January 2007

KL7KC
Fairbanks, Alaska

Arctic Amateur Radio Club

The Short Circuit

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FCC to nix CW

DETAILS ON PAGE 6

The Copper Cactus Antenna

Introduced by John Slater KL1AZ

Below are the plans that I started with when I built my Copper Cactus antenna back in 2000 with the help of Bob Ball KL7AH. Many thanks to Gary Deutschmann KG0ZP for this article which I found on the web site AC6V. This article is copied directly from the web site.

I modified my antenna so that I could use 259 connectors with a jumper between the 2 stubs. With KL7AH's help we completed the 2-meter portion in 2000. I originally built this for dual band operation and did not add the connection for the 440 side until this past Feb just prior to the Jr. Yukon Quest. You will notice that there is a jumper cable between the 2m and the 440 connector. The SWR on both sections set up this way is less that 2:1 on both 2m and 440. The location of the PL-259 UHF connector is directly across from where the feed line is soldered on the stub for each band. This can be made into a multiband configuration from 6 meters all the way up to 23 cm.

I have this antenna located just out side my shack in the basement of my home mounted on the fence about 6 ft off the ground. KL7AH had his just stuck in the ground about 2 ft high with a short piece of copper pipe to keep it out of the snow and was able to receive and transmit with great ease.

If some of you have been paying attention to *QST,* about a year ago you would have read an article about someone who used the modifications that I used on this fine homemade antenna.

Figures 1 & 1/A-B show it mounted on the corner of my fence. Figure 2 shows the 2-meter connection. Figures 3 & 3A show the 440 connection. Photo 4 & 4A show SWR on 2m (1.4:1). Photo 5 shows SWR on mid range 440 (1.8:1).

From KG0ZP

To: All Amateurs

From: Gary - KG0ZP

RE: The COPPER CACTUS ANTENNA

Dear Fellow Hams

Here are the numbers (Table 1) for the Copper Cactus J-Pole antenna!

I hope you are already familiar with the construction of the standard J-Pole antenna, so I won't go into any unnecessary detail.

The antenna may be built as a MonoBander, DuoBander, TriBander, QuadBander or whatever with great success.

You can either feed it with separate coax's for each band or a single coax, however, separate coax's make it much easier to tune.

There's no trick to building them, just remember the overall length is for the lowest frequency of operation. In other words, a MonoBander, DualBander and TriBander are all exactly the same length overall 58.09" on 2 mtrs.

Feed the coax up the center of the pipes. Use T-Fittings at the proper distance below the top of the antenna for the desired frequency. The only problem is that the more bands you try to incorporate into the antenna, the harder it is to get the SWR flat on all bands.

Figure 1.

For best results, build the highest band first, eg. the 435 MHz antenna, If you really want it to look neat, use 3/8" copper for the vertical and 1/4" copper for the transformer section (stub). Naturally the finished

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(Cactus —Continued from page 1)


Fig. 1A

product will be in the shape of a "J".

Now build the next band, eg. the 223.5 MHz antenna, by adding pipe to the T-connector that is the base (mast mount) of the 435 MHz antenna, I use 1/2" for the vertical and 3/8" for the stub of this section.

Now build the 146 MHz antenna, don't forget the overall length of the antenna is the lowest frequency you will be using. I use 3/4" for the vertical and 1/2 for the stub.

The stub must be parallel to the vertical, however you can point the base of each stub in any direction you like. I prefer 3 equal distant points, but you can make them all on the same side if you wish. I feel the three points make it look like a cactus.


Fig. 1B

My measurements on overall length, and stub length are from the centerline of the separation pipe (horizontal) to the top of the antenna. The Separation distance is technically from centerline to centerline, but inside measurements are fine and visually look better.


Fig. 2

Some of the measurements are less than physically possible, in this case just push the T-Fitting and elbow as close together as you can get them, no need to trim the fittings.

The Connect at measurement is from the top of the horizontal member to the point of connection.

Final Note: If you use 1/2" pipe for all the construction, on the 2-meter stub, add 1/4" to its length, or use pipe-caps and adjust them up or down to get the 1/4" additional length.

The antenna should be in perfect tune, SWR less than 1.2 - 1 on all bands, using separate coax for each band.

Solder all the joints before installing the coax, any pipe you have left over can be used as the mast.

To install the coax, drill a 1/4" hole in the top of the horizontal part of each T-fitting closest to the vertical, then tilt the drill at an angle, so that the drill bit is sorta heading down the vertical.

Enjoy Building: If you have any questions just ask, or further instructions, just send me a message and I will promptly respond.

PS Until you are familiar with the construction techniques of the J-Pole, I wouldn't attempt any more than three bands the first time out. In fact, A dual-bander, using the above dimensions will be perfect every time.

73s de Gary - KGØZP ⌗

More KL1AZ photos on p 3.

Table 1 Copper Cactus Dimensions

Frequency	52 MHz	146 MHz	223.5 MHz	435 MHz	912 MHz	1265 MHZ
Pipe Dia.	1"	3/4"	1/2"	1/2"	3/8"	3/8"
Stub	54.70"	19.36"	12.65"	6.46"	3.02"	2.16"
Overall Length	163.92"	58.09"	37.94"	19.39"	9.07"	6.49"
Separation	5"	2"	1-1/4"	3/4"	1/2"	1/4"
Connect at	6"	2-1/4"	1-1/2"	1"	3/4"	1/2"

HRD vs. DXLab Suites

By Dan Wietchy KL1JP

I've only recently become interested in making my radio work harder and faster. Rig automation appeals to me; specifically in contest logging and in the ability to automatically reply to a DX spots using CW – it's almost magical. I wanted to find a software and "black box" solution that would be compatible with my simple (low end) laptop and dial-in internet connection. I'm thinking along the lines of using this system for the upcoming Field Day. I wanted something that was almost foolproof; fairly inexpensive and was compatible with CW and Psk31 modes. I want to develop a laptop/computer combination, work the bugs out and develop a personal familiarity with it so – come Field Day, the only thing I worry about is propagation.

For the purpose of my experiment, I'm using a Yaesu FT-857 radio (HF/VHF/UHF) together with an LDG Z100 autotuner. An older model Winbook laptop (circa 2000) running Windows 2000 and a PCMCIA - card based modem provides the "horse-power" to drive the software. Based on the price alone, I'm comparing two software packages, DXLab Suite and Ham Radio Deluxe (HRD). Both products are free – you can't beat that!

During the recent CQ World Wide CW contest (November 25-26), I had a good chance to compare both the HRD and DXLab software capability. With CW operations running full bore, I played with both software packages – using DXcluster spotting and attempting to control the radio only with the software. It was my attempt to set up an entire 'hands-off' operation.

Installation: HRD wins

During my initial installation of DXlab Suite, the software kept trying to access the host website and download patches, updates and miscellaneous support files. Having only a dial-in internet connection, that's the last thing I wanted to happen. It took me a while to figure out that the install origin and subsequent installation folders can

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Fig. 3

Fig. 4

Fig. 4A

Fig. 5

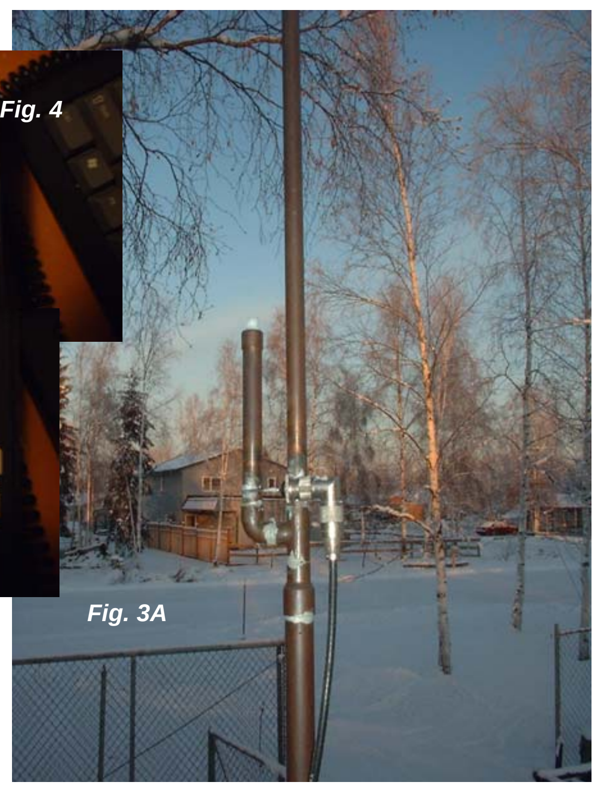
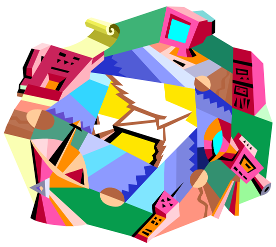


Fig. 3A



(HRD vs. DXL — Continued from page 3)

be controlled thru the DXlauncher properties. Once you have the launcher set up correctly, then the software behaves rationally. Installation of HRD, on the other hand, is very simple. The download consists of 1 file, a CDRom image - 90 megs in size. Both individual files and a CDRom image is presented on their website. I recommend that you download the image- not the individual files. Once you uncompress theimage zip file, it will create the necessary folders and files and self-install.

Stability : DXLab wins

Even though DXlab Suite is a trifle bit more confusing to download and install, it seems to be more stable using low end computer equipment. While keeping DXlab running, I was able to minimize the software and hop onto the internet to get my email, browse the web and run several other programs in the background. The low power laptop never missed a beat. However, when attempting to accomplish the same tasks using HRD, my laptop locked up several times and I wound up having to reboot too many times. That behavior could be frustrating during a contest and result in the loss of both contacts and points.

First impressions: DXlab wins

The DXLab software is very modular. You can run any one or more of the modules you would like. I enjoyed the ability to open specific windows and position them where I wanted them to sit. The HRD software, on the other hand is very well integrated – almost too integrated. Full screen with modules sort-of crammed into probably ideal locations. I would have chosen to move several items from the left side of the screen to the right hand side of the screen, rather than their default positions. It appears that you can change the

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	DXLab Suite	Ham Radio Deluxe
Downloading Procedures	8 Large Files	1 Large file
Program Size	48 megs	93 megs
Installation Procedures	Confusing	Very Easy (CDRom image)
Look and Feel	Modular – separate windows	Integrated
Computer Compatibility	Not One Problem	Locked up Laptop 3-5 times
First Impression	Like it a lot	Some functions not located well. Seems congested.
One Item I Liked	DxView with immediate plotting of spot on map.	Satellite module
Dxcluster Reporting	Fast with user selectable reporting interval	Seems slow – no ability to change report interval
DxSpot Mapped To Map	Yes	No
DXCluster	telnet – easy to configure	telnet and website - limited
Advanced Yaesu Control	Limited	Extensive
CAT line – Connect and Disconnect Ability	NO	YES
Compatibility	Not One Problem	Static burst/noise
PSK31 capability	Winwarbler – problematic	Deluxe PSK31 – very extensive - superb

(HRD vs. DXL —Continued from page 4)

"look & feel" of the software by investing some time into customization. I didn't want to. In some instances, there are almost too many features visible at any one time in HRD.

DXCluster Spotting and Mapping: DXLab wins

I really think the DXSpotting and DXView is MUCH better than the similar capability offered by HRD. In the DXView module, as new spots appear, they are automatically mapped onto the DXview "world map" and highlighted for 2 seconds. It's incredibly easy to see where new spots pop up; Europe, Western US, Asia etc… Furthermore – you can position your mouse cursor on the spot and a pop up box appears displaying frequency, mode, etc…. You can also double click the spot and instantly retune the radio to the frequency reported by the spot. To go from initial spot to contact takes less than 1 second. In HRD, although a world map exists, I see no capability to automatically locate and map the spots as they are reported. I also found cluster reporting a lot slower. There appears to be no way to change the reporting time interval in HRD while in DXLab, cluster reporting can be controlled by the second.

World Map Capability: DXLab wins

Both DXLab and HRD offer a world map view with overlay capability. The user can click informational overlays on and off. For instance; you can turn on the Maidenhead Grid boundary overlay so you can check your proper location or a contact's grid location. This capability also offers the ability to display grayline, auroral activity, sunrise and sunset times, paths between spotted DX stations and more options that I know what to do with. Using many of the options requires "real-time" internet connections. I had no problems using dial-up with either software package. Although both DXLab and HRD offer similar capabilities, I found DXLab faster.

Advanced Yaesu Control: HRD wins

The one ability I really liked was only available in HRD. It was advanced control capability over my FT-857 radio. I suspect this may be radio specific. HRD gave me the ability to control almost every advanced feature in my radio; CW pitch, CW speed, AGC, ISP, etc… This was not the case in DXLab – at least not in the software setup offered by default. I suspect that it was possible to set up macros and the like to provide some if not all of the capability but I didn't want to spend the time.

PSK31 Ability: HRD wins

The embedded PSK31 Deluxe module in HRD is about the best I've seen. On the other hand, the Winwarbler module in DXLab is clunky, seems to require a few more software "things" and despite my best effort – I've not been successful in setting it up correctly. The psk31 module in HRD installed flawlessly and operated correctly the first time I used it.

Command Module Memories: DXlab wins

When I see an interesting spot, it's nice to have the ability to lock that frequency into memory. Hopefully, another click can instantly retune the rig. In DXLab, that memory saving ability is comfortably placed right alongside the rig control knob in the "command" module of DXLab. A simple click saves the current rig frequency to 1 of 10 quick memories. There are actually 10 banks of 10 memories totaling 100 available memories. I still haven't figured out where that capability is in HRD. I'm sure it's there – just not sure where.

User Customization: A Tie

Both software packages offer almost unlimited customization, from what the mouse wheel does, to macros and scripts, screen placement of individual icons and programs, software colors, buttons, initial band settings, radio configuration, etc....

Satellite Tracking & Position: HRD wins

Within the HRD software, there is a module that will display the track and positions of many of the amateur radio satellites. I can certainly appreciate the usefulness of this ability during Field Day contests. Nothing like it exists the DXLab software although there are probably "add-on" modules that would work as separate programs.

An embedded MP3 sound recorder: HRD wins

HRD software boasts an avail-

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"[T]here are almost too many features visible at any one time in HRD. "

FCC: No Code!

On December 19, the FCC issued an historic Report and Order (R&O) in the "Morse code" proceeding, WT Docket 05-235. The R&O follows fast on the heels of the Commission's December 15 public notice announcing the elimination of the Morse code exam requirement for all Amateur Radio license classes. The R&O also addresses the ARRL's request to eliminate the disparity between "Tech Plus" licensees (Technicians with Element 1 Morse credit) and Technician licensees — present and future — who have not passed a Morse code test.

"In summary, we believe that the public interest will be served by revising the Amateur Service rules to eliminate the telegraphy testing requirement," the FCC concluded in the document.

Also under the new ruling, the Commission extended identical HF privileges to No-Code Technicians and Techs-Plus. "Based on our review of our rules, we agree," the FCC explained in its *R&O*. "Consistent with our decision herein to eliminate the Morse code requirement, we are eliminating this disparity by amending Section 97.301(e) to afford Technician and Technician Plus licensees identical operating privileges."

The rule revision will mean Technician and so-called "Tech Plus" (Technician with Element 1 Morse credit) licensees will get voice and telegraphy privileges in four HF bands that are identical to those of Novice class licensees. "In eliminating this disparity between Technician and Technician Plus licenses, we are simplifying the Amateur Service licensing structure and promoting regulatory parity," the FCC said.

The December 19 R&O spells out the specific Part 97 changes going into place once the new rules go on the books and indicates that the effective date will be 30 days after the document appears in the *Federal Register*. Publication likely will occur in January, with the new rules going into effect in February.

Initial comments from the amateur community were very mixed. Many, including CW operators, welcomed the code rule change. Others predicted the final decline of amateur radio. A traditional argument to retain the CW requirement for HF privileges has been dropping the gate, so to speak, would permit ill-behaved "outbanders" and CB-ers to wreck the bands. Many repeaters in urban areas and some HF frequencies are inhabited by cretins with foul mouths, and they have been for many years. CW didn't keep them out of the hobby. On the other hand, the rule's advocates believe the risks outweigh the benefits by recruiting new members. Only time will tell if the problems will increase or not. ⌖

(HRD vs. DXL — Continued from page 5)

able MP3 sound recorder. The only limiter seems to be available hard drive space. The quality of the record is adjustable – from a coarse bit rate to a very fine bit rate. The first time I used this to record a QSO – it failed miserably. After their software tutorial and some adjustments, the recorder appeared to work.

Leaking RFI and static problems: DXLab wins

Using HRD software seems to generate a troublesome static burr. While the radio is connected to the laptop you'll hear a continual static burrrrr – burrrrr – burrrrrrrrrrrrrrrr, Switching from the standard Yaesu CAT cable to a ZLP shielded cable (ZLP electronics) does no good. I've read the HRD FAQ about this problem – it seems I'm not the only one to have noticed it. Evidently changing the UART polling rate is suppose to fix it but the suggested fix doesn't seem to work.

In future I need to test differences and report on:

- *Automatic QSL Customization differences*
- *QSL Logging differences*
- *QSL Customization differences*

Downloads and further details including other reviews can be found here:

http://hrd.ham-radio.ch/

http://www.dxlabsuite.com/

http://www.eham.net

Making Sense of Space Weather

By Larry Ledlow, Jr. N1TX

The latest solar eruptions responsible for fine aurora and poor HF conditions prompted me to put together this introduction to space weather and understanding official forecasts and bulletins. "The answers are in the numbers," as the saying goes, but what good are numbers you can't understand? Anyone who has glanced upon the Space Environmental Center (SEC) web site likely will be overwhelmed by a dizzying array of numbers and scientific lingo. I hope to demonstrate the basics are easy to understand and should be monitored by any active radio operator, HF and VHF alike.

What's Out There

Space is a harsh place with radiation and particles streaming in from all directions. The sun is by far the dominant source for the earth. Scientists have studied these interactions in order to understand the effects solar disturbances have on the terrestrial environment and man-made technologies. Serious disruptions to communications and power grids are well documented. Solar observations continue to advance, and forecasting "space weather" has become an essential service to everyone from ham radio operators to satellite controllers.

Unfortunately, the information bulletins from the SEC are often enigmatic, much as a weather bulletin might be buried in highly technical meteorological jargon. As basic consumers, we really just want to know if it's going to rain tomorrow. It is the same for many radio operators. They just want to know if conditions will be good or bad tomorrow. Much of what follows is from personal experience as well as extracted from the SEC web site to help you navigate the waters if you're new to space weather.

There are three basic effects the sun can have on the earth. When Old Sol erupts, it spews forth electromagnetic radiation, high-speed charged particles — mostly protons — and accompanying magnetic fields to wreak havoc with anything in their paths. The possible results for those of us on Earth include solar radiation storms, geomagnetic storms, and radio blackouts.

Sunspots, dark areas on the solar surface, contain transient, concentrated magnetic fields. They are the most prominent visible features on the sun, and a moderate-sized sunspot is about as large as Earth. Sunspots form and dissipate over periods of days or weeks. They occur when strong magnetic fields emerge through the solar surface and allow the area to cool slightly, from a background value of 6000 degrees C down to about 4200 degrees C. This area appears as a dark spot in contrast with the sun. The darkest area at the center of a sunspot is called the umbra. Here the magnetic field strengths are the highest. The less-dark, striated area around the umbra is called the penumbra. Sunspots rotate with the solar surface, taking about 27 days to make a complete rotation as seen from Earth. Sunspots near the Sun's equator rotate at a faster rate than those near the solar poles. Groups of sunspots, especially those with complex magnetic field configurations, are often the sites of flares. The number of sunspots tends to vary according to an 11-year cycle.

Other solar features of importance are coronal holes, prominences, flares, and coronal mass ejections (CMEs). These are generally less understood by non-professionals.

Coronal holes are variable solar features that can last for months to years. They are seen as large, dark holes when the Sun is viewed in x-ray wavelengths. These holes are rooted in large cells of unipolar magnetic fields on the Sun's surface; their field lines extend far out into the solar system. These open field lines allow a continuous outflow of high-velocity solar wind. Coronal holes have a long-term cycle, but it doesn't correspond exactly to the sunspot cycle; they holes tend to be most numerous in the years following sunspot maximum.

Solar prominences (seen as dark filaments on the disk) are usually quiescent clouds of solar material held above the so-

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Unfortunately, the information bulletins from the SEC are often enigmatic...

A large CME can contain a billion tons of matter that can be accelerated to several million miles per hour.

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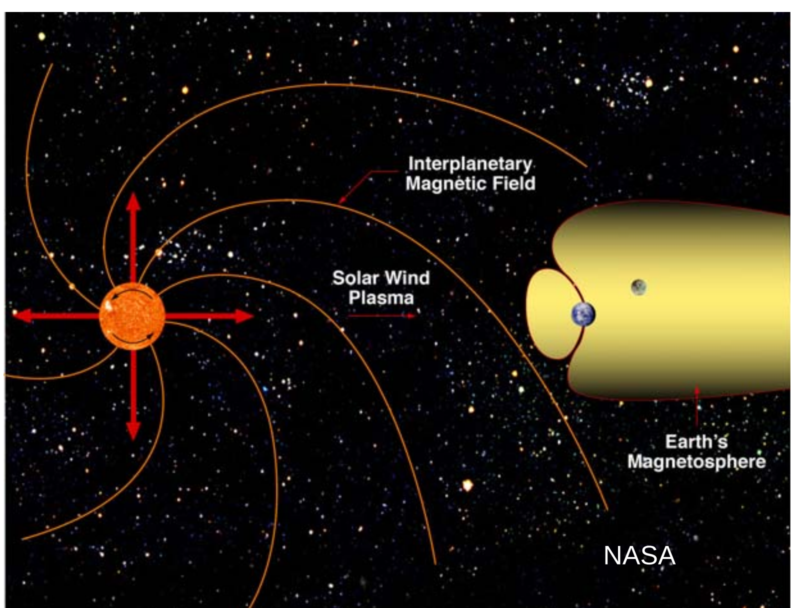
lar surface by magnetic fields. Most prominences erupt at some point in their lifetime, releasing large amounts of solar material into space.

Solar flares are intense, temporary releases of energy. They are seen at ground-based observatories as bright areas on the Sun in optical wavelengths and as bursts of noise at radio wavelengths; they can last from minutes to hours. Flares are our solar system's largest explosive events which can be equivalent to approximately 40 billion Hiroshima-size atomic bombs. The primary energy source for flares appears to be the tearing and reconnection of strong magnetic fields. They radiate throughout the electromagnetic spectrum, from gamma rays to x-rays, through visible light out to kilometer-long radio waves.

The outer solar atmosphere, the corona, is structured by strong magnetic fields. Where these fields are closed, often above sunspot groups, the confined solar atmosphere can suddenly and violently release bubbles or tongues of gas and magnetic fields called coronal mass ejections. A large CME can contain a billion tons of matter that can be accelerated to several million miles per hour in a spectacular explosion. Solar material streaks out through the interplanetary medium, impacting any planets or spacecraft in its path. CMEs are sometimes associated with flares but usually occur independently.

Impact

The tide of electromagnetic energy and particles from the sun makes up the solar wind, which streams forth across the solar system. The solar wind travels outward from 600,000 to 2 million mph. A strong burst of visible light, x-rays, and radio noise may take only two hours or so to reach earth. However, a stream of charged particles follows behind 36-72 hours later. In the case of a CME, the particles — mainly protons — are accelerated to more than 25% the speed of light and can impact Earth in less than an hour after the eruption's peak is observed.



The solar wind flows around obstacles such as planets, but those planets with their own magnetic fields respond in specific ways. Earth's magnetic field is very similar to the pattern formed when iron filings align around a bar magnet. Under the influence of the solar wind, these magnetic field lines are compressed in the sunward direction and stretched out in the downwind direction. This creates the magnetosphere, a complex, teardrop-shaped cavity around Earth.

Because the solar wind varies over time scales as short as seconds, the magnetosphere boundary is very dynamic. Its shape and volume vary a great deal. As the magnetosphere extracts energy from the solar wind, internal processes produce geomagnetic storms.

Aside from the intensity of any eruption or flare, the ultimate impact on our planetary environment will depend on the Earth-blast orientation. Relatively few eruptions are aimed directly at our planet, and many strike only glancing blows.

In addition to the beautiful aurora, the sun's tantrums can also have serious effects for earthlings. Charged particles and intense radiation threaten satellites, astronauts, high-altitude aircrews, power grids, and pipelines, not to mention radio disruption across the spectrum. Sensitive electronics like microprocessors can be disrupted or even destroyed by incoming subatomic particles. X-rays will change the characteristics of the ionosphere. Increased noise and loss of normal propagation modes can significantly degrade or shut down navigation signals and

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NWS & AARC Working Hand in Hand

The NWS bent over backwards to lure interested AARC radio operators into their marvelous shack.

By Dan Wietchy KL1JP

The National Weather Service Skywarn event is fun and very informal. Visitors have always been encouraged to simply drop in to operate the radios, enjoy the camaraderie, pick up an operating tip or two, sample the food or try their hand at several of the available radios.

Technician level members have normally used the Skywarn operating period to gain an understanding of HF bands, radio protocol and "getting over" their initial intimidation of calling "CQ CQ this is KL7FWX" into the microphone. Mentored by any of the available General level operators, Skywarn provides a real "first taste" of HF capability. I'm surprised that more technicians don't take advantage of the educational opportunity it provides. After all – the Yukon Quest isn't that far off and the same radio skills apply.

This year, the folks from the Fairbanks National Weather Service were actively recruiting radio operators. Every radio licensee at the weather service is a technician level and everyone was very curious how their new G5RV antenna would perform. General operators or better were needed to operate that HF antenna so the NWS bent over backwards to lure interested AARC radio operators into their marvelous shack.

This year, the Arctic Amateur Radio Club manned the Skywarn event for the full 24 hours. That may actually be a first for our club. The midnight through 4 AM shift has always been difficult to fill. Roger Burns (AL7BH), having just returned from an extended Asian trip said he'd gladly take that shift since he was still adjusting to Alaskan time and would probably be awake anyway. His gracious volunteer actions filled up our roster to the brim.

On VHF, we logged 21 contacts. Most of these were mobile units on their way to and from the Friday AARC meeting. Linda (AD4BL) gave us one APRS contact and later, when Kody (KL0RN) arrived, he picked up several more for us. Despite our best efforts on HF though, propagation simply did not cooperate. Hours and hours of voice and CW attempts yielded little. The propagation window finally opened a bit about 1 hour before the event was due to finish. Larry (N1TX) was at the microphone and he took full advantage of it, quickly logging several contacts from Vancouver, B.C., one from Oregon and several remarkable long-distance QSO's: Vermont, Ontario, New York and Pennsylvania. These East Coast contacts confirmed what we all hoped - that new G5RV antenna worked and was pointed in the correct direction. ⌖

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communications links.

Like those used to describe tornadoes and hurricanes, NOAA has developed a scale of one to five to express the intensity of these solar wind and radiation impacts on Earth. Solar radiation storm intensities are determined by the number of very energetic ions, protons, and electrons detected by space- and ground-based sensors. A minor storm at S1 may have a little impact on HF in our polar regions. S5, on the other hand, will have major radiation risks to astronauts and polar aircrews as well as wipe out HF propagation worldwide.

Scientists classify solar flares according to their x-ray brightness in the wavelength range 1 to 8 Angstroms. There are 3

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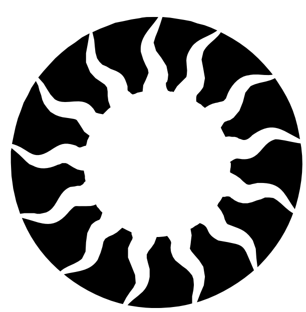

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categories: X-class flares are big; they are major events that can trigger planet-wide radio blackouts and long-lasting radiation storms. M-class flares are medium-sized; they can cause brief radio blackouts that affect Earth's polar regions. Minor radiation storms sometimes follow an M-class flare. Compared to X- and M-class events, C-class flares are small with few noticeable consequences here on Earth. X-ray flare intensities worth of note are specified as M5, X1, X5, X10, and X20, which are increasing strength. Warnings will be issued for a radio blackout when these x-ray bursts are observed. The radio blackout warning scale is R1 through R5. X-rays seriously disrupt the ionosphere by increasing the number of ionized particles. R1 would be minor, brief HF outages. R5 represents a complete outage on HF on the sunlit side of the earth.

What many people do not understand is the impact geomagnetic disturbances can have on

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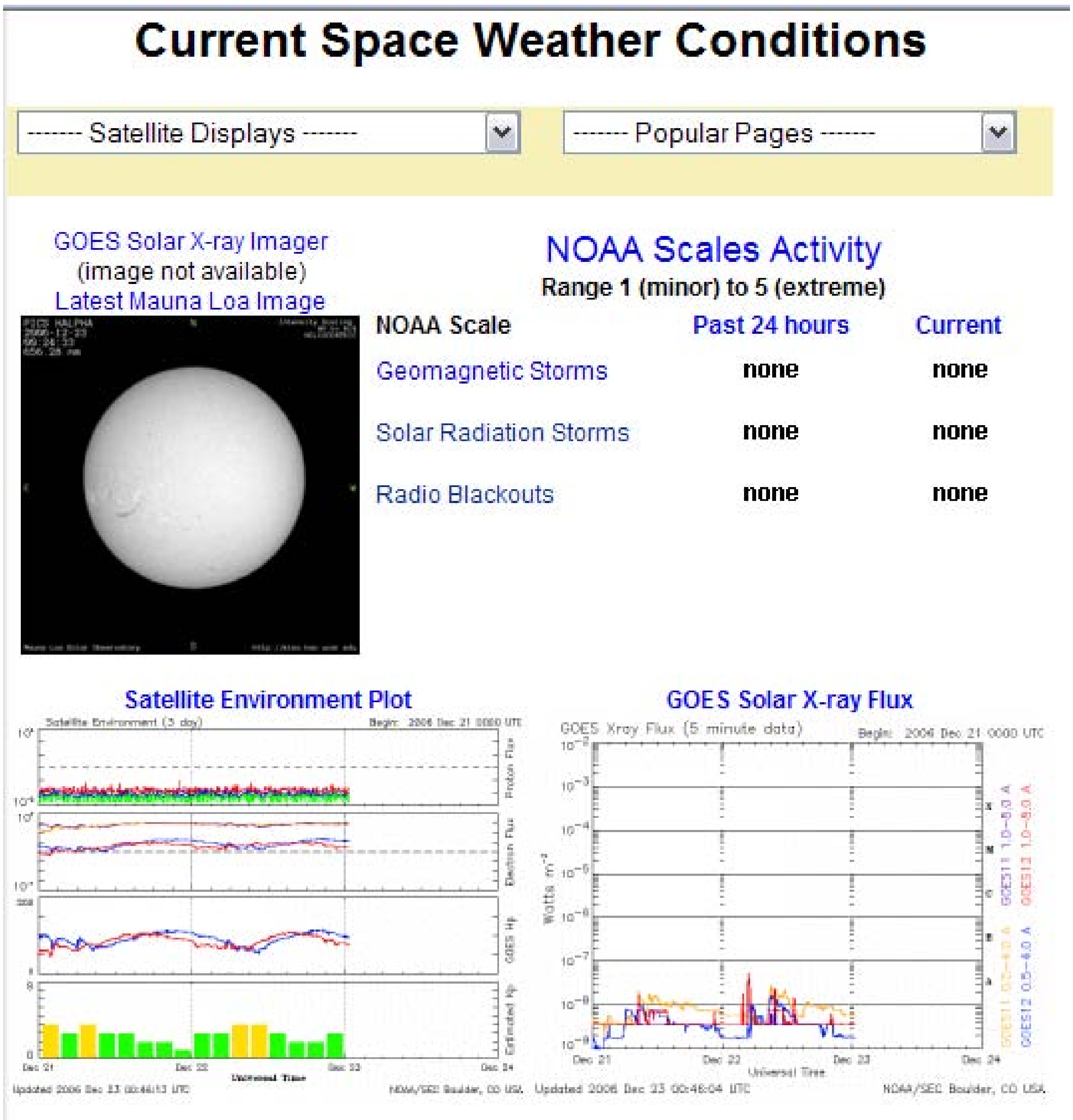

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major infrastructures like power transmission systems and pipelines. You may recall from basic electricity that passing a magnetic field over a wire will induce current in that wire. Similarly, as the geomagnetic field fluctuates, power lines and other long metal structures will have large electrical currents in them. These millihertz fluctuations can stress and even damage electrical transmission equipment, and pipeline flow meters can be disrupted.

Observatories around the world monitor the variations of the magnetic field and compare them to a normally quiet state. The scale on which these changes are measured is known as the K-index.

The K-index is specified on a scale of 0 to 9, with 9 being the most severe geomagnetic instabilities. The K-index measured at various observatories can be (weighted) averaged to determine the overall "planetary K-index", or Kp. Kp values greater than 5 warrant geomagnetic storm warnings.

The strength of the storms is again expressed on an increasing scale of severity from G1 (minor) to G5 (extreme). A G5 would have major impacts on power systems, including widespread voltage control and protective system problems or even complete grid collapse. Transformers could experience damage, too. Spacecraft operations may experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. Pipeline currents can reach hundreds of amps, and HF radio propagation could be impossible in many areas for one to two days. Satellite and low-frequency radio navigation systems can be out for hours or even days. Aurora has been seen as far south as Florida and southern Texas during such events. Complete descriptions of the NOAA scale and the events' potential impacts can be found at http://www.sec.noaa.gov/NOAAscales/index.html. It is attached as a special insert to this newsletter, too.

More Info

The Space Environmental Center's home page on the web (www.sec.noaa.gov) contains a wealth of space weather information, and many links provide paths to detailed reports, archived data, multi-spectral images, and much more. The space weather summary is illustrated by the image on the previous page. In the upper right you can see where the storm warnings would be posted, including those observed in the past 24 hours.

In the lower right portion of the page you can see a three-day plot of the amount of solar x-rays detected by two Geosynchronous Orbiting Environmental Satellites (GOES). In the lower left, the graph shows a three-day plot of (top to bottom) proton and electron counts as well as magnetic field variations measured by the GOES-11 and -12 spacecraft 22,000 miles above the equator. Finally, the bottom bar plot in the stack of four traces is the three-hour estimated planetary K index, Kp, computed from geomagnetic observations.

For those seeking more details, SEC alerts and forecasts are published in text at http://www.sec.noaa.gov/Data/index.html#alerts. In addition to the various real-time alerts, I find weekly reports entitled "27-day 10cm, Ap, and Max Kp Outlook" very useful to anticipate good aurora viewing or poor operating. They are issued on Tuesdays. I strongly urge you to first download the user's guide, which explains the meaning and method behind each report.

Space Weather Outlooks are also published each Tuesday. provide general descriptions of conditions during the past week and an outlook for the next seven days.

There are other good web sites with space weather information. The Danish Meteorological Institute maintains geomagnetic observatories in Greenland, which are useful for arctic radio operators like us. The two-day outlook and data from these sites are available at http://web.dmi.dk/projects/ESA_SWAPP/Public/magoutlook.shtml.

Spaceweather.com is an excellent portal to space weather, aurora, and astronomical news. They have an extensive photo gallery, too.

Current data, forecasts, solar imagery, tutorials, and informative animations can be viewed at The Space Weather Center: www.spaceweathercenter.org. This is one of the best educational sites. ⌖

As the geomagnetic field fluctuates, power lines and other long metal structures will have large electrical currents in them.

Arctic Amateur Radio Club

Membership $20 individual, $25 family. Send checks to
AARC
PO Box 81804
Fairbanks, AK 99708

Phone: 907-479-5203
E-mail: bennie@gci.net

VISIT WWW.KL7KC.COM FOR THE LATEST CLUB NEWS AND EVENTS!

Service to Interior Alaska: We can, we will, we do.

N1CKM & KL1WD Wave Goodbye

This sad news is from Wayne Santos, N1CKM:

Elizabeth and I are leaving Ft. Greely on the 26th (of December) - it's been a great experience. We leave on the ferry from Haines on the 1st of January, so we will still be within 80 meter range until then (Beaver Creek, Hanies Junction and then Haines for the New Year's weekend. We'll try to check in on the 40/80 meter nets, and perhaps you can log us from Yukon and BC. Also, I will start checking into the 3905 Century Club starting on the 26th (40/80M).

Blessings for the new year to you and all our friends in Alaska and in the club.

You can stay in touch by email through:

Wayne N1CKM	Elizabeth KL1WD
n1ckm@arrl.net	e_garramone@hotmail.com

FROM THE BOARD:

The monthly board meetings are NO LONGER held at Trio Hawaiian Grill. A more permanent venue will be announced soon. Contact a board member for information. First Thursday after general membership meetings, 7 PM.

Calendar of Events

Dec 31-Jan 1: Straight Key Night. See right.

Jan 5: General meeting, UAF IARC Room 401. 7 PM. Pre-meeting activities start 6 PM.

Jan 6: License exams. Noel Wein I**CANCELLED**ontact NL7XH.

Jan 17: AARC Board Meeting. Location TBA, 7 PM.

Jan 13-14: North American QSO Party, CW (1800-0900Z)

Jan 20-21: North American QSO Party, SSB: (1800Z-0900Z)

Jan 27-28: CQWW 160m Contest, CW: Start 1500 AKST Jan 26, runs 48 hours.

Feb 2: General meeting, UAF IARC Room 401. 7 PM. Pre-meeting activities start 6 PM.

Feb 3-4: Jr. Yukon Quest. Starts noon Sat, Chena River near Visitor's Center. Operators needed. Contact AD4BL.

Feb 3: License exams. Noel Wein Library. 1 PM. Contact NL7XH.

Feb 4: North American Sprint, SSB. 0000-0400Z.

Feb 8: AARC Board Meeting. Location TBA, 7 PM.

Feb 10: Yukon Quest begins in Whitehorse. Operators needed. Contact AD4BL.

Feb 10: FISTS Winter Sprint, 1700-2100Z. www.fists.org

Feb 17-18: ARRL International DX Contest, CW.

Mar 3-4: ARRL International DX Contest, SSB.

Yukon Quest Signups

We need volunteers to help set up the AARC Net Control (Log Cabin), volunteers to man checkpoints and safety locations, radio operators to provide 24/7 support at the Log Cabin, spotters and miscellaneous support personnel. The race begins 2/10 in Whitehorse.

Contact AD4BL or sign up using the on-line form at http://www.kl7kc.com/QuestVolForm.htm

Happy New Year!

NOAA Space Weather Scales

Category: Scale	Category: Descriptor	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
		Duration of event will influence severity of effects		
Geomagnetic Storms			Kp values* determined every 3 hours	Number of storm events when Kp level was met; (number of storm days)
G 5	Extreme	Power systems: widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. Spacecraft operations: may experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. Other systems: pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.)**.	Kp=9	4 per cycle (4 days per cycle)
G 4	Severe	Power systems: possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. Spacecraft operations: may experience surface charging and tracking problems, corrections may be needed for orientation problems. Other systems: induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.)**.	Kp=8, including a 9-	100 per cycle (60 days per cycle)
G 3	Strong	Power systems: voltage corrections may be required, false alarms triggered on some protection devices. Spacecraft operations: surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. Other systems: intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.)**.	Kp=7	200 per cycle (130 days per cycle)
G 2	Moderate	Power systems: high-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. Spacecraft operations: corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. Other systems: HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.)**.	Kp=6	600 per cycle (360 days per cycle)
G 1	Minor	Power systems: weak power grid fluctuations can occur. Spacecraft operations: minor impact on satellite operations possible. Other systems: migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine)**.	Kp=5	1700 per cycle (900 days per cycle)

* Based on this measure, but other physical measures are also considered.
** For specific locations around the globe, use geomagnetic latitude to determine likely sightings (see www.sec.noaa.gov/Aurora)

Scale	Descriptor	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
Solar Radiation Storms			Flux level of ≥ 10 MeV particles (ions)*	Number of events when flux level was met**
S 5	Extreme	Biological: unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. *** Satellite operations: satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage to solar panels possible. Other systems: complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.	10^5	Fewer than 1 per cycle
S 4	Severe	Biological: unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** Satellite operations: may experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. Other systems: blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.	10^4	3 per cycle
S 3	Strong	Biological: radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk.*** Satellite operations: single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. Other systems: degraded HF radio propagation through the polar regions and navigation position errors likely.	10^3	10 per cycle
S 2	Moderate	Biological: passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk.*** Satellite operations: infrequent single-event upsets possible. Other systems: effects on HF propagation through the polar regions, and navigation at polar cap locations possibly affected.	10^2	25 per cycle
S 1	Minor	Biological: none. Satellite operations: none. Other systems: minor impacts on HF radio in the polar regions.	10	50 per cycle

* Flux levels are 5 minute averages. Flux in particles$\cdot s^{-1}\cdot ster^{-1}\cdot cm^{-2}$ Based on this measure, but other physical measures are also considered.
** These events can last more than one day.
*** High energy particle measurements (>100 MeV) are a better indicator of radiation risk to passenger and crews. Pregnant women are particularly susceptible.

Scale	Descriptor	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
Radio Blackouts			GOES X-ray peak brightness by class and by flux*	Number of events when flux level was met; (number of storm days)
R 5	Extreme	HF Radio: Complete HF (high frequency**) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector. Navigation: Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 ($2x10^{-3}$)	Fewer than 1 per cycle
R 4	Severe	HF Radio: HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. Navigation: Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	Strong	HF Radio: Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. Navigation: Low-frequency navigation signals degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	Moderate	HF Radio: Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. Navigation: Degradation of low-frequency navigation signals for tens of minutes.	M5 ($5x10^{-5}$)	350 per cycle (300 days per cycle)
R 1	Minor	HF Radio: Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. Navigation: Low-frequency navigation signals degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

* Flux, measured in the 0.1-0.8 nm range, in $W\cdot m^{-2}$. Based on this measure, but other physical measures are also considered.
** Other frequencies may also be affected by these conditions.