

Vol. 14 No.5

www.ceitron.com/mvus/mvus.html

June / July 2000

Club Memorial Call W8KSE

June Meeting. Friday, the 23rd, at 7:30 PM at the Perkins Restaurant at SR 73 and I-75.
Meeting Topic: TBD

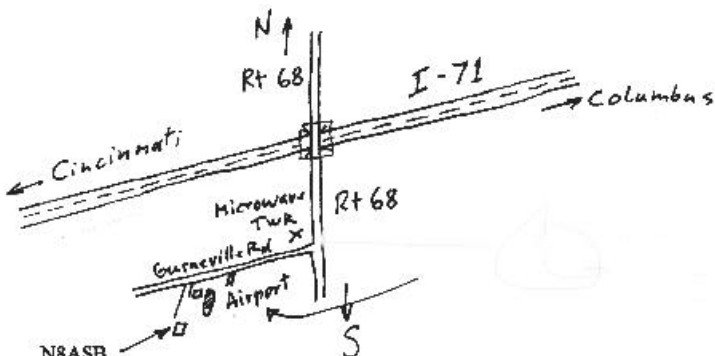
There is no Meeting in July on account of the Central States Conference (see below)

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Upcoming Events.

Central States Conference/Winnipeg, Canada.....	20/22 July
Microwave Update/ Philadelphia, PA.....	28/30 Sept.
AMSAT Symposium / Portland, Main.....	27/29 Oct.



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de N8ZM.

Well, I am late getting this written, once again; and I'm sure that has messed up Gerd's plans to get this out on time, and on his schedule. Not to mention that what little quality of thought and information that these monthly messages might usually contain is severely reduced. Classic case of work interfering with the personal life.

Anyway, we will have a meeting this month, on Friday the 23rd (that's our traditional 4th Friday), so don't say you weren't told!

Hamvention appears to have been a big success, not only overall, but for MVUS activities as well. Merle and Red put together another outstanding VHF/UHF/microwave forum, including our own Bruce, KA8EDE, talking about his beacon designs. Bruce reports that Kent Britain, WA5VJB, collared him afterwards with specific instructions to "Publish that!" I've been telling him that for several years, so now maybe he will do it. We picked up eleven new members bringing total membership to 105. One of the new members is from Italy (Francesco, I6FCR).

The editor of QEX was at the VHF Weak Signal dinner pleading for articles and offering serious bucks for the effort. I encourage all of you who have done some nice projects or research to write up something and submit it for publication. The worst that can happen is that it doesn't get published, and most of you are mature enough to deal with a bit of rejection occasionally. Even if you don't believe that you are a good writer, the editors will help you out, that is what they get paid for. I'll even offer to work with any of you who will take the first step of putting your thoughts on paper. I don't consider myself to be any sort of great shakes at writing, but I do have to get this little bit of nonsense past my own editor (her name is Barbara) each month for grammatical approval, and believe me, teachers are tough on that stuff. So I can claim to have some advanced training at the job. I may even create an incentive plan for the first one of you from MVUS to have an article published. No, it won't be a box of radar detectors! "nuff said"

By the way, it is once again time to start planning for the annual MVUS picnic and antenna session. I have secured permission from Daun and Karen Yeagley for us to stage the invasion at their estate, this year on Saturday, August 12th. As always, bring the family and an antenna, as well as a covered dish or dessert to share. MVUS will provide the drinks, burgers, and hotdogs, to be torched by yours truly. Well, not the drinks! Setup will start around 10:00 am, with food to start about 2:00, or whenever I figure out how to light the grill! See you there!

Don't forget Central States at the end of July. As always, we will not have a July meeting.

And make sure Steve Coy has your e-mail address so he can send any late breaking news from MVUS to you.

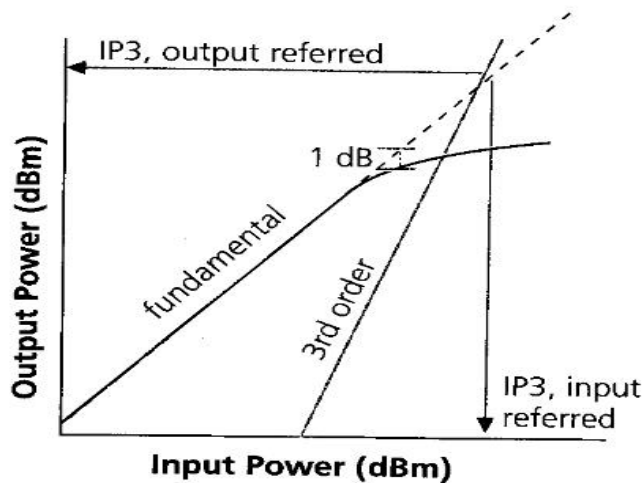
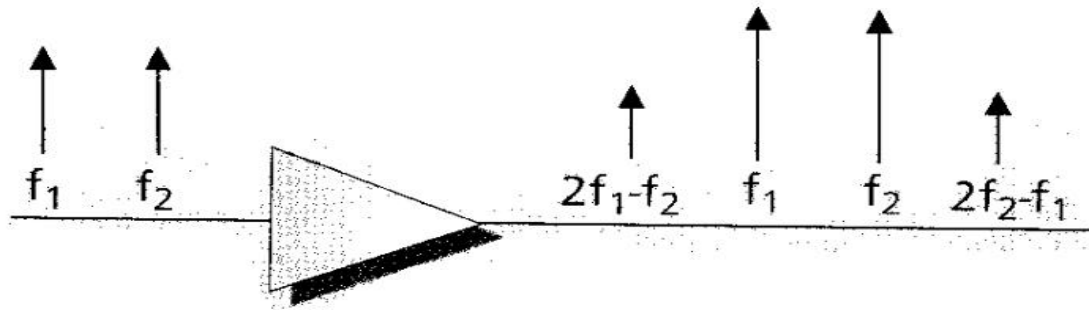
The Universal Licensing System is currently operating and is here to stay.
by Steve, KB8UHY

It has been recommended that you check into this new system to make sure you are listed. Eventually, everyone should be registered. There are a lot of advantages to this system. Instantly change your address, renew your license and apply for a vanity call. Once in the system, it's easy to fill out the forms. Even the payment form is easy to do. Most of the information is picked up from your form 605. Now with this new system, there are some drawbacks. First of all, you need to have Netscape 4.5, 4.51, 4.61, 4.7 or newer versions. IE4.0, or 5.0 will not work. Also, you will need 128 bit encryption for the new security to work. The FCC downloads cookies, java scripts which take up a little over 1 meg of space. Be patient as it does take some time to initialize the system. After you download the java scripts, you will be asked to restart Netscape. If you did everything correct, you should be able to see the new plug-ins when you run Netscape. From there, you should have no problems. Once you register, you should have no problems. If you attempt to register and the system states that a profile exists and you haven't registered, then you will have to contact them and get a new password. I have learned that many of the new upgrades have been put into the system automatically. Now what seems to be a rather simple operation took me 3 days and several hours. Don't try this over an internal network, even if you think the proxy server is OK. Most proxies do not handle port 9000 under the SSL protocol. So, it is best to work from the computer that has the modem. Also, if you do have problems, the FCC maintains a good staff and they will answer your email quicker than most companies. I even received a phone call from them explaining the error code. Good Luck !!

This and That 6/7-00

- **Old Time RFI.** To the average broadcast listener amateur transmission is only a nuisance. Whenever noises of any kind, regardless of their origin, even if they be in his own battery, interrupt the reception of a musical program, the usual broadcast listener blames it on the neighboring amateur, and possibly if the noises get too bad he starts off with blood in his eye and an axe in his hand bent on the destruction of the mast of the supposedly offending “ham”. [Allen D. Cardwell Mfg. Co. in: “A Simple Transmitter, And How It Was Made.” In “The Transmitter” – Magazine, Sept. 1926, Vol. 1 No. 1]
- **Kilo, Mega, Giga.** We are all familiar with those “prefixes” signifying the 3rd, 6th, and 9th power of 10. But what about the 12th, 15th, 18th, 21st, and 24th power of 10. The names for these are in sequence: Tera, Peta, Exa, Zetta, and Yotta. Something to impress your friends or for the Millionaire’s Show!
- **Two Lines of Thought.** If it ain’t broke don’t fix it, or ...if it ain’t broke, it doesn’t have enough features yet. The latter seems to be true with many products that require yearly “updates” and added features to attract buyers. Those products then become unwieldy and/or break down often.
- **Motorola Name.** The first product Motorola started to develop was a record player for automobiles. At that time, the best known player on the market was Victrola, so they called themselves Motorola. [www]
- **A Bad Day in a Brat’s Life.** They didn’t stop to eat or drink all day. By nightfall Dudley was howling. He’d never had such a bad day in his life. He was hungry, he’d missed five television programs he’d wanted to see, and he’d never gone so long without blowing up an alien on his computer.
[From “Harry Potter” by J.K.Rowling]
- **On Top of a Hill.** Why are people who live on a hill never trustworthy? Because they are not “on the level!”
- **Internet Updating.** Even as I am writing this, I can hear my poor little Pentium II groaning under the strain of Sidebar as it struggles to update all the information I’ve put into it. You know you’ve hit an all time low when you start feeling sorry for a computer. [Frances Katz]
- **Boat Anchor.** Only a few short years ago – I’ll call them the good old days – if you wanted to buy or sell a boat anchor, you subscribed to the Yellow Sheets or went to a hamfest. But times have changed. Suddenly yellowsheets is gone and the hamfests are full of junk computers. Boat anchors, for better or worse, have gone digital. There is irony here, somewhere.
[Chuck Penson, WA7ZZE in “Electric Radio”]
- **Nickel Metal Hydride (NMH) Batteries.** NMH cells should not be mixed with other types or with cells of a different charge level. OK so far! But here is a new one: Do not connect 20 cells or more in series!
[Sanyo]
- **Millenium Musings.** ...When you count your money, is the first dollar: “dollar no. 0” or “dollar no. 1”. If your answer is “dollar no. 1”, then why would you count years starting with no. 0? If you are with me on this, then the year 2,000 must be the final year of the second millenium. So we still have time before the third millennium arrives! [David Maliniak]

3rd Order Intermodulation



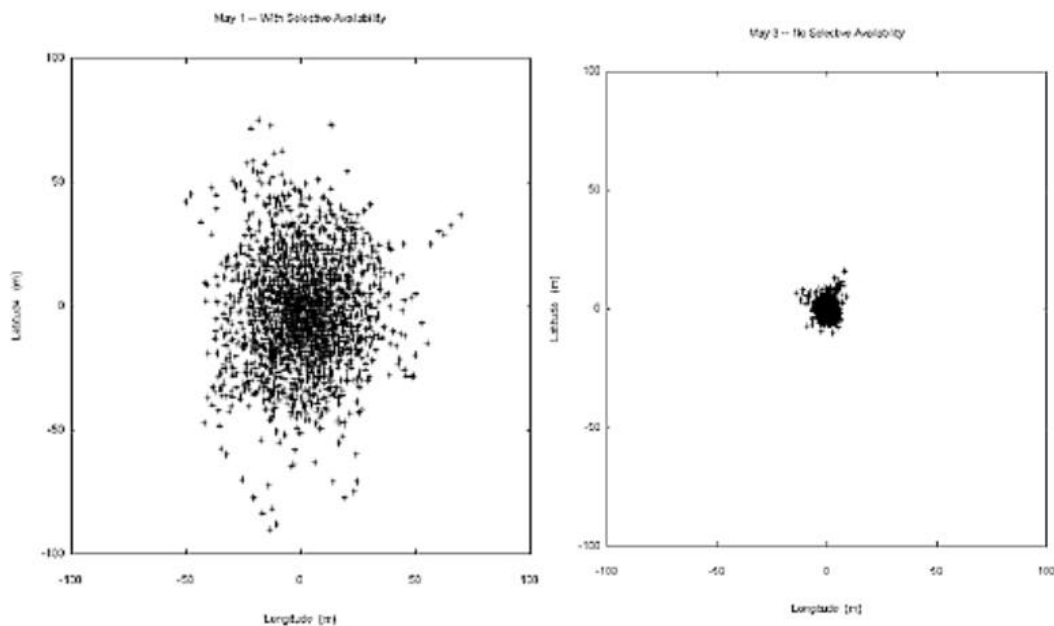
Third-order intermodulation (IP3) distortion, like 1 dB gain compression, is a measure of amplifier nonlinearity. When two or more signals, f_1 and f_2 at different frequencies are applied to an amplifier, nonlinearities in the amplifier cause the output to contain additional mixing frequencies called intermodulation (IM) products. They are at $(mf_1 \pm nf_2)$ and at $(mf_2 \pm nf_1)$ where $m+n$ is the order of the IM product.

Even-order products are located near the baseband while odd-order products are located on either side of the input signals. Third order products are closest to the input test frequencies and the most difficult to filter. When the amplitudes of the f_1 and f_2 pair (fundamental) are equal and in the amplifier linear region, for each 1-dB increase in fundamental power, the amplitude of the 3rd order products increases 3 dB. If these two transfer functions were extrapolated and plotted, the theoretical power where they are equal is called the IP3. It can be referred to the input or output.

Bandpass Filters do make a Difference

by Roger Rehr, W3SZ, ex-AA3QK ex-WA3JYM

Here at W3SZ I have been bothered with a very variable noise floor on 144 MHz. I felt that some of this was power-line noise, but I was concerned that some of it represented **IMD**. When my antennas are aloft, they have a clear view for 10's of miles in all directions, and as I live in a suburban area, there are innumerable commercial/cellular transmitters within view. I have until recently used SSB Electronics mast-mounted preamps with helical filters before the preamp input. Still I felt there was IMD entering the system in spite of the helical filters, and producing problems. I have **KA0RYT cavity-filter-input preamps** waiting to go on the tower in place of the SSB preamps, to help with this problem. But I wanted to look into things more closely. So, I put two ARR 144 MHz GaAsFET preamps on the mast in place of the SSB preamps. These preamps do not have helical filters, and so should be more prone to out of band interference. I mounted them at the feed points of my M2 2MXP20 2 x 2 EME array (one preamp for each polarity, so I can later do dual receive and synthesize any desired angle of rotation on receive) and ran them to a testbed receiver consisting of a Q-Bit RF amplifier followed by a TUF-1H mixer, a BRf-90 IF amp, an 8 KHz filter at the IF of 40.455 MHz, a second mixer to take the signal down to audio frequency, and then an audio amp. I fed all of this to the soundboard on the computer, so that the test signals could be recorded digitally for later comparison. Please note that the system was NOT set up to minimize IMD; otherwise, I would have had additional filtering before the mast-mounted preamps to improve the selectivity of the ARR's, used an active first mixer with a higher IP3, etc. What I wanted to do was to set up a system that WOULD be susceptible to IMD, to see if it WAS really a problem here, and then to try the "cure", i.e. a bandpass filter, and see what difference the filter made. I used the W3CCX beacon, 49.4 miles distant, for my test signal, with the EME array pointed about 40degrees away from the beacon (this is where the antennas must sit when the tower is down, to keep from hitting the house). I listened to (and recorded) the audio signal from the W3CCX beacon at 144.283 MHz with and without a DCI 144 MHz 4-pole bandpass filter before the Q-Bits RF amplifier. The results are impressive. The **IMD here TOTALLY obliterates** the signal from the W3CCX beacon 50 miles away when the filter is not in place; the beacon is Q5 when the filter is in place. I recorded both sets of conditions with my horizontal and my vertical antennas (all part of the EME array). The signals are in the wave files at the URL below. The gains were all kept constant for these recordings, and there was NO AGC: <http://home.epix.net/~rrehr/filtersFrame1Source1.htm>. I am rebuilding the shack here, and hope to try all of this out back "on the moon" soon. Any comments are welcome. 73, Roger, W3SZ. From "Cheese Bits" (Mt. Airy VHF Radio Club, Inc.)



Global Positioning System (GPS)

24 Data collected before and after "Dithering" was turned off on 1 May 2000. 100 foot square. New accuracy is within +/- 25 feet.

IMD – Measurements

On March 18, 2000 we met at Tom's (N8ZM) house for a day of measurements. As it turned out we did mostly intermodulation distortion (IMD) measurements.

Two HP signal generators, type 8640B, were used. Signals from those were attenuated with 6 dB attenuators then combined with a resistive hybrid. Total attenuation for each signal (f1 and f2) was 10 dB. The level of those signals were adjusted and read from the generators. Using just one signal, the minimum detectable signal (MDS) was determined by just listening using the BFO. Next the S-meter was calibrated. This was used later to convert the IMDs from S-units to dBm levels. Finally using a formula the 3rd order intercept point (IP3), which is the accepted quantity to indicate IMD susceptibility was determined.

$$IP3 = (3 \times Pin - IMD3) : 2 \quad [\text{in dBm}]$$

A value of between +20 dBm and + 30 dBm is considered good, of course, the higher this value the better the receiver performs in the presence of strong signals.

Graph

Measurement Set-Up, Generating Two Signals

IC-745 (WB8GXB)

MDS (14MC, SSB) -135dBm (Barely Audible Tone)

MDS (28MC, SSB) -131dBm

S1	S2	S3	S4	S5	S6	S7	S8	S9	S9+	S9+
-101dBm	-97dBm	-94.5	-92	-89	-85	-82	-78	-74dBm		

Pin 0dBm IMD3 S 7.5 = -80dBm >>>> IP3 +40 dBm

RC4 (W8ULC)

MDS (14MC, SSB) -140dBm

S1	S2	S3	S4	S5	S6	S7	S8	S9	S9+	S9+
		-108dBm	-103	-100	-95	-88.5	-83	-77.5		

Pin -10dBm IMD3 S7 = -88.5dBm >>>> IP3 + 29 dBm
 Pin -5dBm IMD3 S8 = -83 dBm >>>> IP3 +34 dBm

Yaesu 707 (KA8SSB)

MDS (14MC, SSB) -140 dBm

S1	S2,5	S3	S4	S5	S6	S7	S8	S9	S9+	S9+
	-118dBm			-113			-106	-98		

Pin -25dBm IMD3 S9 = -98 dBm >>> IP3 +11.5 dBm

TR-7 (KA8EDE)

MDS (14MC, SSB) -130 dBm

S1	S2	S3	S4	S5	S6	S7	S8	S9	S9+10	S9+20
-104 dBm	-100	-96	-93	-90	-86	-82	-78	-74	-65	-56.5

Pin -10 dBm IMD3 S6 = -86 dBm >>> IP3 +28 dBm

Pin -15 dBm IMD3 S3 = -96 dBm >>> IP3 +26 dBm

Yaesu 920 (W8ULC)

MDS (14MC, SSB) Preamp on -135 dbm

S1	S2	S3	S4	S5	S6	S7	S8	S9	S9+20	S9+
-99.5	-98dBm	-97	-94	-91	-86	-82.5	-75	-60	-42dBm	

MDS (14MC, SSB) -135 dBm

Pin -20 dBm IMD3 S5.5 = -87 dBm >>> IP3 +14 dBm

Preamp turned off!

Pin -7 dBm IMD -81 dBm >>> IP3 +30 dBm

6 m Measurement MDS (50MC, SSB) Preamp off -129 dBm

S1	S2	S3	S4	S5	S6	S7	S8	S9	S9+	S9+
-89.5	-89	-87	-84	-82	-78	-72	-65	-54		

Pin -5 dBm IMD S8.5 = -59.5 >>> IP3 +22 dBm

MDS (50MC, SSB) Preamp on -137 dBm

S1	S2	S3	S4	S5	S6	S7	S8	S9	S9+	S9+
		-108.5		-101		-93		-75dBm		

Pin -25 dBm IMD -69.5 dBm >>> IP3 -2dBm

Loopers versus Yagis

From The "Northern Lights Reflector" **Mike King, KM0T** <scsueepe@mtcnet.net> 13 Feb 2000

A few weeks ago I asked for comments on loopers verses yagis for 903 and 1296. Got quite a few responses. Here is the comment's summary as best as I can figure. There are not a lot of hard data in the comments, just guys usage of the various antennas and their opinions.

- 1: Don't get caught up in published gain figures as the sole deciding factor. Depending on the test setup for the antenna, the gain can vary per wavelengths above ground. "Stackem for more gain" as one said. See #9 below.
- 2: Gain is depends pretty much on boom length, yagi or looper. (Incidentally, all I could find on this was in the UHF and Microwave experimenters' book. In chapter 9, the discussion of rod verses loop elements basically became a choice of personal preference.)
- 3: For smaller boom lengths, the looper may have an edge on gain, but as the boom length increases, these become essentially equal. The looper does have larger sidelobes than the yagi.
- 4: The feed method of the yagi may be harder to tune then the looper type feed. Loopers are easier to reproduce faithfully.
- 5: Yagis detune more than the loopers when wet was the consensus. Although some did indicate that both detune when wet.
- 6: Loopers are a "quieter" antenna than the yagi.
- 7: Loopers are a more efficient feed as the current is distributed evenly throughout the entire loop verses a dipole type feed.
- 8: Loopers get damaged easily by birds, without a doubt - yagis are more robust. One mentioned that birds don't sit on his looper because the sharp edges on the loops, so the birds don't like them. The loops are however easy to fix. (What a pain though when its up on the tower) I got lots of comments about birds crunching the loops, but only one where they said it happened to them. Is this really happening in a large amount?
- 9: Big comments on making the looper or yagi work the best was "feedline" Get better feedline to your antenna and it will really be the best place to improve the signal received and ERP, verses whether or not your using a loop or standard yagi.

Now for some more controversial opinion. Remember, they are not from me, so flame somebody else, Hi!

A: A number of posts talked about loop yagis consistently outperforming M2 yagis at VHF conferences.

B: The M2 1296 35 el was built for around 1269 Mhz and not rescaled for 1296, thus the performance is lacking at 1296. They work fine at the design freq.

C: Loop yagis perform as advertised at the VHF conferences.

D: Long loop yagis flex too much and hence have a loss in gain.

E: Loop yagis were initially designed cut and try, not optimized. So hence the ease in tuning and more forgiving bandwidth, but not a clean pattern. (I did not get any opinion on recent looper designs, whether they are optimized by computer or whatever)

Sample of June Contest Reports

From the "Northern Lights Reflector"

Preliminary **Rover Report** from **N0YVY/R, Steven H Sawyers** <sawyers@inav.net> Sun, 11 Jun 2000 23:55

Bill NOLNO agreed to risk his life, limbs, and health and operate while I drove and coughed, so we hit the road at 1:00PM local. (I know this breaks the tradition of the Cedar Rapids Micro wave Society of starting at least one hour into the contest.) Had equipment for 6, 2 144, 222, 432, and 1296.

We did everything from the M² omni antennas - did not even take a beam with us. Operating style was RUN AND GUN. Most QSOs were made while in motion unless we wanted to do 1296, or were near the top of a hill in which case I would just pull off to the side of the road, and Bill would run the bands with who ever and what ever they had. Route was basically north from west the four corners west of CR to Rochester, then to the Twin Cities then east into Wisconsin and then diagonally back to CR when we ran out of time.

WE HAD A BLAST!!! Thanks to everyone for working us Preliminary stats:

Activated 12 GRIDS Approx **240 QSOs**

6 was open on Saturday and Sunday so have about 20 grids on the magic band.

High points - SSB and CW on 1296 - I need to work on my code. Last QSO was 1296 CW from the side of highway 13 in northern Iowa to give the operator a first time 1296 into EN 42. QSO finished with 10 seconds to spare - as verified by Garmin GPS. M² HO Loop Antenna's worked great.

GPS is wonderful for nailing down location and time - works even better with SA turned off.

Low points - Spending over 2 hours in Minneapolis after midnight trying to find a room for the night - only took 12 full hotels then only got about 4 hours sleep - but the room came with a Pizza. Ask us some time.

Frying the Yeasu 8500 FM dual band due to a wiring reversal - and the fuse did not blow! Full report with lessons learned after we get the score figured.

And ...From the Home Station by Charlie, N0AKC Chippewa Falls, WI cbetz@sgi.com

Here are my results (home station) for last weekend's contest:

6M: 146 x 80 2M: 67 x 26 222: 27 x 18 432: 36 x 19 903: 3 x 2 1296: 2 x 2

Totals: 281 x 147 = 52,038

This is by far the best score I've had operating from home. It's also the first full effort I've put in from home during the June contest. It was a lot of fun. Many thanks to the rovers, especially KF0UK, who gave me a whole bunch of Q's & grids. On the down side, I was rather disappointed in my inability to hear on 903 & 1296. I guess I have a few station improvements to make on those two bands. Also, this contest was not without my usual equipment problems (hey, what would a contest be for me if I didn't have to stop & fix something??). I had an intermittent relay on 2M in my mast mounted preamp box. I ended up repairing a dead preamp and installing it in the shack. I also had a dead preamp on 432 and an open cable between the relay and preamp on 1296. Then, 10 minutes from the end of the contest, the rotor on the big tower (6M & 2M antennas) decided to die. Fortunately it happened with 10 minutes to go instead of 10 minutes into the contest! So, now I have to figure out what to do to make 903 & 1296 work better. I also found out in the contest that I need more power on 6M. But I found that when the band opened up it wasn't possible to hold down a frequency with just 100 watts. Paul, you'll be safe for awhile....more power on 6 probably won't happen for awhile, since I have other things that I have to fix first.

Asronomy Photo of the Day URL: <http://antwrp.gsfc.nasa.gov/apod/archivepix.html>