely should consider the tree's "growth potential". The power company is concerned about this because of potential required pruning. Best are trees that grow 25' or less in height such as: redbud, dogwood and crabapple. Trees that grow 40' or less (medium height) are Washington hawthorn or golden raintree. Nurseries might identify suitable trees with special "hang tags". DPL (Dayton Power & Light)

- **Word Processor**. What a name! It facilitates bad writing by way of fast and easy corrections. When something is wrong, it's usually *all* wrong! Once a magazine gave me a PC to lure me into modern America. I used it as a planter. - Don't compare those things with real inventions. A stick with a small ball at one end that dispenses ink from a plastic tube: *That's* an invention! Roger Rosenblatt.

- **Liquid Candy.** *Teens are drowning in soft drinks.* The average teenage boy chugs 3 ½ cans a day - that is more than 110 gallons a year. Girls aren't much better, they guzzle 2 ½ cans daily. In fact, kids today drink twice as much soda as milk; 20 years ago, the reverse was true. The possible fallout: fat kids, rotten teeth and brittle bones. Time.

- **A Pharmacy on every Corner.** It used to be we had gas stations on the four corners of street crossings. Now pharmacies are taking on that distinction. More and more pills for every imaginable ailment are being peddled.

- **The No-Man's Land** of the earth's sky is between 40 and 110 miles up. Air is too thin for atmospheric craft and too thick for spacecraft. L.M. Boyd

- **P3d Launch**. During a recent "Happy Birthday" ceremony American style(with singing) for Peter, DB2OS, at the Orlando lab Karl, DJ4ZC, the project leader remarked: "Let's hope at your next birthday our bird is up in space." No firm commitment yet but Karl remains *very* optimistic.

- **Power Shift**. Engineers now often wear casual clothes while their managers wear uncomfortable business clothes. By analogy, when you see an organ grinder and his monkey, it's always the monkey who has to wear the uncomfortable red vest and hat. If the monkey had the power, he'd be wearing dockers. That's all you got to know. Scott Adams (in Time)

- **While you were not Looking.** Your power company wants a piece of the action. As of late they have been installing new ground wires which contain a fiber optics core…

- **Nuclear Submarines.** Judging from the computers that many of my friends and acquaintances own - you'd think they are spending their evenings designing nuclear submarines. Bill, KQ4YI

- **Linux.** This operating system, available free, is in competition with Windows NT. Its supporters love the following Gandhi quote: "First they ignore you, then they laugh at you, then they fight you, then you win!"

- **Windows.** How good can software be when you have to push the "Start" button to turn it off?

- **Three Books.** When Troy, Ohio was founded in 1807 nobody recorded why the name was chosen. A Connecticut physician, Asa Coleman, who settled there in 1811, wrote: "Homer was simply in the intellectual air. If a pioneer brought but one book with him, it was the bible. If he brought two, the second one was "Pilgrims Progress". If he brought three, the third one was the "Iliad." John Fleischman

MAKING WAVES

By Ed, K2VEE

Do you remember when generating a RF frequency meant finding (or grinding) the right crystal for that oscillator circuit or winding coils and selecting capacitors and varactor diodes to give the tuning range needed? If you remember that, then you have gained a wonderful perspective about the different ways in which RF frequencies have been generated over the years.

From those not-so-humble oscillators found in the likes of Heath, Johnson Viking, and Collins rigs, we've graduated to the 'Frequency Synthesizers' of the Yeasu, Icom, and Kenwood era. The circuits became quite a bit more sophisticated, and many of the Hams who wouldn't hesitate to dig into their tube oscillator rigs, now justifiably shy away from tinkering with their $$$$ radios. Thus, many of us have forgotten how RF frequencies are actually generated and have come to expect the inclusion of this so-called '*Frequency Synthesizer*' in all the radios they use. But just what is a frequency synthesizer and how do they work?

Frequency Synthesizers are different from oscillators in that they use a *reference frequency* as a basis for creating the desired output frequency – an oscillator generates the output frequency directly. The output frequency in a synthesizer should retain most of the characteristics of the reference frequency (stability, phase noise etc.) while taking on the new frequency and amplitude of the desired output. Naturally, we all know about the fact that the frequency synthesizer can be remotely or manually tuned to the frequency of interest without us really worrying about frequency drift…and that's their real beauty to a Ham.

But the Frequency Synthesizer is not the same for every application. They basically come in three general varieties;

Direct Analog Synthesizer
Phase-Locked Loop (PLL)
Direct Digital Synthesizer (DDS)

The **Direct Analog Synthesizer** is composed of fixed oscillators, mixers, filters and frequency dividers assembled in cascade networks which produce finer tuning capabilities with each succeeding stage. Technically, since these do not require a reference frequency, they are not actually a 'synthesizer' but are a very important means to generate frequencies when only a few frequencies are needed.

/Fig1/

By far the most well known synthesizer is the **Phase-Locked Loop** type shown in Figure2. Since the PLL is reasonably economical and can be used too generate a wide range of frequencies, it has found its way into may of the recent 'off-the-shelf' HF, VHF and UHF radio designs.

/Fig2/

In a PLL network, the stable reference oscillator, which usually runs at a lower frequency than the desired output, provides the standard of comparison. The final output frequency, derived from a Voltage Controlled Oscillator (VCO), is fed to a variable digital divider that is set so that the divided-VCO frequency is equal to the reference frequency. A phase comparison of the actual divided-VCO frequency is made to that of the reference oscillator. Any phase differences that appear, whether it's just a slight phase shift or a frequency difference (which shows up as a large phase shift), will generate a proportional error voltage within the Phase Detector. The Phase Detector error voltage is then filtered and fed (in the correct polarity) to the VCO so as to move the output frequency and hence the divided-output frequency ever closer to that of the reference. It is only with the entire loop closed that the output frequency remains as a stable multiple of the reference. The resolution of the PLL is generally good but is limited by the component choices for the phase detector, VCO and filter and further compromised if high speed switching is required.

Truly the PLL has been the workhorse in the Frequency Synthesizer arena with the newest versions capable of generating frequencies in the GigaHertz region.

With the advent of better and faster digital technology, a new synthesizer has grown in prominence - particularly whenever fast switching of frequencies is essential as evidenced in Spread Spectrum transmission. The **Direct Digital Synthesizer** is unique in that it uses a digital word definition and a reference clock to generate the desired output frequency. As indicated in *Figure3*, the DDS uses digital arithmetic and high-speed memory to create the digital representation of a sinewave. From there, the addition of a Digital-to-Analog (DAC) converter and appropriate smoothing filter gets the output frequency into the analog world where we put it to use. Note that in the DDS diagram there are no closed loops required for its operation – the all-digital generation creates the precise frequency and phase desired. It is only in the conversion to analog that some imprecision can occur.

/Fig3/

The digital part of the DDS generates the frequency by taking a user selected number (ΔP) and adding it to the contents of an accumulator (set initially to zero). The output of the accumulator generates a ramp whose 'stepsize' is increased by ΔP for each tick of the reference clock. Since the accumulator can only hold so many counts – the bigger the stepsize (ΔP) increment at each clock, the faster the accumulator will reach its max count and then begin to step down by the same increment. As suggested in *Figure4* , the bigger the step size, the faster the ramp will run between the limits and hence the higher will be its output frequency. A ramp created from an increment 10 times bigger will be 10 times higher in frequency.

/Fig4/

Since the accumulator deals in creating ramps, and we want a sinewave output, a high-speed memory look-up table is provided within the DDS. As indicated in *Figure5* this memory converts the digital ramp output words to equivalent digital sinusoidal words – now ready for conversion to analog via the DAC.

/Fig5/

These DDS units can only generate frequencies up to 40-45% of the clocking frequency but they can do so with great resolution and very high speed.
The benefits of DDS and PLL technology are really complementary. Designers today are combining the two techniques in circuit blocks suggested in *Figure6* . Using these configurations, they can achieve the advantages of each.

/Fig6/

For the Ham this means that we now have at our disposal a whole new arsenal of components with which to 'make waves'. From building a utility audio oscillator, a adjustable frequency reference for a special HF/VHF converter, or even for the adventurous experimenter working in the UHF frequencies – don't hesitate to use Frequency Synthesizers to rekindle the project construction instincts some of us have relinquished to the commercial radio makers.

Narrowband Dielectric Patch Antennas, Part 2

By Chris Fagas, WB2VVV

The halfwave by halfwave patch and the ground plane form a cavity in which there is an intense field. This field intensity is the reason why the lowest loss dielectrics must be used. The dielectric loss in the patch antenna is proportional to the loss tangent of the dielectric substrate. The Rogers Duroid 1/16th inch (0.062") 5880 I have used in all of my models uses a very low loss dielectric substrate. For comparison, substituting the new popular Rogers 4003 would slightly more than double the dielectric loss, while substituting standard glass epoxy FR4 would increase the dielectric loss by about eleven times. Another important factor is the dielectric constant, or relative permittivity, of the substrate. The higher the dielectric constant of the circuit board substrate, the smaller the patch's dimension will be. This is particularly important for the lower UHF bands, lest the patch will be too unwieldy, and also require a huge board if the dielectric constant is too low. On the other hand, greater cutting accuracy is required for higher dielectric constants, since being off a few mils is more significant. The following table shows the loss tangent and the dielectric constant of several popular circuit board materials

In addition, the metalization should have very low resistivity and a thickness of about three times skin depth. Copper thickness on circuit boards is determined by copper weight. Copper weight is specified as the copper weight per square foot, and usually varies from 1/8 ounce to 2 ounces per square foot. This corresponds to a copper thickness of 4 um to 70 um, respectively. For the frequencies below, 1-2 ounce per square foot would be perfectly usable. The following is a table of several metals, note how low the resistivity of copper is, and thus how well it will perform in this application

It was interesting to see that the larger ground plane of antenna 2 resulted in a gain increase of 0.75 dB, as compared with antenna 1. This means that the ground plane dimension that I have used is a reasonable compromise that gives up only a little gain for a more compact dimension.

Also, the traditional coaxial cable and power divider phasing harness of antenna 3 appears to be a little lossy. It's gain was only 1.75 dB better than the single patch, even though it had twice the antenna aperture. This is 1.25 dB off the theoretical 3 dB gain increase. I originally suspected that possibly my stacking distance was too close which might explain the somewhat low gain, and very clean pattern with very low level sidelobes. However, when I tested antenna 4, the quad patch using a microstrip corporate feed, the result was 5.8 dB better than the single patch, for four times the antenna aperture. This is only 0.2 dB off the theoretical 6 dB gain increase, which is very close, and it had exactly the same stacking distance. The stacking distance I used was 5/8th of a free space wavelength, center to center. I am happy to add that the sidelobe performance was still excellent. Apparently, the microstrip corporate feed is just a very low loss way to feed a patch array

While the microstrip corporate feed does appear to be a very low loss way to feed a patch array, it does make one slight compromise with respect to polarization. Because it has microstrip feeders running both vertically and horizontally and the microstrip feeders do indeed radiate, its polarization purity is not quite as high as the other linear polarization varieties I analyzed. This manifested itself as a relatively low cross polarization null on the test range. In most applications this will not be an important issue, and possibly over a heavily reflective propagation path it is even a slight advantage. However, this also means that it is a slightly less useful antenna for mitigating interference that is vertically polarized, if that is a goal.

In summary, the relative gain of these little antennas was proven at both the East Coast VHF Conference antenna range, and also on my antenna range. They are very practical and compact antennas for the high UHF bands

Introducing the **Second, North American High Speed Meteor Scatter (HSMS) Contest**
sponsored by:
The Western States Weak Signal Society.

Purpose: To promote the development of skilled HSCW operators in North America.

Objective: Work as many North American stations as possible via meteor scatter during the contest period using HSCW on the amateur radio bands above 50 MHz. HSCW for the purpose of this contest is any speed no less than 495 LPM (99 WPM).

Contest Period: **0000z, 1 May 1999 to 2400z, 9 May 1999** You may operate up to 48 hours during this time period. An operating period begins with your first TRANSMISSION and includes time spent listening between transmissions. Operating time must be taken in 30 minute blocks. Time spent listening outside of your operating periods does not count towards your operating time. Multi-ham households--Each licensed ham is eligible to operate 48 hours under their own callsign.

Contest Operation: Random and scheduled QSOs count for contest credit. The use of the letter system for CQing is REQUIRED, ie. CQF, CQX. Report is your four digit grid square. Real-time skeds, spotting assistance, DX-alerting nets, etc. are permitted for the purpose of arranging contact attempts. Refer to the Region II HSCW standard operating procedures <http://www.nitehawk.com/rasmit/hscw-sop22.html> for suggested HSCW techniques and meteor scatter calling frequencies. The use of HSCW on VHF SSB calling frequencies is poor operating technique. A station may only be worked once per band during the contest period unless one of the stations has changed grid squares. A separate log is required for each grid activated. Each grid activated will be scored separately.

QSO Requirements: To log a completed contact you must copy: both calls, report, rogers. Any form of liaison communication between the parties involved in a contact in progress is prohibited. Any interruption of a contact in progress requires both stations to restart the QSO attempt from the beginning. All information required for a complete contact must be exchanged using meteor scatter and no other propagation mode.

Classes: Single Operator Limited--2 meters only Single Operator Limited--Multi-band
Single Operator Unlimited--2 meters only Single Operator Unimited--Multi-band
Limited: Station ERP is restricted to less than or equal to 5kw. Unlimited: Station ERP is greater than 5kw.
Multi-band stations must enter in the class corresponding to the highest ERP used. A station may only enter in ONE class.
Multipliers: The sum of each unique four digit grid square worked on each band.

Scoring (QSO points): BAND ASSISTED RANDOM
6m 1 1 / 2m 3 6 / 1.25m 9 18 / .7m 9 18
The final score is the sum of all QSO points from each band times the multiplier.

Awards: Certificates will be awarded to the top three overall, and to the highest scoring station in each USA/VE call district and each North American DXCC country for each category. In addition, a certificate will be awarded to the highest scoring portable station activating two or more grids (based on the sum of their scores from each grid activated). A minimum of 2 QSOs is required to qualify for any award. Additional certificates may be awarded where activity warrants. Participants can only enter in one class for contest credit.

Reporting: The following information must be contained on the summary sheet which must accompany the log: Callsign used, Grid Square(s) activated, Maximum ERP used, Name, Address, and Email Address (if available). Log information must contain the following data: Callsign of station worked, starting and ending times/dates of contact (and operating periods), Frequency, Reports, and sked or random.

Miscellaneous: Station equipment can only be used under one callsign, with the exception of multi-ham households. Single Band Entrants, time spent working stations on bands other than 2 meters does not count against your 48 hour operating time. Single band entrants are requested to send in check logs for all contacts made on other bands. The decisions of the awards committee are final. All logs must be postmarked or email dated no later than May 30th. Email logs must be sent in ASCII format to: hscw@contesting.com.

Postal mail logs may be mailed to: **WSWSS HSCW Contest P.O. Box 86 Downey, CA 90241-0086**

Sample blank log page/summary sheets are available from http://www.qsl.net/n7stu/hscw.html or a reasonable facsimile may be used. A printed copy of the rules and sample log/summary sheet can be obtained by sending an SASE to the WSWSS. Please enclose an SASE if you would like to receive a printed copy of the results via postal mail.

Note: The radiant of the Eta Aquarids shower is projected to provide the best conditions during the contest (in North America) from approximately one hour before sunrise local time for approximately eight hours daily. This is the suggested best operating time each day. Remember though, HSCW contacts can be completed at any time of the day.