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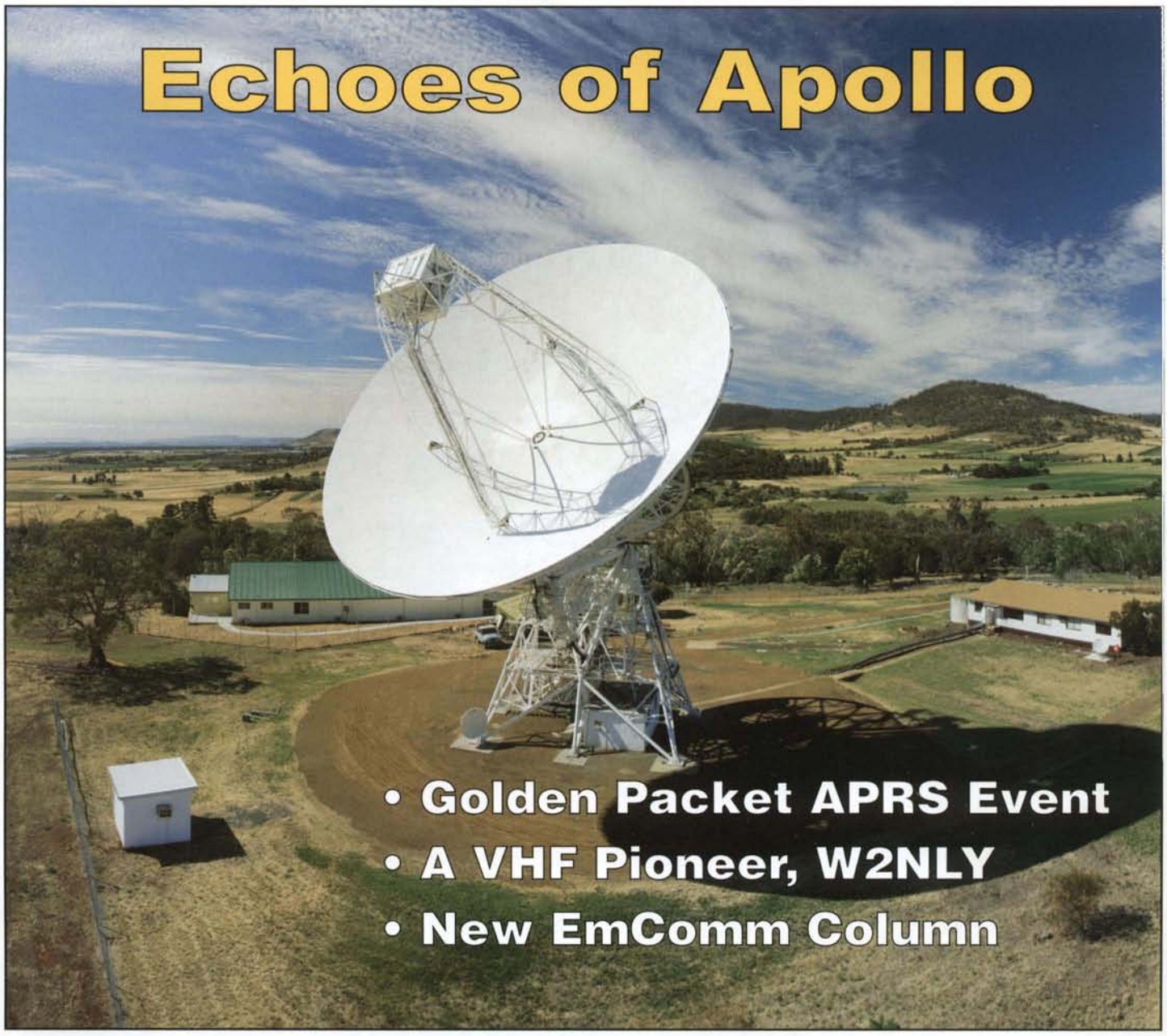

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contents

Spring 2009
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FEATURES

COLUMNS

DEPARTMENTS

On The Cover: This University of Tasmania owned 26-meter dish was built in 1965 by NASA and installed at the Orroral Valley Tracking Station near Canberra. It was part of NASA's worldwide tracking and data network, operated by the Space Projects Branch of the Australian Department of Science. It typically maintained contact with a dozen satellites per day. It was involved in the Orbiting Solar Observatory (OSO), the joint US-USSR manned Apollo-Soyuz mission, and the Space Shuttle program, as well as tracking the re-entry of Spacelab over Australia. When the tracking station was closed by a reorganization, the dish became surplus. NASA then donated it to the university. It was moved to Mount Pleasant between July 1985 and February 1986, and officially opened on May 13, 1986.
Photo courtesy Dr. Jim Lovell, the University of Tasmania.

CQ VHF Ham Radio Above 50 MHz

LINE OF SIGHT

A Message from the Editor

On the "EVE" of Something Big

During the late morning of March 25, 2009—at 1038 UTC, to be precise—members of the German amateur satellite organization (AMSAT-DL) began transmitting signals on the Bochum 20-meter dish. Those signals would take a 100-million km (45.46-million mile) round trip to Venus. The total time for the round trip was five minutes. It was at the end of those five minutes when the AMSAT-DL hams began to hear the echoes of their transmissions. Thus, history was made—the first ever Earth-Venus-Earth (EVE) reflection of an amateur radio transmitted signal. They were able to replicate their experiment the next day for several hours, often sending the Morse code characters for the letters "hi," which harkened back to the "hi" message transmitted by the first amateur radio satellite, OSCAR 1.

In actuality, the goal of reflecting signals off the surface of Venus was an intermediate goal of AMSAT-DL. Its long-term goal is to orbit a satellite around Mars. This effort to bounce a signal off Venus was a test of their equipment, which, it seems, worked quite well.

As you can see, the title for this editorial is "On the 'EVE' of Something Big." Indeed, we might be on the eve of a resurgence of space exploration. NASA is well into its plans to return to the Moon and explore Mars. Japan has indicated the possibility of robotic exploration of the Moon by 2020. Therefore, it seems a natural for the folks at AMSAT-DL to want to be a part of the action with their plans to orbit Mars with an amateur radio satellite.

How else can amateur radio become involved? Already some members of the moon-net reflector have suggested an EVE QSO between AMSAT-DL and another big dish. Thus far, however, no one has stepped forward to accept the challenge. When it happens, it will be written about within the pages of this magazine, as well as reported in my "VHF Plus" column in *CQ* magazine.

What else can amateur radio operators do? Part of the answer can be found in the article entitled "Echoes of Apollo," which can be found beginning on page 6 in this issue. In the article Pat Barthelow, AA6EG, announces events to honor the 40th anniversary of Apollo 11th's lunar landing. The principal on-the-air event, World Moon Bounce Day, will begin June 27, at 0200 UTC. Pat has lined up several big and not-so-big dishes from around the world for participation in EME contacts. As of this writing some, such as the Mt. Pleasant 26-meter dish in Tasmania and the Stanford 45-meter SRI dish, are tentative in their commitment because of possible last-minute scheduling conflicts. Others—such as the CAMRAS Group's 25-meter Dwingeloo dish in Holland, the new 22-meter dish at Eaglin Space Center at Morehead State University in Kentucky, the 4.6-meter Smiley dish at the Pisgah Astronomical Research Institute in North Carolina, and the Deep Space Exploration Society dish locate on Table Mountain in Colorado—are committed to being on the air on World Moon Bounce Day. For the latest information, please check the EOA website: <http://www.echoesofapollo.com>.

What else can hams do? Involve young people, which seems like my continual drum beat. The EOA can be a huge educational event for young people. Having them witness echoed signals from the Moon is exciting for all the participants. Even more exciting, however, is for one of those young ppeople to speak into a microphone and 2.5 seconds later hear the return.

For example, in 2007 in celebration of the UK's Jodrell Bank Telescope's 50th anniversary, a group of children read and listened to their poetry being bounced off the Moon. The video, available on YouTube and linked to the EOA website (see: http://echoesofapollo.com/moon-bounce/), shows the children reading and the parents taking pictures of their children. One of the children later remarked that it was a lifetime event for her.

Other educational opportunities exist. For example, the Grote Reber Museum is located on the site of the Tasmanian 26-meter dish. Reber is the father of radio astronomy. Perhaps the museum could hold open hours during the time of the event or in relationship to the event. Perhaps other educational events can also be planned. If you are working on such an event, then please report it to the EOA website.

As you will see from the EOA website, there are a lot of activities happening in celebration of the anniversary. Several of the activities are not amateur radio related. Even so, the huge potential for worldwide publicity for amateur radio certainly exists—and it is certainly possible that we are indeed "On the EVE of Something Big."

Someone has to Write about This Stuff

With this issue Mark Morrison, WA2VVA, contributes his eighth installment of his well-written and well-researched articles on our history. For the past two years he has focused on files and audio tapes that his father stored during his years as a ham radio operator.

For this issue, however, Mark goes away from the file cabinets and the reels of tapes and into the home of one of the remaining pioneers of his father's day who is still alive. Jim Kmosko, W2NLY, graciously consented to two interviews with Mark. What you read beginning on page 26 is the result of those interviews.

While Mark has spent two years writing his great stories, there are so many more stories to be told. For example, so little is known about Grote Reber's amateur radio activities. Another pioneer on the other end of the KH6UK-W6NLZ circuit was John Chambers, W6NLZ. Perhaps someone can take up the challenge to write about pioneers such as Reber and Chambers.

Another New Column: EmComm

With this issue we introduce Mitch Gill, NA7US. Actually, Mitch does a great job of introducing himself beginning on page 60. Mitch will cover emergency communications from a VHF perspective. Topics he will cover in the not too distant future include interoperability, pre-positioning of assets, and EOCs. If you have an area of EmComm that you would like him to cover, please contact him via his e-mail address: <na7us@arrl.net>.

And Finally . . .

It has been my pleasure to serve as your Editor for the past seven years. As I begin my eighth year at the helm, I am looking forward to many more great things to emerge from the wonderful world of VHF and above. As I stated above regarding EVE, perhaps we are on the EVE of great things, not only for EVE and EME, but also for the entire VHF and above spectrum.

Until next time...73 de Joe, N6CL

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Echoes of Apollo

A World Space Party and an Amateur Radio EME Event

It was on July 20, 1969 that the world witnessed the Apollo astronauts set foot on the moon's surface. For those of us alive at the time, it was one of those flashbulb events—events for which you remember where you were and what you were doing at the time. Now, 40 years later, amateur radio operators around the world are being encouraged to participate in events to celebrate the anniversary. Here AA6EG gives comprehensive coverage to the amateur radio related plans for the celebration.

By Pat Barthelow,* AA6EG

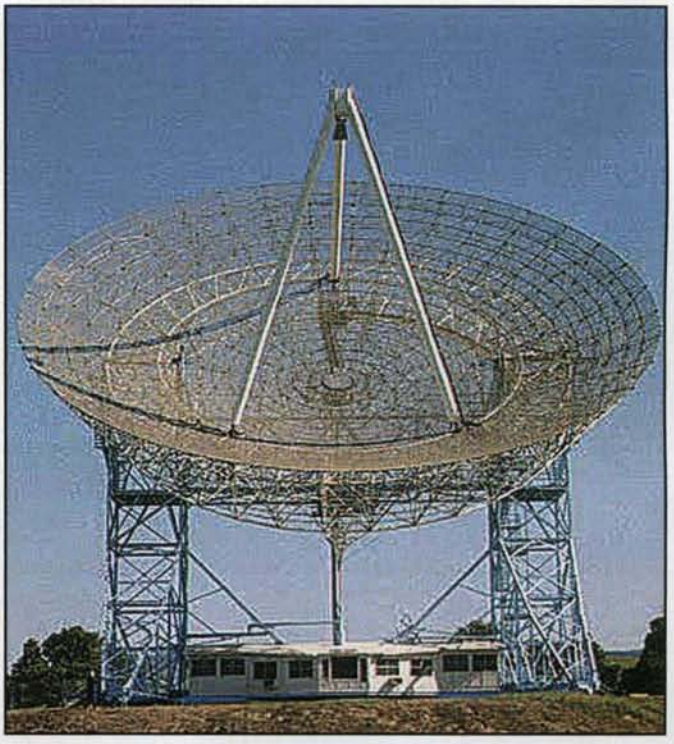
In December 2008 I discovered a website that was a gathering place of members of the Overseas Telecommunications Veterans Association (OTVA), an Australian group with a high percentage of hams as its members. In visiting with them I discovered that some of them were thinking about commemorating, celebrating, the 40th anniversary of the Apollo 11 moon landing. In time plans were formulated for such commemorations, and as it turns out events have been taking place throughout the year and will culminate on July 20th, the anniversary date of the moon landing.

During the course of my visiting with these members, I discovered that some of them had active roles in the Apollo 11, and subsequent, moon landing missions, and had some exceedingly interesting behind-the-scenes stories to tell about that historic space mission and that era of telecommunications.

We discussed the Australian-produced movie *The Dish*, which I had only recently seen and enjoyed. I was amazed at the skill of the movie makers in bringing those of us who had lived that era back to the time, with proper electronic equipment, with "Nixie tubes," and familiar names and models of the era.

I wondered how accurately *The Dish* portrayed the reality of the events, set at the famous Parkes Radio Telescope. I wondered whether the scenes inside the huge 65-meter Parkes dish control room were shot inside the real Parkes. It turns out that the interior scenes were very accurate, shot in a high fidelity set, meticulously recreating the real Parkes control room at the time of the Apollo missions. Particularly prominent in the Parkes control room, both real and the set, were the huge gusset plates and associated nuts and bolts that fortunately held the structure together through the severe windstorm experienced during Apollo 11.

In the movie a lot of creative license was taken with the plot relative to historic events, but I am sure it will hit resonant chords with radio amateurs and professionals who have been around big dishes. Another dish, at Honeysuckle Creek, was a critical player early on during the moon walk, but was not mentioned in the movie. Robert Brand, an OTVA member and now



The 45-meter SRI dish near Stanford University is scheduled to be available during the EOA on-the-air event. (Photo courtesy of SRI International)

**599 DX Drive, Marina, CA 93933*
e-mail: <Patrick.Barthelow@apolloeme.com>

The new 22-meter dish at the Eaglin Space Center at Morehead State University in Kentucky will be used for the EOA on-the-air event. (Photo courtesy of Morehead State University and Jeff Kruth, WA3ZKR)

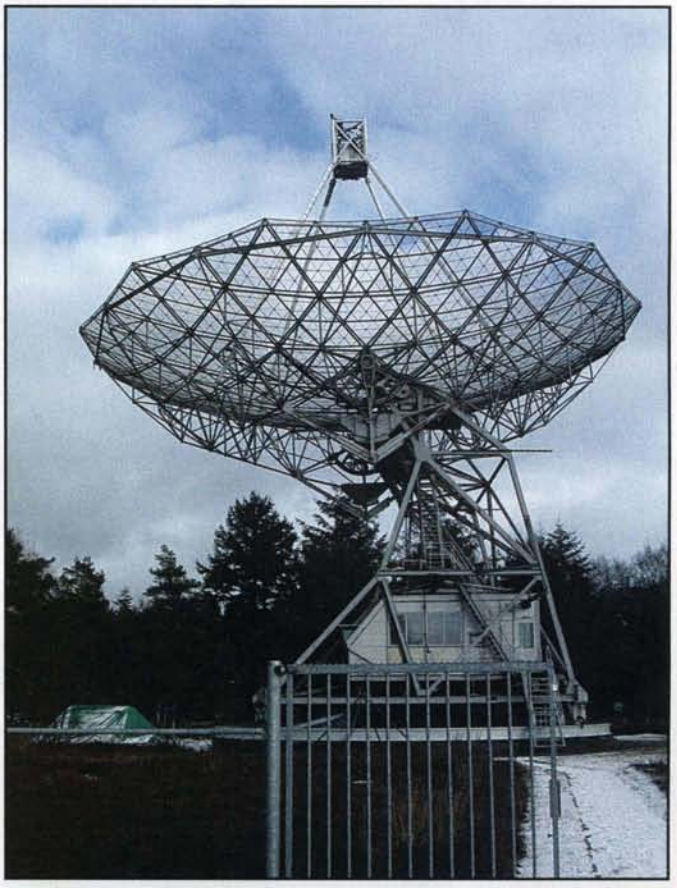
The re-emergent CAMRAS Group's 25-meter Dwingeloo dish in Holland will be on the air. (Photo courtesy of the CAMRAS Group)

EOA (Echoes of Apollo) Events Manager, filled in with information and had especially interesting true tales of, for example, from time to time finding deadly Australian Brown snakes inside the Parkes control room among the warm racks of equipment.

I thought that the Australians might like to add to their planned anniversary celebrations "revisits" to the moon, only this time via radio waves. That idea went over very well, and is being refined with an EOA team mustered, evolving now into a planned, multifaceted, worldwide special event. The event includes EME, science outreach activities, special event stations, and local, national, and international public interaction and participation.

An Invitation to the Ham Radio Community

I would like to invite the worldwide amateur radio community to join the Echoes of Apollo (EOA) event, which is planned to be the world's biggest "Space Party," in June in any capacity suitable to your interests, whether it be EME, HF special event station setup, or IT connectivity (networking—we want to distribute activities via the internet). We are planning for Friday, June 26, at 1700 PDST (or 0200 UTC June 27), which is predicted to be a time and date with good EME conditions between West Coast USA and southwest Australia, where some of the large dishes that may participate are located. This sked is subject to change, and additional skeds are in the works. Keep



The radio telescope atop the Dwingeloo dish. (Photo courtesy of the CAMRAS Group)

informed about amateur radio exact schedules, stations participating, and activities by visiting the EOA website: <http://www.echoesofapollo.com>.

Incidentally, there appears to be a blockbuster movie coming out in June with a moon theme, appropriately called *Moon*, directed by Duncan Jones and Starring Sam Rockwell. Nathan Parker Films is involved, and I have contacted Nathan, who wants to experience moonbounce. I am arranging for Nathan to "guest op" at an EME station sometime, perhaps during EOA.

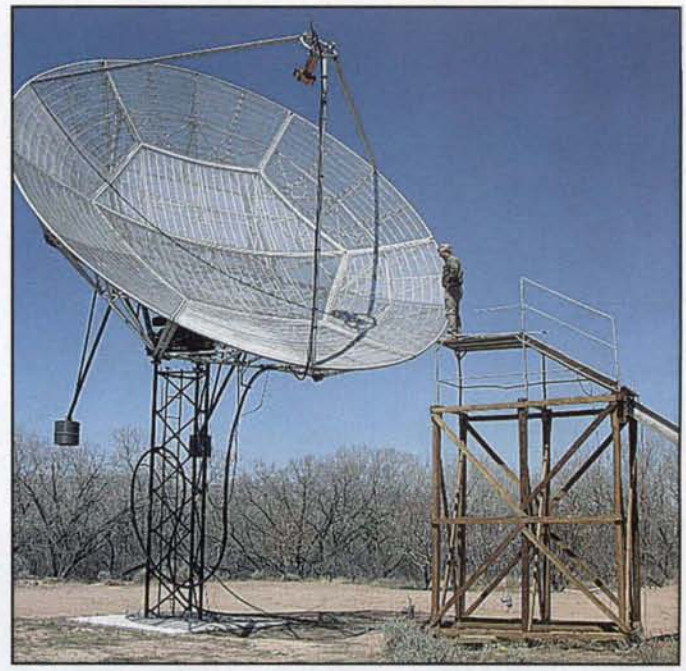
Our prime objective in the EME activity of EOA is to have fun and work with 23-cm SSB EME communications between Australian EME stations and the world EME community during the month of June, and in some cases to July 20. There are a number of players in the EME community who are capable of SSB communications on this band, especially if we access the large Australian dishes we are seeking. We don't want to leave out anyone in the EME community, so please, you are welcome to

The 4.6-meter "Smiley" dish at the Pisgah Astronomical Research Institute in North Carolina is scheduled to be activated during the EOA activity weekend. (Photo courtesy of PARI)

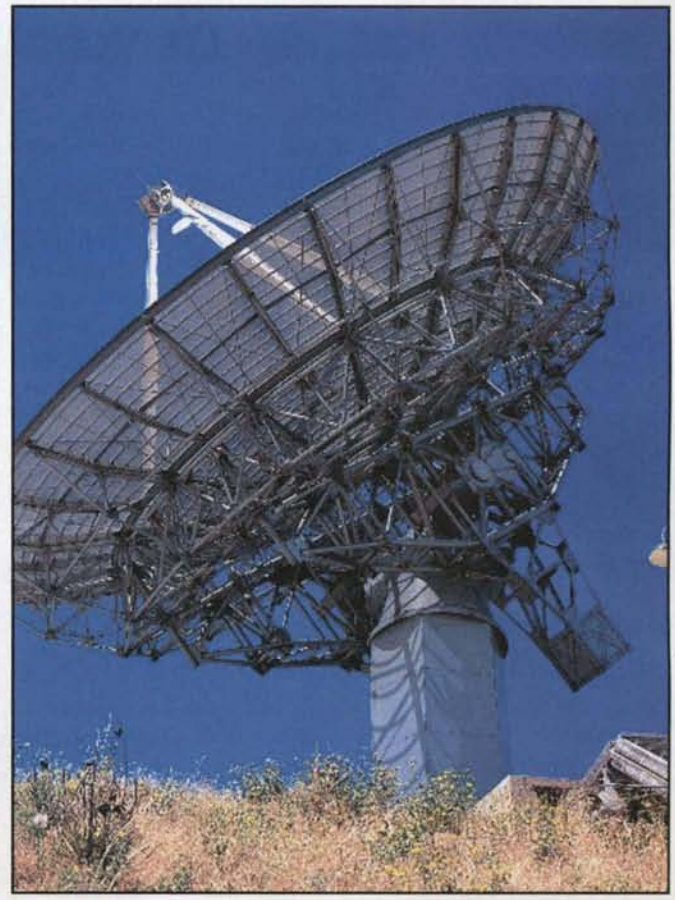
The Jamesburg Dish An Update

My experience in EME is unusual, as I have mainly seen/heard/operated EME as a result of my founding and working with the restoration and operation of the Jamesburg Earth Station. I mustered a very talented technical team that did most of the hands-on technical work and dish restoration. For the most part, they are members of the 50 MHz and Up group of central California. The current status and future of Jamesburg is in the hands of its private owner, who wants to sell the beautiful 160-acre property, including the Earth Station. The owner leaves no options off the table, including leasing the Earth Station, or the original plan, demolition of the dish and development of the property. Someone needs to find a part-time "killer application" for Jamesburg that can pay the freight on the site, and also allow educational and science outreach opportunities in which amateur radio could play a key role. The very recent news of Venus "Echoes" experiment done by AMSAT-DL begs the creation of funding for further experiments of that sort, possibly using Jamesburg, if Jamesburg ever re-emerges into operation.

(For more on the Jamesburg Earth Station and its role in EME, see the articles by AA6EG in the Spring and Summer 2007 issues of CQ VHF—ed.)



Joe Martin, K5SO, of Espanola, New Mexico, plans to use his 28-foot EME dish for the EOA party. (Photo courtesy of K5SO)



The Deep Space Exploration Society (DSES) will turn on its 20-meter dish located on Table Mountain, Colorado. (Photo courtesy of DSES)

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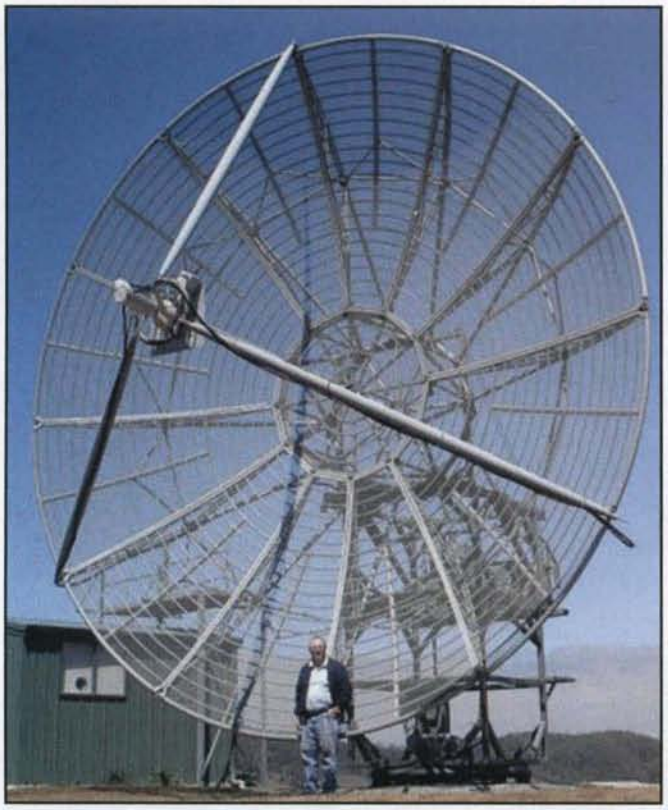

Doug McArthur, VK3UM, will use his famous 28-foot Kennedy dish in Australia for the EOA event. (Photo courtesy of VK3UM)

Chris Skeer, VK5MC, will use his 9.8-meter dish during the EOA party. (Photo courtesy of VK5MC)

join in with other EME modes and frequencies. Coordinate with me at: <Patrick.Barthelow@echoesofapollo.com>. There will be EOA special event QSL cards created and issued for EOA contacts from HF to microwave.

Our proposalthe latest news is that our request for EME use of the 45-meter SRI Dish above Stanford University has been granted, on a not-to-interfere basis with their professional work, and we are clear for late June. Immense thanks are due to SRI International for allowing us to use the Big Dish for this EOA event.

I come from "old school" 1960s-era ham radio, with, to this day, a special love of DX, HF CW signals coming over the pole from Europe, and various forms of contesting, with about 40 amateur radio Field Day weekends in the log with the same core team, the Chews Ridge group, K6MI. Today, though, our EOA team doesn't think that particular HF mode, by itself, has the panache for attracting new blood to ham radio and using ham radio as a medium of science outreach. Our EOA team thinks EME has the exotic challenge and mystery to warrant use in demonstrations having science outreach within their objectives and can attract new blood to ham radio.

Some of the dishes committed to the EOA event include the new 22-meter dish at the incredible Eaglin Space Center, Morehead State University in Kentucky, directed by Dr, Ben Malphrus with lead engineer Jeff Kruth, WA3ZKR.

We also have the seasoned and re-emergent, CAMRAS Group's 25-meter Dwingeloo dish in Holland. In Colorado, the Deep Space Exploration Society is tuning its 20-meter dish on Table mountain for 23-cm EME, among a host of other projects. In North Carolina, we are preparing "Smiley," the 4.6-meter dish of the Massive Pisgah Astronomical Research Center (PARI), for use.

Well-known EMEer Joe Martin, K5SO, of Espanola, New Mexico, plans to use his effective 28-foot EME dish for the EOA party. "Down under" we have Doug, VK3UM, the seasoned EME master, with his famous 28-foot Kennedy Dish, scorched and singed (but okay), by the way, by the brutal and deadly Australian bush fires that raged through his property and through large areas of Victoria, Australia.

Another big dish that is being set up and groomed for EME is the University of Tasmania's 26-meter dish at Mt. Pleasant, near Hobart, Tasmania, and managed by Dr. Jim Lovell (no relation to the astronaut, except for the passion for space). Jim's big dish needs to be groomed for EME, and his professional staff, including ham radio ops on board, will be doing the EME preparations. Local Tasmanian hams are encouraged to help Dr. Lovell prepare the giant dish. Please get in contact with Dr. Lovell, at: <Jim.lovell@utas.edu.au>. Also, Chris Skeer, VK5MC, will participate, adding his magnificent 10-meter dish.

Press-time deadlines and constraints have limited my comprehensive coverage of other leaders in the world EME community. Updated information is always being added to the EOA website. Please visit the site regularly for the updates, including future EME projects. Finally, please come join us and enjoy the party off the moon. ■

Internet References and EME Resources

Echoes of Apollo: <http://www.echoesofapollo.com>
Stanford/SRI Dish: <http://www.sri.com/esd/dish/index.html>
Morehead State University Space Sciences: <http://ssc.moreheadstate.edu/>
University of Tasmania, Mt. Pleasant: <http://www-ra.phys.utas.edu.au/observatories/mount-pleasant.html>
CAMRAS Dwingeloo Dish: <http://www.camras.nl>
Apollo 11, the *rest* of the story: <http://www.parkes.atnf.csiro.au/news_events/apollo11/>
DSES Dish: <http://www.deep-space.org>
OK1DFC Large Dish, Czech Republic: <http://www.ok1dfc.com/>
Overseas Telecommunications Veterans Association: <http://www.otva.com/>
"432 and Above Newsletter" by Al Katz, K2UYH: <http://www.nitehawk.com/rasmit/em70cm.html>
Movie Information: *Moon*, Directed by Duncan Jones: <http://www.imdb.com/title/tt1182345/>
Movie Information: *The Dish*: <http://www.imdb.com/title/tt0205873/>
Jamesburg EME: <http://www.jamesburgdish.org>

The Appalachian Trail Golden Packet APRS Event

From KI4SGU's announcement in the February 2009 "VHF Plus" column in *CQ* magazine about a 2-meter simplex group focused on the Appalachian Trail came a query from WB4APR concerning the possibility of traversing the trail with a single packet. Here are the exciting results of their dialog.

By Jorge de la Torre, KI4SGU,* with Bob Bruninga, WB4APR†

Growing up in the '70s I would often pass time in the long hot Louisiana summers reading radio and electronics magazines, mixed with a steady supply of *National Geographic* and *Boys Life*. As a young Cuban immigrant living on the south shore of Lake Pontchartrain, there was little I could do to equal those adventures and exploits, either in money or access to faraway mountains or glaciers.

Now, however, I still often dream the dream of exploring new and exotic DX destinations, but I'm now fully integrated into American culture with all the normal pressures of mortgage, family, and job, all of which keep me firmly planted in antenna-restricted suburbia.

Occasionally, while waiting in the infamous Atlanta commuter traffic, I entertain myself by planning radio adventures for my fellow commuters and myself, albeit with nearby radio contacts, or working LX (see sidebar), as the group calls it. During one such planning QSO, the idea of activating the whole of the Appalachian Trail, all 2100 miles of it, with radios started to formulate in my head.

After doing a little internet research, I learned that the trail had originally been the vision of another urban dreamer, Benton MacKaye, in 1921. He imagined a trail that would offer the urban dweller an escape. The Appalachian Trail opened as a continuous trail in 1937. It was designated as the first National Scenic Trail by the National Trails System Act of 1968. I also learned in my research that many other amateur radio operators enjoyed the trail and worked simplex and repeaters along its length. Most notably on the repeater efforts is Beau Bushor, N1MJD. His list is available at <http://www.fred.net/kathy/at/hamguide.html>. To date, however, no one had ever passed traffic for the entire length of the Appalachian Trail.

In my further internet searches I did find amateur radio operators on mountains—lots of them. They all seemed to have a real interest in the hobby. I learned about two similar groups out west, "Operation On-Target" (http://www.ontargetbsa.org/) and the Colorado-14er Ham Event (http://www.14er.org/). Yet these events are held out in the Rockies, with the staggering height of those peaks, giving them the advantage of commanding overlooks. Nevertheless, I don't live out west. I live with the gentler and more modest peaks of the Smoky Mountains and the Appalachians. Still, I wondered if it would be possible to communicate more than just a few dozen miles with an HT.

In the late fall of 2008, after a few experimental trials on the more humble metropolitan peaks of Atlanta (Kennesaw, Lost, Stone, and Sawnee), I learned that 80–100-mile contacts with a 5-watt HT and an Arrow antenna were not only possible, but easy to arrange with other

These radios are APRS user friendly. (Photo courtesy of WB4APR)

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like-minded amateur radio operators. Therefore, in order to help with the scheduling I decided to start an internet group by the name of Peak-2-Peak. More on our group can be found at: <http://groups.yahoo.com/group/peak-2-peak>.

During the first week of the group's existence, in early 2009, many members joined, sharing their stories much like my own, wanting to escape the confines of their normal lives and comfortable ham shacks. Many of the early members were predictably my repeater buddies from right here in the metro Atlanta area. However, I knew if I was ever going to realize the dream of full north-south message transit, I would need many more hams to embrace this idea. I would need them from faraway places such as Vermont and Maryland to help me. OK, Vermont and Maryland are not exactly Descheo or Borneo, but hey, this is VHF, so work with me here.

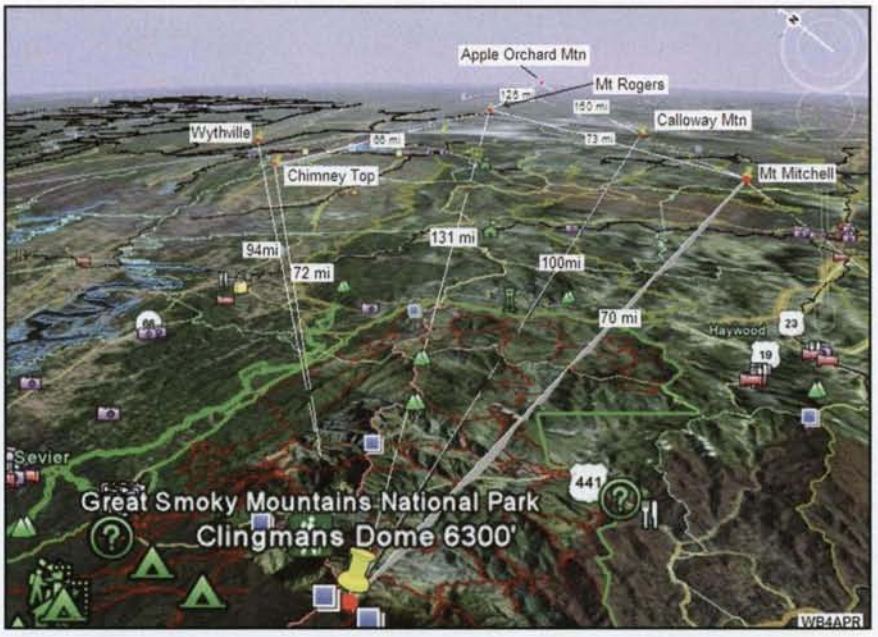
A few weeks later you could have knocked me over with a feather, when one morning while checking my e-mail and processing the membership requests for the Peak-2-Peak group, I got a message from none other than APRS (Automatic Position Reporting System) legend Bob Bruninga, WB4APR. After he joined the group, he was most helpful and enthusiastic. He also shared the dream that I had.

In fact, he did one better. When he read about my idea in a brief press release I had sent to *CQ* magazine (see the February 2009 issue, page 89), he commented that he had thought of something similar many years back, but in his version he would pass APRS packets (what a surprise), and only one packet for the entire length of the trail—One Golden Packet. In a blizzard of e-mails between us and a few others we planned and refined the idea. The "Appalachian Trail Golden Packet APRS Event" was (re)born.

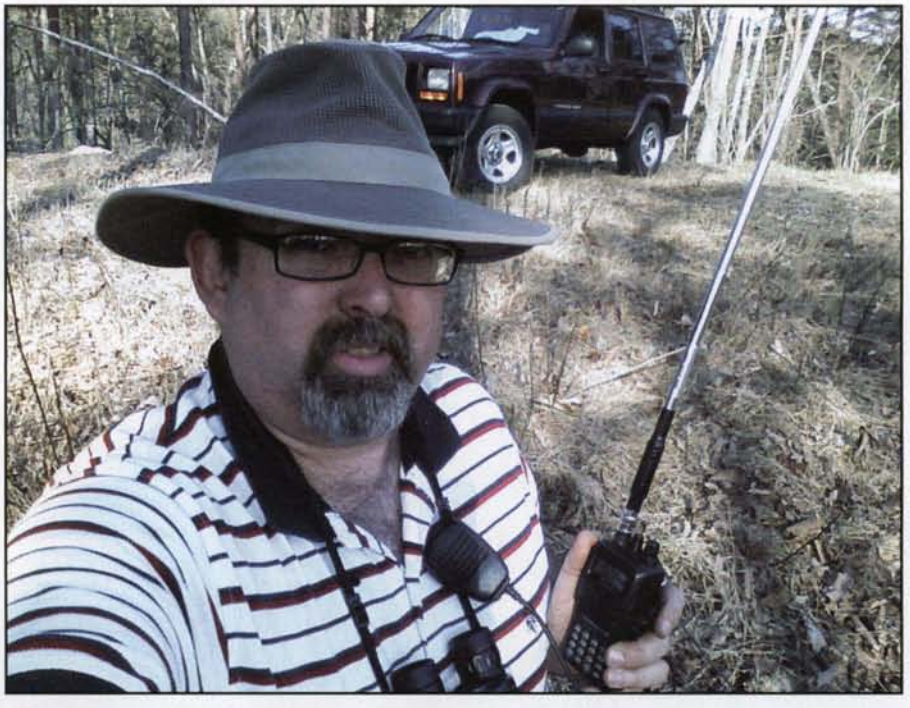
The Appalachian Trail Golden Packet APRS Event would be a yearly event where we would marshal enough amateur radio communication teams on mountain peaks in the eastern USA to be able to communicate APRS messages from beginning to end of the Appalachian Trail on a weekend. The Appalachian Trail is normally considered a 2100-mile walk, but the RF path is more on the order of only 1200 miles, and using 60- to 80-mile links, we should be able to do this in fewer than 20 hops.

This Appalachian Trail Golden Packet APRS event is scheduled to take place in July to coincide with the Annual Appalachian Trail Festival at Castleton State College in Rutland, Vermont. For more information on that event, see: <http://www.vermont2009.org/>. To sign up for this APRS event as a volunteer anywhere in the 14 states along the trail, see the web page: <http://www.aprs.org/at-golden-packet.html> for the latest formation, or send a message to the Yahoo group <http://groups.yahoo.com/group/peak-2-peak/>. Also remember that APRS was never just about tracking; it was originally messaging! For more information about this and other misunderstandings, see the article posted at this website: <http://www.aprs.org/APRS-tactical. html>.

To pull this event off right, preliminary



Google Earth Graphics layout of line-of-sight accessible points from Clingman's Dome. (Graphic courtesy of WB4APR)



The author working peak-to-peak during a recent trek in the Appalachian Mountains. (KI4SGU photo)

link tests are also highly encouraged during Field Day, or sooner if possible, so pack up the kids and the radios in the van and head for the hills.

Now for the Technical Stuff

Although the normal APRS network provides full coverage along the Appalachian Trail on the USA APRS channel of 144.39 MHz, this channel is too heavily shared by local coverage and support and any one link is limited to about two hops. Therefore, we will use a special uncongested frequency just for this event.

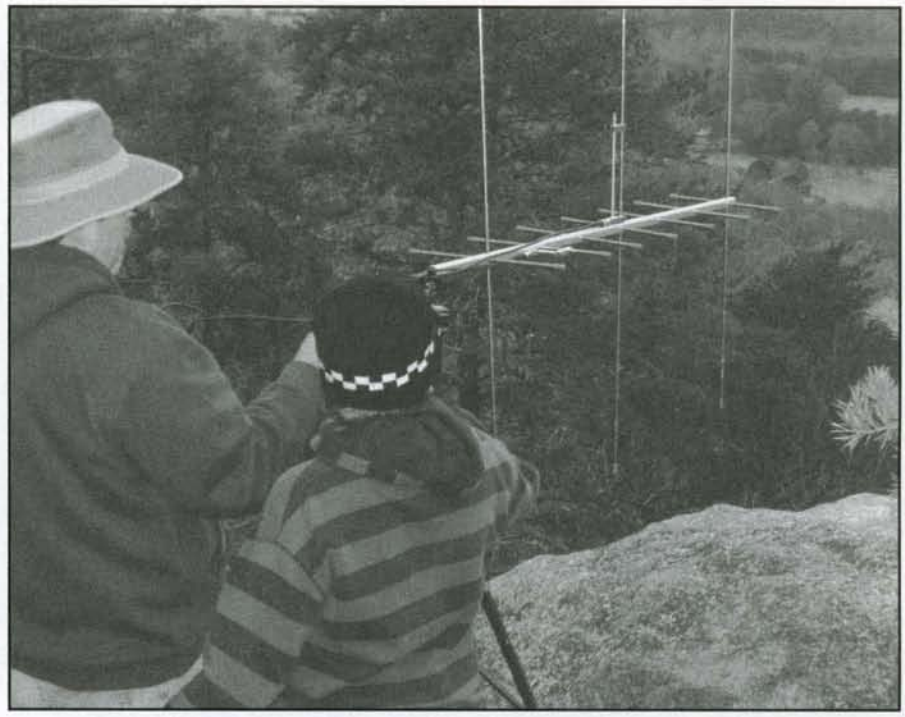
Frequency. Finding a clear frequency for the one-day event is a significant problem. I hope we might include the ATV crowd and the use of their 144.37 FM voice and balloon data frequency. I'm proposing it here to see if there are any conflicts.

For voice coordination, the APRS FM simplex channel 445.925 will be used, as well as the simplex frequency 146.520 MHz, as specified by K4JWM for wilderness-protocol-style contacts (see: <http://k4jwm.wikidot.com/wilderness-protocol>). Also the idea of "voice alert" on the normal 144.390 channel is yet another tool (see: <http://aprs.org/VoiceAlert3.html>).

Significant APRS Characteristics for this Event. The following will be used:

1. AT stations will operate with a traceable path LINK7-7 for messages.
2. AT stations will use the shorter nontraceable HOP7-7 for positions.
3. Stations should be able to see seven adjacent nodes in both directions.
4. As the links will be linear links, there will be few dupes.
5. Packets will be regenerated at the midway point for seven more hops.
6. D700/D710s can act as portable digis for the ultimate in simplicity.
7. Phase-I: To get the end-to-end Golden packets successfully.
8. Phase-II: After Golden packets then station messages are welcome.
9. Phase-III: After station messages then other trail hikers are welcome.
10. Phase-IV: Beyond that, other stations off the trail are welcome.

Station and Route Planning. For maximum range between hops, the path from Georgia to Maine will zigzag between mountain ranges rather than trying to shoot straight along the Appalachian Trail ridge. The height-above-average-terrain (HAAT) between the Appalachian Trail peaks (but along the trail ridge) is only a few hundred feet, which limits line-of-sight distances to only about 20 miles. However, zigzagging from the Appalachian Trail peaks to adjacent mountain ranges and back will take advantage of *thousands* of feet difference in HAATs across valleys and should be able to get much farther per hop.



Author with his son Nick on Sawnee Mountain, Georgia. (KI4SGU photo)

Setting up these off Appalachian Trail sites is knowledge that cannot easily be derived from just looking at the Appalachian Trail maps alone, and requires input from local sources who know the highest peaks ±50 miles from the Appalachian Trail. Those sources are probably the VHF contesters, repeater owners, and local clubs.

Packet Paths. The message packets (Golden Packets) will use the traceable TEMP7-7 paths for accountability. Position packets generally do not need to be traced. They will use the very short (but nontraceable) HOPn-N paths for all position reports. This will drastically reduce the length of each position packet.

Message Formats. For the official long-haul Golden Packets we will use only BULLETINS (BLNx) NORTHbound and only ANNOUNCEMENTS (BLN#) SOUTHbound. This eliminates ACKS and QRM yet lets everyone read the mail. Adjacent station-to-station messages for setup and coordination may use conventional APRS messaging on the normal 144.390 APRS channel.

Retransmission. Regenerating a DX message packet is the key to the long-haul success of this operation, since any given packet can only go seven hops before it is exhausted. For planning purposes, we suggest having seven full-function APRS packet stations at the key regional boundaries for easy re-entry and typing of the messages. This simplifies all of the stations in between, which can then be simple digipeaters only. A mobile D700 (or portable KPC-3 TNC digi) parked at the right place may suffice. I think we can do it in 14 hops using APRS, and we need help figuring out all the teams and details at many of these 14 sites.

The group needs your VHF and hiking experience at these locations to help with site planning. Of course, we will need volunteers at all the sites, and no one has yet tcome forward with local knowledge at some of these sites. This is an excellent opportunity to get your local clubs involved.

South to North. We have identified the following sites and to date we have the following commitments:

Springer Mountain, KI4SGU, KE4NOB, and others from the Atlanta area

Whiteside Mountain, KI4DSO team

What Does Working LX Mean?

Simply put, working LX is essentially the opposite of working DX. The "L" in LX usually means local. This practice evolved with some of the Atlanta hams traveling away for business or vacations and then making contacts back to friends in Atlanta. I was introduced to the group by Bill, KB4KFT, and Arnold, KC4ZUA. They had been doing it for some time in a very informal way. My contribution to the group was helping it grow by better organizing and promoting the "LxPeditions." These events are a lot fun and seem to motivate folks to build or buy new antennas or other portable gadgets to improve their performance. They are neither radio contests nor science projects, but borrow many of the fun aspects of both.

Typically the LxPeditions are 250 to 300 miles out from Atlanta, on 75 meters, and scheduled for late evenings during the week. They usually include, and grew out of experiments with, near-vertical incident skywaves (NVIS). We sometimes also schedule the events at *lunch* time (yet another meaning for the "L" in LX) and on 10 meters. We have even had a few on 2 meters, and one was on the satellites.

Working LX while mobile is permitted, as is working them from your home QTH, but the real the fun comes in setting up a mini Field Day station, and then comparing notes on antenna deployment techniques and portable battery packs, etc. Setting up these stations is harder than it would seem, and makes one very good at setting up and tearing down one's mobile station.

These events usually last only one or two hours. Most of the guys who participate know each from the metro 2-meter repeaters and area clubs. It is also a fun way to teach the younger hams about HF and NVIS, because most events are Tech friendly and stay to the Tech portions of the bands.

Although working LX is mainly a regional concept, the idea could easily be adopted by clubs or groups around the country. Also, the term "LX" has caught on and seems popular with all who hear it. More information can be found at the group's home page: <http://groups.yahoo.com/group/LxPeditionsAtlanta/>.

Be forewarned: The group will not accept any request for membership unless the requester has already worked at least one LX event. This is the only rule that the group has as a prerequisite for membership.

LxPeditions Atlanta group is at the origins of the Peak-2-Peak group, having taught me some the lessons of getting hams excited to get on the radio with different and unique event ideas.

Sugarloaf Mountain, team needed

Pilot Mountain, team needed

Clingmans Dome, western path, team needed

Roanoke Mountain, one can see parking lots on Google Earth! team needed

Horse Haven Mountain, team needed

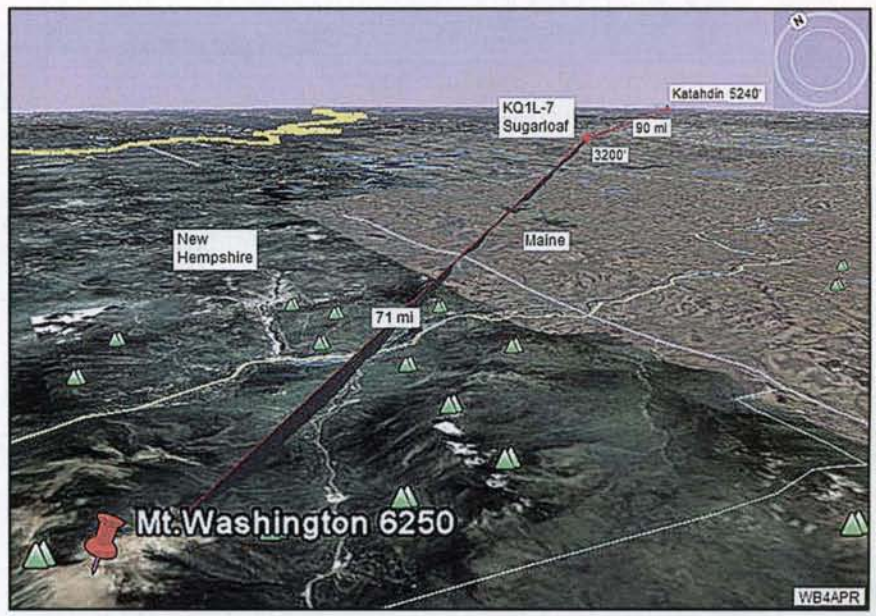
Apple Orchard (AO), a popular VHF site 146.685/t100

Mill Mountain, team needed

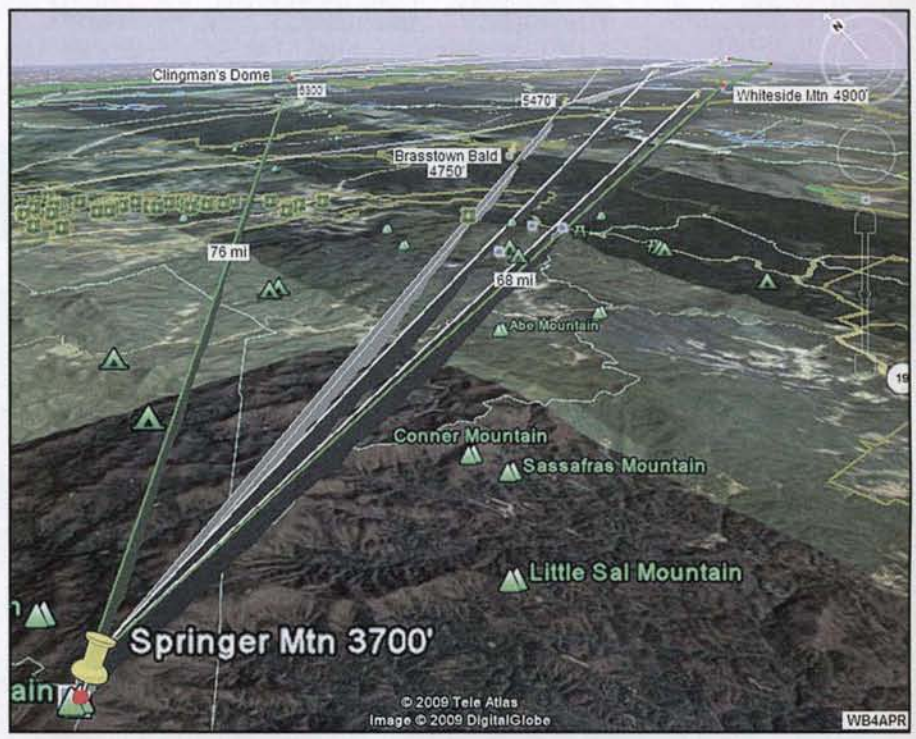
Maryland Mountains, WB4APR will cover and be central relay point

Gov Dick Hill, SE of Harrisburg, team needed

Camelback Mountain, NY, looks like



Google Earth Graphics of the line-of-sight path between Mt. Washington in New Hampshire and Mt. Katahdin in Maine. (Graphic courtesy of WB4APR)



Google Earth Graphics layout of line-of-sight accessible points from Springer Mountain in Georgia. (Graphic courtesy of WB4APR)

a ski area, and therefore we need to secure access privileges ahead of time; team needed

Mount Greylock, a well-known site, N1NCI-3 digi, DX club on board

Mount Washington, another well-known site, team KQ1L-7

Sugarloaf, team needed

Mount Katahdin, a rugged climb, *strong* team needed!

The most important thing we need is a list of any existing emitters on these existing mountains that we can monitor from other sites to help passively determine path quality. We also need lots of teams to help activate all those peaks. There are many good spots still available, so please consider joining us.

Geography

Many of the images in this article were generated by using Google Earth. To learn how use Google Earth to observe RF paths see: <http://www.aprs.org/hamtrails/aprsGoogleEarth.txt>. Other web useful line-of-sight tools can be found at Mountain Peaks and Summit Names. This tool creates simulated views from peaks (great for line-of sight); see: <http://www.mountainpeaks.net>. Mountain Peaks, Summits, and High Points—find a nearby peak for your next Peak-2-Peak event (see: <http://www.mountainzone.com/mountains/>).

The following is a list of some of the highest points along the trail; some are on the previous list, and some are not. The ones that are not slated as APRS sites would be great vantage points for those hams who want to observe the event via FM voice, but do not want to take part in the main APRS event. These hams would function as human repeaters passing traffic and helping to coordinate the fun.

Georgia: Blood Mountain, 4,461'

North Carolina/Tennessee: Clingmans Dome, 6,625'

Virginia: Pine Mountain, 5,500'

West Virginia, Peters Mountain, 3,956'

Maryland: Quirauk Mountain, 1,880'

Pennsylvania: Big Pine Flat Ridge, 2,080'

New Jersey: High Point State Park, 1,685' (base of observation platform)

New York: Prospect Rock, 1,433'

Connecticut: Bear Mountain, 2,316'

Massachusetts: Mount Greylock, 3,481'

Vermont: Killington, south-southwest slope, 4,010'

New Hampshire: Mount Washington, 6,288'

Maine: Katahdin, 5,267'

Please remember that this is *not* VHF contesting. This is *not* weak-signal work. We must have dead-solid FM packet links with 90-percent-plus reliability! Also remember that after seven hops that it equates to only a 50-percent chance. Therefore, if your shack is anything like mine (comfortable and full of high-tech gadgetry), here is a real chance to get out and enjoy the great outdoors. Working VHF/APRS in the high country will be technologically challenging while at the same time a whole lot of fun. This should be a very exciting event and a good opportunity to get on to those mountain-tops and play radio! This is also great chance to practice all of those Field Day skills and learn more about packet radio. It will be a tech-friendly and QRP-friendly event. Therefore, we encourage you to get out and get involved! ■

CDE/Hy-Gain Rotors
How to Keep 'em Turning – Part II

In Part I of this series, we looked at how to repair the most commonly experienced problems with bell-shaped CDE/Hy-Gain rotors. Despite Murphy's best efforts, not all rotor (rotator) system problems are found on top of the tower. Sometimes the problem can be found, and corrected, in the shack. In this part, we'll cover what can happen to the various styles of controllers that are used with these rotors and how to identify and repair those problems.

By Brad Pioveson,* W9FX

An often-seen post on antenna-related e-mail reflectors inquires about what kind of controller one can use with specific types of CDE/Hy-Gain rotors. The answer is an equivocal, "It depends."

The history of these rotors can be traced back to the days of the CDE Ham M-series. These first rotors were delivered with a controller that sported a single, lever-operated switch and a large meter, housed in a compact brown or black plastic case (photo 1). That single-lever switch performed all the functions needed to move the antenna remotely. When the operator pushed the lever to the left, the switch energized the rotor's brake-release solenoid while applying power to the rotor motor, turning the rotor in the counterclockwise direction and simultaneously engaging the DC circuit that turned on the indicator meter. When the operator released the lever switch, power was simultaneously removed from the DC circuit, the brake solenoid, and the rotor motor. The brake wedge, no longer held back by the energized solenoid, thus instantaneously slammed into the nearest groove in the rotor's lower housing, regardless of any movement of the antenna/mast assembly. Inertia was a diabolical enemy of these brake wedges. Hams with sizable antenna arrays mounted above Ham M rotors soon learned how to change brake wedges, as they would often shatter from the rotational torque applied to them.

There were four "series" of Ham M rotors. Series 1 or 2 rotors must be mated with Series 1 or 2 controllers. If you are unclear on that point, let me suggest you read that sentence again. Failure to heed this warning invariably results in expensive "smoke" being liberated from both rotor and controller.

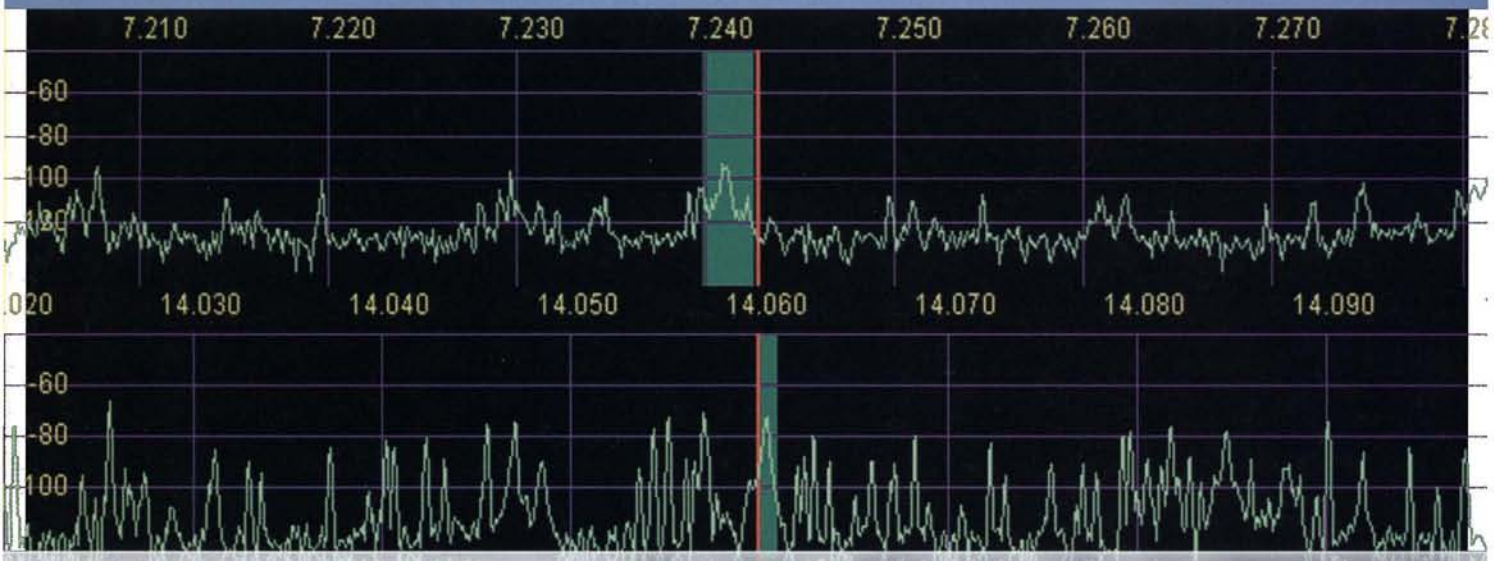
Series 3 Ham M rotors featured improvements that changed the rotors into the electrical configuration still in use today. In other words, a Series 3 Ham M rotor is electrically the same as Ham II, Ham III, Ham IV, Ham V, and TailTwister rotors. The Ham M Series 3 and 4 controllers will electrically operate any of these rotors. It's not a terribly good idea to use the old single-lever controllers on these more modern rotors for the reasons outlined above. If, however, you are in a pinch, have a light load on the rotor, and are careful to avoid moving the antenna during high winds (which might add to the rotational torque on the system), you can get by with an old, single-lever controller.

The single-lever controllers will happily work without any kind of restrictions

Photo 1. Examples of three rotor controllers. The top one sports a single lever-operated switch and a large meter. The bottom two show the later additions of the direction control and brake switches (lower right in both controllers), as well as the calibration and on/off switches (upper right on both controllers). (Photos by the author)

**301 Kirsch Street, Benton, IL 62812*
e-mail: <w9fx@verizon.com>

Did You See It?



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when coupled to the TR-44, CD-45, and, CD-45 II rotors. These rotors are not equipped with brake wedges, so the lack of the ability to independently control the brake is immaterial.

The Ham M Series 5 rotor from CDE addressed the problems with brake-wedge shearing, a problem that plagued the single-lever controller owners. With this new model, CDE introduced the three-switch controller. This unit sported one push-type lever switch each for CCW and CW rotation, and a third switch to engage/disengage the brake wedge. With this innovation, CDE changed the name of their rotor to the Ham II.

Since the Ham II rotor controller was introduced, the only major changes to these controllers have been in appearance and housing styles (again, see photo 1). With the advent of the Ham IV units, point-to-point and point-to-terminal-strip wiring (see photo 2) was replaced with a single PC board that mounts to the back of the unit's meter, held in place by the meter terminal nuts (see photos 3 and 4).

The TailTwister (or T2X) controller is a special case. This unit is, in all functional respects, the same controller used in the Ham IV units (and its predecessors, as noted above), except for the addition of a couple of LEDs that are installed in the front panel. The LEDs dress up the panel a bit and offer the operator some visual feedback that CW or CCW rotation has been commanded. Truth be told, the rotor doesn't care whether or not those LEDs exist, so a TailTwister rotor can be controlled using a Ham II controller.

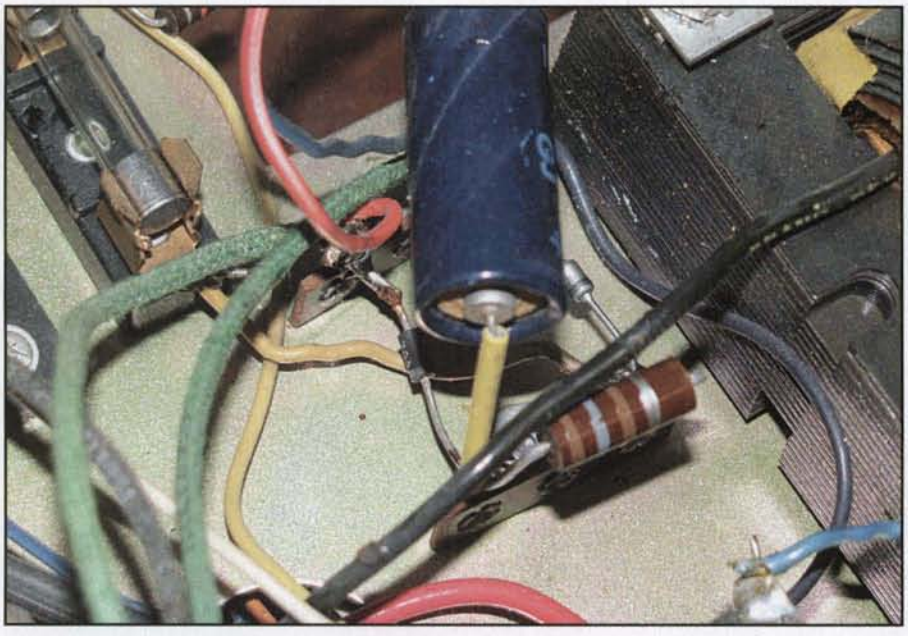
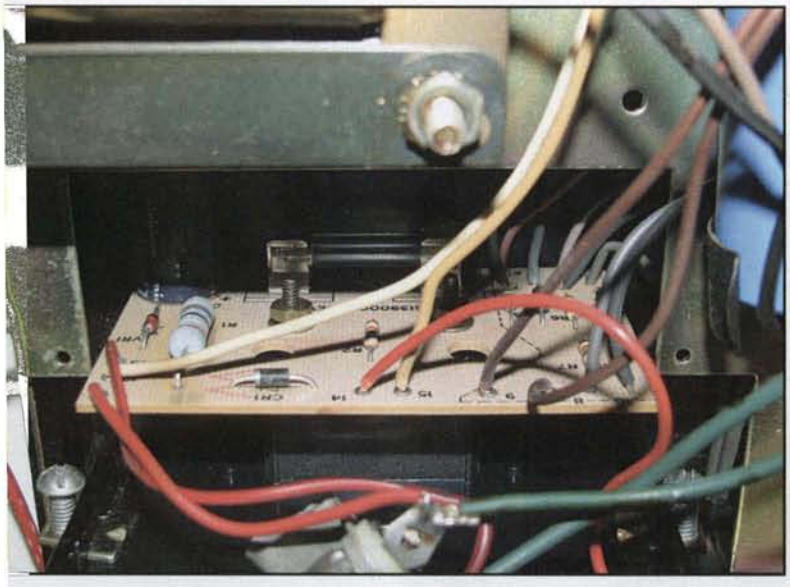


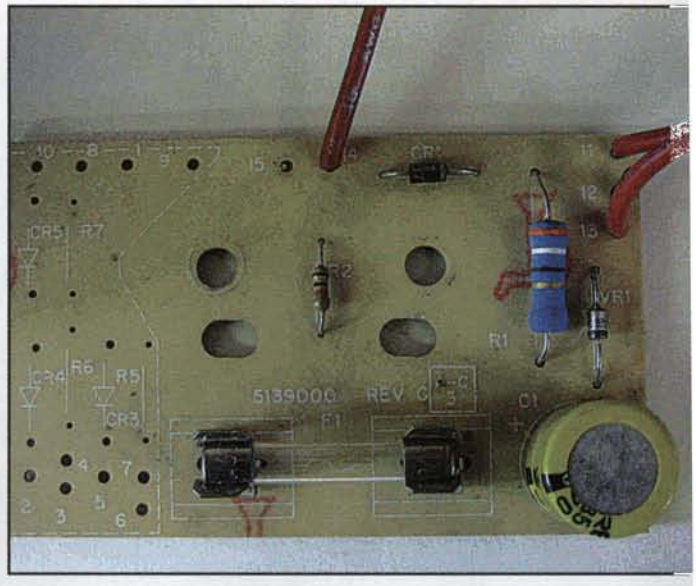
Photo 2. An example of point-to-point and point-to terminal wiring. The zener diode is wired between two terminal strips in the center of the photo. The location of the 3-amp fuse is in the upper left corner of the photo.

Theory of Operation and a Caution

Note: Some of the checks and tests require that the rotor controller be powered up—i.e., attached to the AC line and energized. Depending upon your individual unit, the AC line voltage can be either 120 VAC or 240 VAC. ***This voltage can seriously injure or kill you. Use extreme caution.*** If you are unfamiliar with the safety precautions that must be used when testing energized circuits, refer the unit to someone who is.

The controllers[1]—from the Ham M Series 3 all the way to the most modern units—provide AC and DC voltage and current to the rotor, and measure the DC current across the rotor's rheostat (azimuth potentiometer) to give the meter indication in the shack. There are two transformers in the controller. One provides the AC voltage for the motor and brake circuits, and the other is an instrument transformer from which AC volt-





Photos 3 & 4. A single PC-board, which mounts to the back of the unit's meter. The zener diode that is identified as VR-1 on the PC board is located on the left edge of the board in photo 3 (lefthand photo) and on the right edge of the board in photo 4.

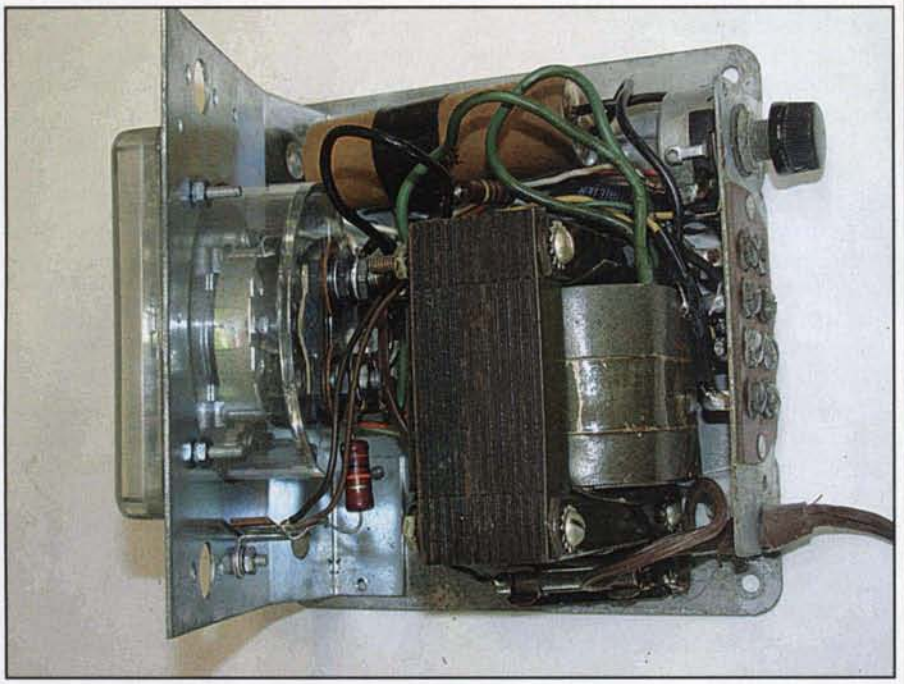


Photo 5. The location of the 3-amp fuse is in the lower edge of the photo, just below the transformer.

age is derived and rectified. This rectified half-wave DC is "regulated" by a 1N4743 13-volt 1-watt zener diode to provide the DC voltage used by the meter circuit. This zener diode is identified on the PC board legend as "VR-1." (See the left edge of the circuit board in photo 3 and the right edge of the circuit board in photo 4). In the Ham II controller, this zener is wired between two terminal strips (see photo 2).

There are two fuses in the modern controllers. One of these fuses protects the overall current demand of the rotor system. This is a 3-amp AGC-style fuse. Note that this is a 3-amp fuse, not a 30-amp fuse. In the lever-switch controllers, this fuse is located inside the housing, in a fuse holder (photo 5). In the Ham II and later controllers, this fuse is located on the back panel (photo 2). New replacement transformers and meters are expensive.

The second fuse protects the instrument transformer. These are 1/8-amp AGC-type fuses. Again, I strongly encourage you to use the proper size of replacement fuses, and I remind you that fuses do not get tired or old and simply open for no reason. If one of the fuses in your controller opens, it's time to troubleshoot the system and find out why the protective elements did their jobs.

The most common gripe among CDE/Hy-Gain controller owners is that the pilot lamp—the meter illumination lamp, if you will—fails. These are easily replaced, and are GE number 1819 lamps, available from electrical and illumination suppliers. These lamps, like all incandescent bulbs, generate heat. The plastic-housed, modern controllers have a piece of aluminum tape affixed to the underside of the top cover. That aluminum strip is placed there to prevent the heat from the pilot lamp from warping the plastic cover. If the tape is gone, it would be a good idea to replace it using aluminum duct tape. A 1-inch square piece is adequate (see photos 6, 7, and 8).

There are three options currently available for replacing a failed incandescent built with long-life LEDs. There are direct-replacement LED lamps. These can be directly substituted for the number 1819 bulb. I have one of these in one of my Ham III controllers and it does a fair job, but the cone of light transmitted by the LED doesn't fully illuminate all of the meter face. Recently, I noted that Idiom Press is marketing a small PC board equipped with three LEDs and the necessary voltage dropping circuitry.[2] This substitute for number 1819 lamps would appear to be a perfect fit, both in terms of size and application, and interestingly is priced at less than what I had to pay for an industrial LED number 1819

lamp substitute. Finally, for those comfortable with the use of hand tools, one could reuse the base of a bayonet bulb, fitting a high-intensity LED and a suitable voltage dropping resistor into the base, making your own LED substitute.

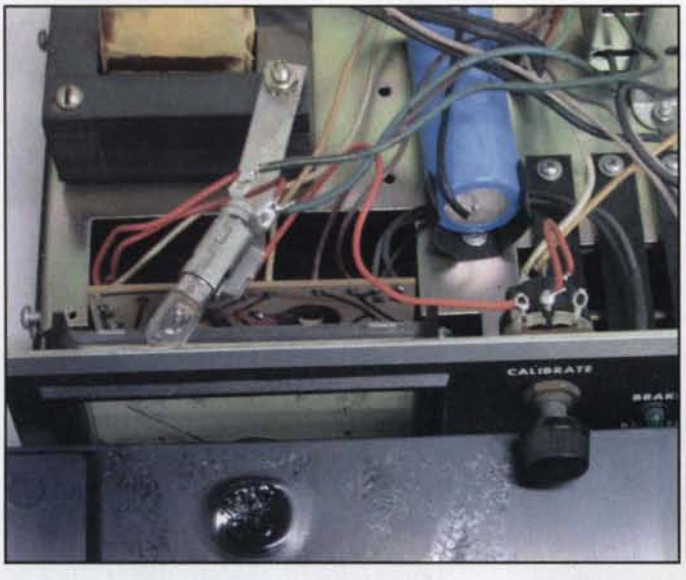
The Meter Doesn't Work

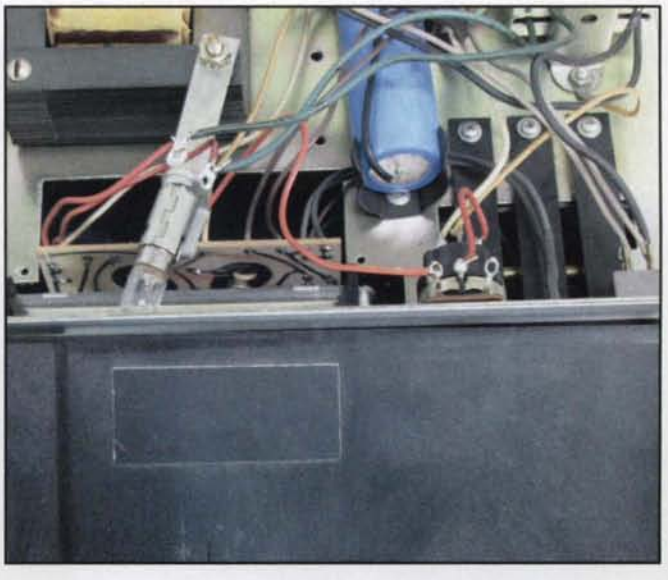
If your rotor is working, moving left and right, and the brake is operating properly but the controller meter isn't indicating, it's time to get out the VOM. Before you do anything else, make sure that the rotor cable connections to the back of the controller are secure. If everything appears well there, set your VOM to DC volts and attach your probes to terminals 3 and 7 of the controller (see photo 9). With the controller turned on (not necessary to release the brake or turn the rotor), you should see ~13 VDC across those two terminals. If you don't see that voltage, the problem is in the controller. If you do find the DC voltage to be on those terminals, the problem lies either in the cable or the rotor.

Assuming you didn't find any DC voltage coming out of the controller, you are going to have to troubleshoot the DC circuit inside the controller. Now, before you do anything else, unplug the line cord and remove AC power from the controller. Then proceed to remove the top cover from the controller. The first thing to check is the DC circuit fuse. That's the 1/8-amp fuse I mentioned in the paragraphs above. It will be located either on the PC board mounted to the meter terminals (see photos 3 and 4), or in older controllers, in a fuse clip mounted to the chassis (see photo 10). Pull the fuse out of the holder and check it for continuity. If it's open, you may be able to squeak by with a replacement fuse. EMP discharges from lightning strikes can cause these fuses to blow. If the replacement fuse pops as soon as you try the controller again, you're going to have to dig a little deeper.

If the DC voltage is present on terminals 3 and 7 of the controller and the meter is still providing no indication, turn off the controller and remove the wires from terminals 1, 3, and 7, after having noted the colors of the wires so that you can properly rewire the controller. If you have a Cinch-Jones connector equipped controller, disconnect the plug from the controller's socket. You are about to remotely check the "health" of the rotor's internally mounted azimuth potentiometer (and/or the cable between the controller and the rotor). The azimuth potentiometer's value is approximately 500 ohms.

Using your VOM in resistance-mea-





Photos 6, 7, & 8. These photos illustrate the effect of the hot bulb on the plastic cabinet. Note the bubbling of the cabinet just above the meter in photo 6 (left) and in front of the meter in photo 7 (bottom left). This effect is why it is necessary to ensure that the duct tape shown in photo 8 is securely in place. Both photos 7 and 8 (bottom right) also show the starting capacitor, which is blue.

suring mode (ohms), check for the presence of approximately 500 ohms of resistance between the wires that were attached to terminals 3 and 7. Write down your measurement.

Next read the resistance between wire 1 and wire 3. This should be somewhere between a few and approximately 500 ohms. Record this measurement.

Now measure the resistance between wire 1 and wire 7. Again, this should be between a few and 500 ohms of resistance. Record this measurement.

The arithmetic sum of these last two measurements' values should equal the total resistance as measured between wires 3 and 7.

If you read an open circuit (infinity resistance) between wires 3 and 7, the rotor cable is damaged, the connection at the rotor has a problem, or the rotor azimuth potentiometer has failed. Part I of this article discussed replacing those potentiometers.

If you read a short circuit—or nearly so—between wires 1 and 3 and wires 1 and 7, the problem, again, could either be cable, wiring connection (at the rotor), or a failed potentiometer. In this case, I would strongly suspect a failed potentiometer. Wire/terminal 1 in the Ham-series rotors is ground for both the DC and AC circuits.

The Meter Works but the Rotor Won't Turn

If your controller's meter is working and indicates the direction in which the rotor has stopped, but your efforts to move the rotor result in no movement, there are a couple of checks you can make from the shack. (*Note: The following checks will not apply to the TR-44/CD-45/CD-45 II rotors, as they have no wedge brakes.)*

• Release the rotor's brake by pressing the "Brake Release" switch or moving the lever switch left or right and listen (or, have a friend do this for you) for the resounding "thunk" from the rotor. That noise is the brake solenoid operating.

• Using your VOM in AC volts range, the cable wired to the controller, and the controller's AC power OFF, attach your probes to terminals 1 and 2 of the controller. Turn on the AC power to the controller and depress the Brake Release switch and hold it, or if you are working with one of the older, lever-style units, move the lever switch left or right and hold it. You should measure approximately 26 VAC. Release the switch and turn the controller OFF.

• If you have access to a clamp-on AC ammeter, clamp it around wire 1 or wire 2 (not both). Turn on the controller, energize the brake release, and read the AC current in the circuit. This current should be in the 1-ampere range. If, however, this current is measured at significantly more than 1 amp (I have measured them at up to 15 amps!), power down the controller and get your climbing belt.

What you just checked was the brake solenoid circuit. The controller places AC power to terminals/wires 1 and 2 to energize the solenoid. The solenoid retracts the attached brake wedge – which is, just as it sounds, a wedge of steel that mates with grooves cast into the inside of the lower rotor housing. If the voltage is

Photo 9. This photo shows the terminals in the upper right. The blue starting capacitor is also shown.

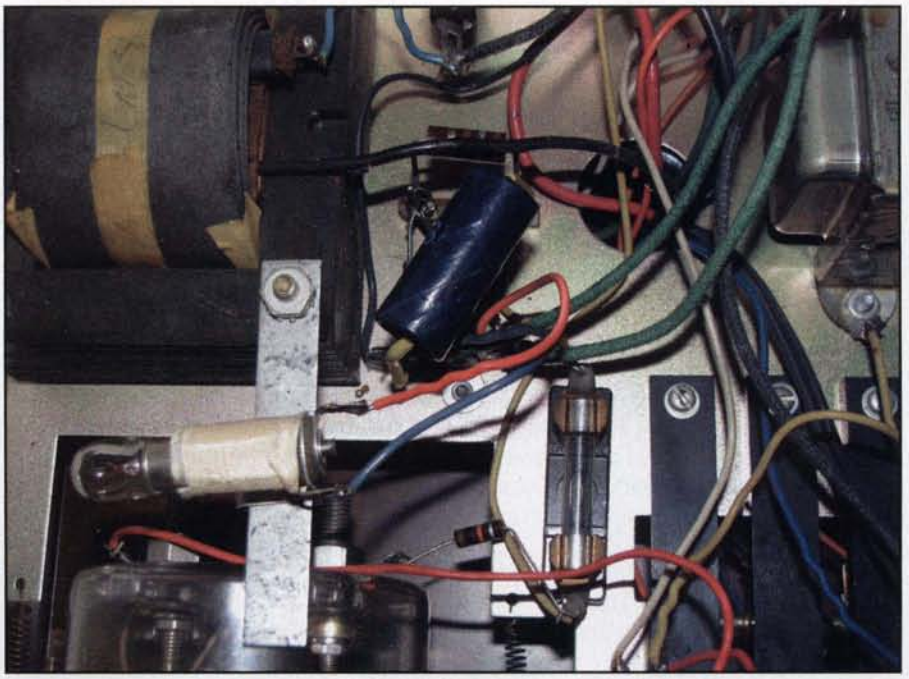


Photo 10. The location of the 1/8-amp fuse, which is located to the right in the photo.

there, and the current is within norms, the solenoid circuit is intact and the solenoid has not become mechanically jammed. If, however, the voltage is correct but the AC current is high (up to 15 amps), the solenoid, which is attached to the brake wedge, has become mechanically bound or blocked, and therefore the rotor cannot move. It's time, in that case, to get the rotor down and onto the bench for repairs.

TailTwister rotors are notorious for having the occasional brake wedge idiosyncratic problem. The brake wedges in the T2Xs from time to time tend to stick in the grooves of the lower housing. In later production years, Hy-Gain modified the profile of the steel wedge to help eliminate this problem. The "field engineering solution" (ham shack work-around) is simply to nudge the rotor, with the brake release engaged, alternately CCW and CW—i.e., rocking it a bit, to help release the wedge.

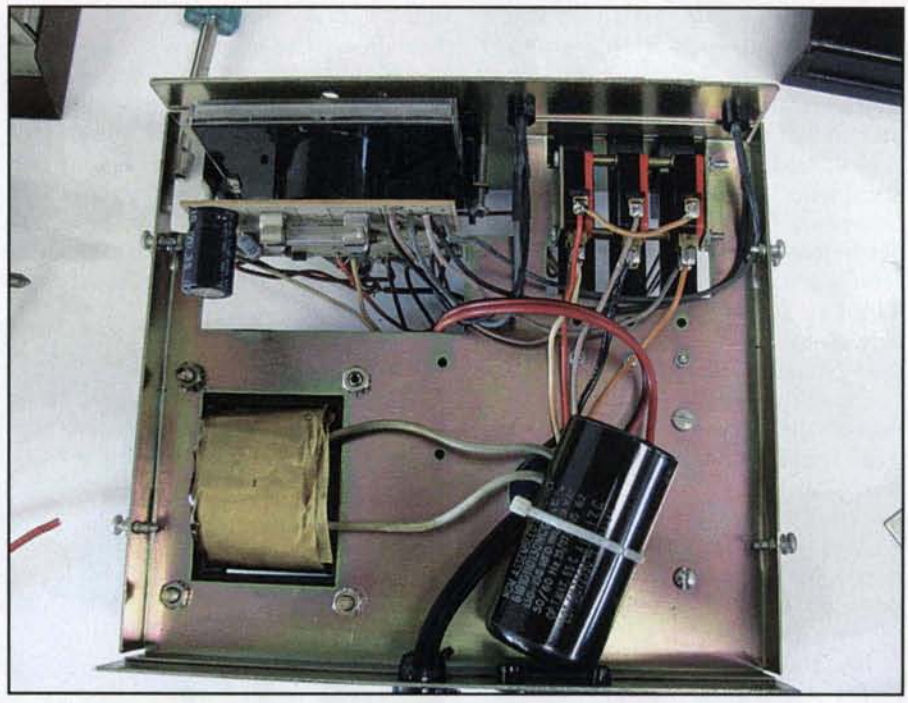


Photo 11. This photo shows the newer starting capacitor, which is black.

The Brake Circuit is OK but the Rotor Still Won't Turn

If the brake solenoid is operating, appears not to be jammed, and the rotor still won't turn, then it's time to check the motor circuitry. The motor circuit consists of a split-phase AC motor. This motor is provided with ~26 VAC by the controller. The voltage appears across terminals/wires 1 and 4 or 1 and 6, depending upon the direction of rotation.

- Remove AC power from the controller and disconnect the wiring from terminals 1, 5, and 6 (again, note colors for rewiring later).
- Using your VOM in a low ohms range and measure the resistance between wires 5 and 6. This measurement should indicate just a few ohms; the motor itself represents about 3.5 ohms of resistance, plus you'll have the resistance of the rotor cable added to that.
- Measure the resistance between wires 1 and 5, and then 1 and 6. These two measurements, added together, should equal what you read in the previous test.

If the resistance readings are in the ballpark, good news: It would appear that the motor, and cable, are electrically intact.

- Reconnect all rotor cable wires to the controller.
- Set your VOM to AC volts and attach your probes to terminals 1 and 5.
- Energize the controller, release the brake, and press the CW (right) rotation switch. You should see approximately 26 VAC indicated on your VOM.
- De-energize the controller and attach your probes to terminals 1 and 5.
- Energize the controller, release the brake, and press the CCW (left) rotation switch. You should see approximately 26 VAC indicated on your VOM.
- De-energize the controller.

If your controller passed these tests, and if your controller is over four or five years old, it is possible that the motor start capacitor, which is housed in the controller, has failed.

Motor Start Capacitors

Every CDE/Hy-Gain rotor controller has a motor start capacitor wired into the circuit (see photos 5, 7 through 9, and 11). This capacitor is located inside the controller, thankfully, and not inside the rotor. The first signs of an aging (and thus failing) motor start capacitor is that the rotor will begin to move sluggishly. If your rotor used to turn smartly and, say, make a full revolution from stop to stop in 70 seconds but the unit has started slowing down, your motor start capacitor needs to be replaced.

These capacitors can be obtained from most electrical-supply shops and probably all motor-rebuilding shops. Industrial suppliers such as W.W. Grainger, etc., have them as well, and they aren't expensive. These non-polarized capacitors used to be housed in paper sleeves. Modern versions are housed in plastic tubes. Put another way, the new ones are substantially larger in physical size than their older cousins (see photo 11).

The value of these capacitors is not critical. When the controller was built, the factory installed 120–140 µF capacitors. These days, the 136–156 µF, 110–125 VAC units are the available replacements. Both Mallory and Sprague manufacture these capacitors.

Squeezing the larger capacitors into the controller housing can be a little problematic. Depending upon the type and age of your controller, you may find the original capacitor retained in a spring clip installed on the upper chassis of the controller. The new capacitors are too big to fit into that clip. As an alternative, you can squeeze a new capacitor into the controller under the chassis. I have successfully used cable ties and an adhesive-backed cable-tie retainer to keep the capacitor in place (again, see photo 11).

If you're using one of the older, lever switch controllers, it's not possible to easily fit the new capacitor into the controller's housing. You can, however, mount it external to the controller using a cable-tie/tie-point arrangement to secure the tubular capacitor in place. In this case, the wiring can be tied to the screws of the terminal board.

Wiring the new capacitor into the circuit couldn't be easier. There are only

two connections to the capacitor, and it's non-polarized. Using number 16 or number 14 insulated wire, solder one wire to each of the two capacitors' terminals. Solder the other ends of these wires to terminals 4 and 8, respectively, on the backside of the controller's terminal board or C-J connector.

Another interesting motor-start capacitor mounting alternative is taken from the pages of contest operators' e-mail reflector archives. Some of the contest crowd, specifically those with towers located a long way from the station (and rotor controller), have remotely mounted these capacitors, placing them (in a weatherproof container) under the tower's rotor shelf. That negates the need for using 8-conductor rotor cable, by the way. If the capacitor is remotely mounted, you can use less-expensive 6-conductor cable.

Transformers and Meters

Transformers can fail. As noted previously, there are two of these in the controller. One is used to step down the AC primary voltage to the ~30 VAC used by the motor. The other transformer is used exclusively for the DC part of the circuit—i.e., for the metering. Testing a transformer involves (with the controller disconnected from the AC line!) performing resistance checks. The primary wiring of each transformer should measure continuity from end to end. The secondary circuit of each transformer should measure continuity from end to end. There should be infinite resistance measured between the primary and secondary windings of each transformer.

Most often when transformers fail, the transformer will not pass the "sniff test." Transformers that have developed shorted windings generally do so in a dramatic fashion, and the odor is unmistakable.

The meter in your rotor controller is a precision instrument, and testing of the meter with a VOM, depending upon your VOM's open-circuit voltage, can actually cause the meter to fail. The most common cause of meter failure, by the way, is not electrical; it's mechanical. Debris, dust, particles or bits of wiring, solder, insulation, etc., can find their way into the meter movement. Gentle application of air, such as from a lens-cleaning "puff brush" sold for cleaning optical lenses, won't do damage. Using a can of compressed carbon dioxide, such as that currently sold for cleaning computer keyboards, etc., or a blast from an air hose attached to a compressor, can, however, destroy a delicate meter movement in short order.

Meters can also suffer from a residual static charge. If your controller's meter seems to "hang," never returning to zero, or is stuck in mid-range, a very small squirt from a water spray will neutralize the static electricity charge and will free up your recalcitrant indicator.

Replacement transformers and meters are available, with some caveats, from Hy-Gain. As there are so many different styles of controllers, not all meters are available, and a call to Mississippi (1-662-323-5263) will resolve the issue. They are not cheap. Transformers are readily available, although case styles and, in the case of instrument (DC circuit) transformers, the modern OEM parts now have dual primary windings. Likewise, transformers are not cheap, either.

Keep in mind that used CDE/Hy-Gain controllers abound at flea markets and via the various internet swap and auction sites. In many cases, one can purchase a complete, operating, used controller for less than the cost of the more expensive replacement parts. Of course, the used controller may need a new motor start capacitor.

Conclusion

In Part I of this series you were introduced to the basics of CDE/Hy-Gain rotor repairs. In this part (Part II) the most commonly experienced problems with rotor controllers have been discussed, and some troubleshooting hints and tips have been presented to you.

Again, whatever tests you make, whatever repairs you undertake, always keep your safety foremost in mind. ■

Notes

1. Schematics and manuals for currently marketed controllers are available for free download from the manufacturer at: <http://www.hy-gain.com> and for the older units at: <http://bama.edebris.com/manuals/>.

2. Go to: <http://www.idiompress.com/illuminator.html>.

A Pioneer in the Family
Jim Kmosko, W2NLY

In the Summer 2007 issue of *CQ VHF*, WA2VVA began his series on KH6UK. Since then those articles have brought forth communication with other hams of that era who also have much to contribute to the many areas of VHF history. In this article Mark interviewed W2NLY, and here is his story.

By Mark Morrison,* WA2VVA

When *CQ VHF* magazine first published my articles "The Lost Letters of KH6UK" two years ago, I received many e-mails from people recalling how they once knew one or more of the hams mentioned in that series. One was Bill Musa, K5YG (ex-K2MHJ), who told me that he once worked with Jim Kmosko, W2NLY, while at Lockheed Electronics. Bill suggested that I try to contact Jim and write an article about him. I did check my local phone book, as Jim's QTH was nearby, but was not able to find any listing.

Time went by until just recently, when Bill contacted me again about another of my articles and once more suggested I try to locate Jim. This time I did a search on QRZ.com and was happy to see that W2NLY had recently renewed his license. With Jim's address in front of me, I then wrote him a letter introducing myself and telling him about Bill's persistence about contacting him.

A few weeks passed without hearing anything, and then one day there was a message on my answering machine. It was from Jim! I called him back, and he invited me over to talk about the golden days of VHF radio. Considering that he knew almost everyone whom I have written about, it was a real pleasure to talk with Jim and share our memories of that time. This article is based on two separate visits I made to Jim's house this past February and March.

Photo 1. Jim's first QSL card. In 1939, at the age of 19, Jim applied for both his amateur as well as commercial radio licenses.

Hadley Field

On the evening of July 1, 1925 a crowd of 15,000 gathered in South Plainfield, New Jersey to witness history in the making. Great arc lights illuminated the hastily constructed airstrip known as Hadley Field in anticipation of the big event. At 10:30 PM pilots Dean Smith and J. D. Hill revved the engines on their De Havilland DH-4 biplanes and took off for Chicago, loaded with mail. A chain of beacons installed just the year before, and spaced every 10 miles, showed them the way. Thus it was that the world's first nighttime airmail service began.

In the years that followed, Hadley Field would become a fascinating place, not only for the young children who lived nearby, but also for the curious onlookers hoping to catch a glimpse of some famous aviator. This was the age of Wiley Post, Amelia Earhart, and Charles Lindbergh, all of whom would have known this place. It was here that a young boy named James Kmosko would visit with his father, August, to watch the planes take off and land, and who would return many years later to "launch" some of the Navy's first flight trainers.

The Early Years, W2NLY

As with many of the VHF pioneers, Jim's fascination with radio began at an early age. In 1939, at the age of 19, Jim applied for both his amateur and his commercial radio licenses, receiving the call W2NLY. His first QSL card is shown in photo 1.

As a teenager growing up in the 1930s, Jim would often listen to the shortwave bands. Later he would turn to 160 meters, $2\frac{1}{2}$ meters, and even 10 meters when the band was open, using equipment that he built himself. Photo 2 shows Jim at the operating position of his 160-meter sta-

**5 Mount Airy Rd., Basking Ridge, NJ 07920*
e-mail: <mark1home@aol.com>

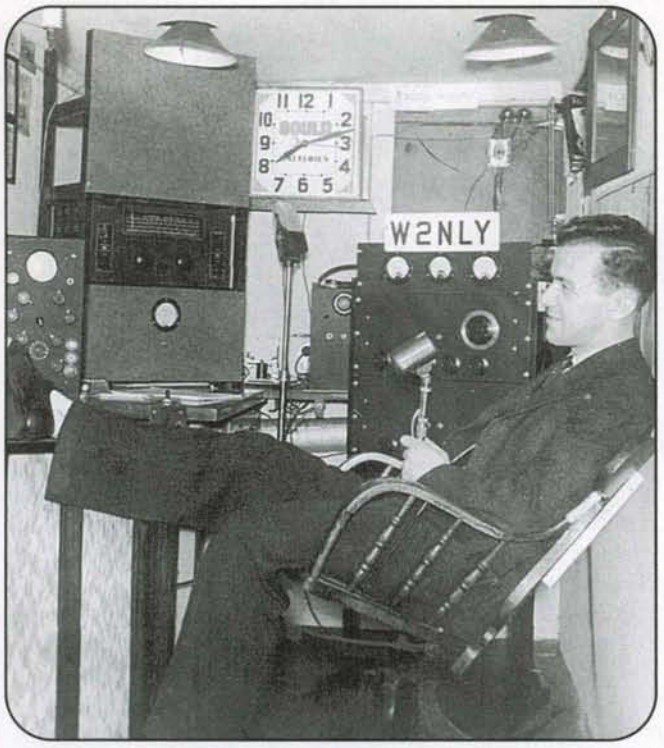


Photo 2. Jim at the operating position of his 160-meter station in South Plainfield, New Jersey in the late 1930s.

tion in South Plainfield in the late 1930s. Jim maintained regular 160-meter schedules with David Roland, W2IWU, most Sunday afternoons following church.

In the early 1940s, Jim worked for the Western Electric Company in Kearny, NJ. It was there that Jim worked on the Army's ubiquitous VHF searchlight control radar, the SCR-268. Jim recalls those early days, describing how the parking lot in Kearny would be filled with as many as 400 such radar units housed in wooden shelters and all directed over the Jersey meadowlands toward the biggest radar target of the time, the Empire State Building. Photo 3 shows an SCR-268 being prepared for a test. Note the two operators standing on the unit.

The SCR-268 used a broadside transmitting antenna and two separate receiving antennas, one for elevation and the other for azimuth. Separate oscilloscopes, one for each receiving antenna, were monitored by individual operators and used to manually track objects. When three such radar units were used to point separate carbon arc lamps, the target would be revealed where the three light beams intersected.

Jim mentioned that you had to be very careful when tuning these units because of the high power they employed. It was possible to be standing 20 feet away holding a quarter-wave stub and observe ionization effects similar to those of a Jacob's ladder, with an arc traveling up and down the stub. Cable layout was also important because of corona effects. Jim described the oscillator unit as having a ring of VT-127s, a tube later available as war surplus and excellent for 2-meter work. The circular arrangement of these tubes allowed the operators to judge their condition simply by comparing the color of adjacent tubes.

The SCR-268 worked at frequencies on the order of 205 MHz, a rather uncommon frequency in amateur radio circles with the exception of the father of radio astronomy, Grote Reber, W9GFZ, who was publishing VHF articles in the mid 1930s.

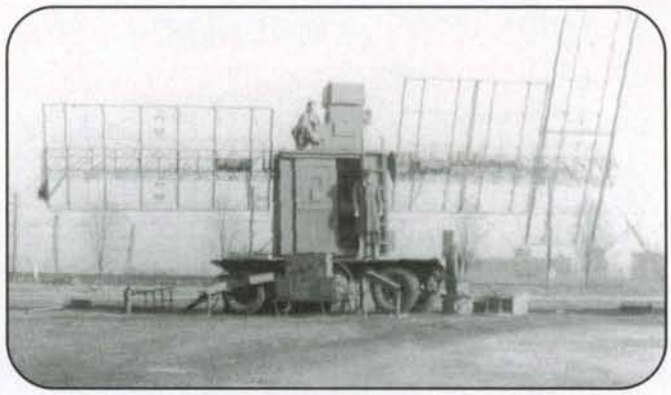


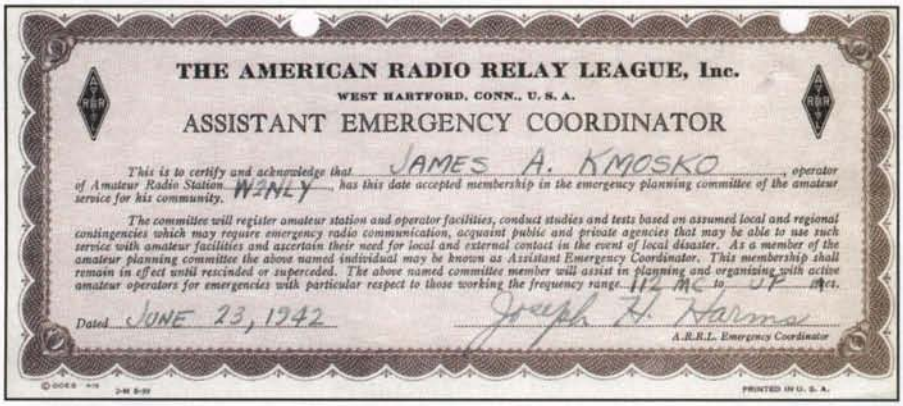
Photo 3. An SCR-268, the Army's ubiquitous VHF searchlight control radar, being prepared for a test at the Western Electric Company in Kearny, New Jersey. Note the two operators standing on the unit.

Photo 4. In 1942 Jim designed and built the War Emergency Radio Station (W.E.R.S.) used by the town of South Plainfield and assigned the special callsign WJSQ by the FCC. This is the station.

Jim's own experience with this radar equipment would pay off later when the FCC allocated the 2-meter band for amateur use.

The War Years

During the war years, amateur radio operations came to a halt and all but emergency stations were forced off the air. In 1942 Jim designed and built the War Emergency Radio Station (W.E.R.S.) used by the town of South Plainfield and assigned the special callsign WJSQ by the FCC. Jim describes the station, shown in photo 4, as follows: "This station was part of a state and nationwide network to back up normal police and fire communication in case of loss of power, etc. The headquarters



THE AMERICAN RADIO RELAY LEAGUE, Inc.
WEST HARTFORD, CONN., U. S. A.
ASSISTANT EMERGENCY COORDINATOR

This is to certify and acknowledge that JAMES A. KMOSKO, operator of Amateur Radio Station W2NLY, has this date accepted membership in the emergency planning committee of the amateur service for his community.

The committee will register amateur station and operator facilities, conduct studies and tests based on assumed local and regional contingencies which may require emergency radio communication, acquaint public and private agencies that may be able to use such service with amateur facilities and ascertain their need for local and external contact in the event of local disaster. As a member of the amateur planning committee the above named individual may be known as Assistant Emergency Coordinator. This membership shall remain in effect until rescinded or superceded. The above named committee member will assist in planning and organizing with active amateur operators for emergencies with particular respect to those working the frequency range 112 MC to UP mcs.

Dated JUNE 23, 1942

Joseph H. Harms
A.R.R.L. Emergency Coordinator

PRINTED IN U. S. A.

Photo 5. For W.E.R.S., Jim was assigned WJSQ-2 for his car. This photo shows the certificate issued to Jim for his amateur service in this regard.

station was … operated at 112 mc, in the 2½-meter band." Jim's dad, August, built the cabinet enclosure. This equipment had its own emergency power source and was located on the second floor of the Police and Fire Headquarters building on then Hamilton Blvd. South Plainfield hams included Joe Harms, W2JME (Emergency Coordinator), who was assigned WSJQ-1 for his mobile station. Jim, W2NLY, was assigned WJSQ-2 for his car, and Tom Meeker, W2MDD, was assigned WJSQ-3. The handheld device Jim is holding in the photo is a 2½-meter walkie talkie he made from an old toolbox that held dry cells for power. Photo 5 shows the certificate issued to Jim for his amateur service in this regard.

Many other hams operated emergency equipment from their cars and participated in scheduled and surprise drills relaying emergency messages in town, town to town, and town to state headquarters to test this nationwide W.E.R.S. Photo 6 shows Jim with the rig he used from his car, yet another walkie talkie!

Jim was a member of the Tri-County Radio Club, which met in the Plainfield area. This club was attended by many budding VHF men, including W2AZL, W2CXY, and others. Jim remembers visiting Carl, W2AZL's house on Coolidge Street, just up the road in Plainfield, which was perhaps at one of the earliest meetings of the Basement Laboratory Group (see WA2VVA's series of articles on the Basement Laboratory Group in the Summer 2008, Fall 2008, and Winter 2009 issues of *CQ VHF*—ed).

After the War

Jim's radar work at 205 MHz and W.E.R.S. work at 112 MHz prepared him well for the 2-meter band when it was allocated to amateurs following the war. Nowhere is this more evident than in the many VHF contests in which Jim participated. Throughout the 1940s the ARRL conducted yearlong VHF competitions, known as V.H.F. Marathons, in order to gauge the amount of activity existing on these bands. Jim won the competition in 1946 and again in 1947. The certificate awarded to Jim by the ARRL (see photo 7) notes "Highest score in Marathon history."

In September 1947 Jim published his classic *QST* article entitled "An Antenna that Multiplies by 50." This article described the antenna Jim used in the VHF marathon that year. The basic design for this antenna would be used in many different configurations, each intended to extend the reach of Jim's signals, with considerable mention in *QST* and *CQ* at the time.

Jim's Designs, 1947–1949

When Western Electric decided to move its radio division from Kearny, New Jersey, to Winston Salem, North Carolina in 1947, Jim found work in a start-up company, Stavid Engineering, formed by three former Western Electric engineers. This company developed special electrical and electromagnetic equipment, such as flight trainers, for the military. Jim recalls the first time he walked into the Stavid offices, which were located over a fish company in North Plainfield, only to be greeted by Dave Roland, W2IWU, the same person he had worked on 160 meters years

Photo 6. Jim with the rig he used from his car for W.E.R.S., yet another walkie talkie!

The American Radio Relay League, Inc.
West Hartford, Conn., U.S.A.

CERTIFICATE OF ACHIEVEMENT
V.H.F. MARATHON

By these presents the American Radio Relay League certifies that J. A. KMOSKO operator of Amateur Radio Station W2NLY is the winner of its Very-High-Frequency Marathon for the period Jan. 15 - Dec. 15, 1947, by virtue of communicating with 803 c. h. j. stations for a score of 7558 points in accordance with the published rules.

Highest score in Marathon history
All-time high scores in the 4th, 5th, and 6th reporting Periods.

Award Committee

Feb. 16, 1948

E. P. Tilton

Geo. Grammer

Photo 7. Throughout the 1940s the ARRL conducted yearlong VHF competitions, known as V.H.F. Marathons. Jim won the competition in 1946 and again in 1947. This is the certificate awarded to Jim by the ARRL, noting "Highest score in Marathon history."

AOR introduces the AR-*Mini*

Big Features! Small Size!

This pocket-size communications receiver delivers BIG performance!

The AR-Mini offers legendary AOR quality and a wide array of the most popular features found in the AR-8200 Mark III. But, the new AR-Mini does it all in a convenient pocket size water resistant version that's very easy on a budget.

Actual size

Whether you use it for work or pleasure, you can take the AR-Mini with you to listen to public safety communications, airline traffic, marine communications, weather channels, trackside communications at car and motorcycle races, radio and television reporters in the field, shortwave communications from around the world, amateur radio frequencies, AM and FM radio signals, analog TV audio and more.

Powered by two AA Ni-MH cells (1.2v), the AR-Mini operates for approximately 22 hours on a single battery charge but it can also be used with AA alkaline batteries or with an optional DC cigar-lighter adapter.

AR-Mini Features include:

- 1000 memory channels (10 banks x 100 channels)
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- 100kHz ~ 1299.995 MHz (+/-2.5ppm)*
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- Cloning capability (AR Mini to AR Mini or through PC connection)
- RF attenuator
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- Scan speed: 8 steps/sec.
- Priority Channel
- 2 VFOs
- Memory channel skip
- Battery save function with auto power off timer
- Free downloadable memory management software
- Preprogrammed "bug" detector frequencies with level beep to find hidden transceivers
- Small size: 2.4" x 3.7" x 0.9" (without projections)
- Weighs only 7.4 oz with antenna and batteries
- Signal meter
- Low battery indicator
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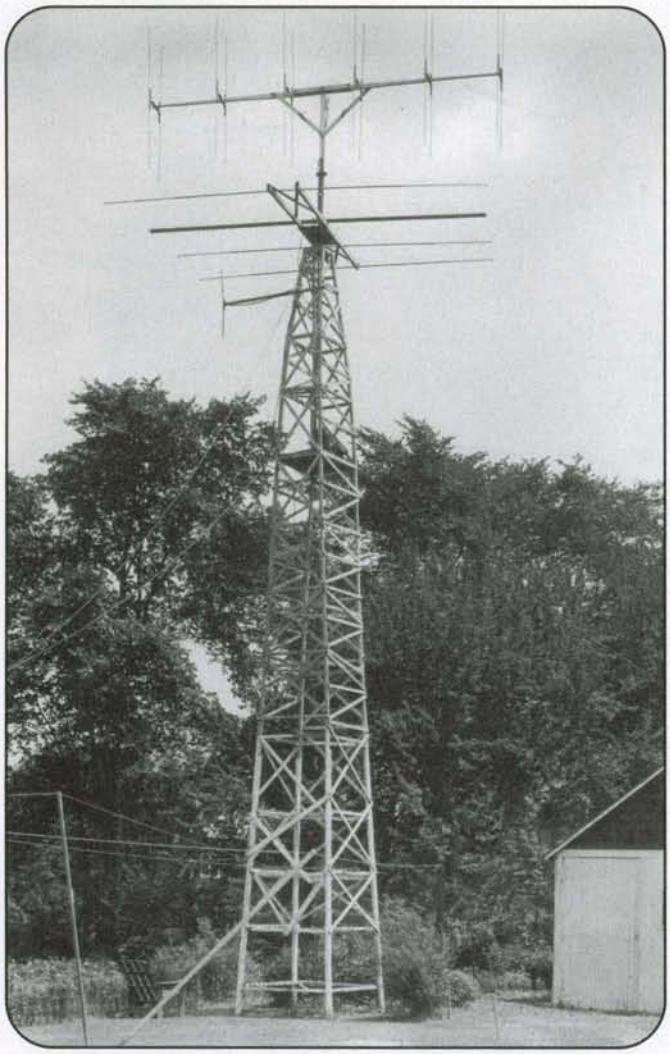

Photo 8. Jim's "Antenna that Multiplies by 50" perched atop the 40-foot tower he constructed in his back yard. This vertically polarized broadside-array antenna bears some resemblance to early radar units such as the SCR-268 that Jim worked on years earlier. Note also the beam for 10 meters.

Photo 9. In 1949 Jim moved from South Plainfield to neighboring Oak Tree. This is Jim's QSL card from that time. Note the illustration showing his "Antenna that Multiplies by 50" and a new wooden tower design.

Photo 10. Jim at the operating position of his Oak Tree, NJ QTH. The station consisted of a 2-meter converter and a Panadaptor that he built himself, as well as an SX-42 receiver. The unit on the far left is a narrow-band IF device that he used for experiments with Walt Bain, W4LTU.

before. With little more than an introduction, Dave said, "You've got the job!"

Jim enjoyed building his own receivers and unlike most VHF men of the day, also designed his own 2-meter converter. Jim says it was something similar to the classic W2AZL converter only using different tubes. Although Jim would become well known for his antenna designs, less well known are the towers he used to support them. Resembling works of art with their gentle curves and distinctive cross-bracing, these towers were entirely made of wood! Photo 8 shows Jim's "Antenna that Multiplies by 50" perched atop the 40-foot tower he constructed in his back yard. This vertically polarized broadside-array antenna bears some resemblance to early radar units such as the SCR-268 that Jim worked on years earlier. Note also the beam for 10 meters. Jim says his wife was very understanding!

Oak Tree QTH: Designs and Experiments

In 1949 Jim moved from South Plainfield to neighboring Oak Tree, a town close to Edison, NJ. Photo 9 shows Jim's QSL card from that time. Note the illustration showing his "Antenna that Multiplies by 50" and a new wooden tower design. In this view it really does look like a radar antenna!

Photo 10 shows Jim at the operating position of his Oak Tree, NJ QTH. This station consisted of a 2-meter converter and a Panadaptor that he built himself, as well as an SX-42 receiver. The unit on the far left is a narrow-band IF device that he used for experiments with Walt Bain, W4LTU. He explained that when working CW, if you set the AGC for a long time constant, you could actually see the S-meter creep upward as a result of ionospheric scattering.

Jim also did a lot of aurora work, adding that it sounded like a hissing sound that would change from T1 to T9 as the antenna was rotated. He mentioned how there were times when an aurora existed but you didn't know it. Many times you could work signals when you wouldn't expect it.

While living in Oak Tree, Jim experimented with different and unique antenna designs, all in an effort to extend the reach

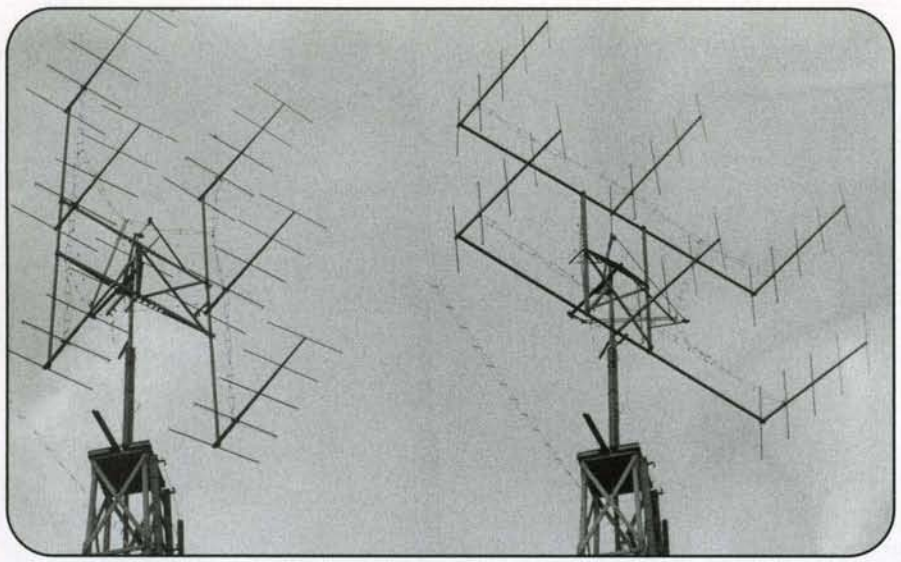

Photo 11. In the November 1950 issue of CQ *magazine, Jim published "More Gain with 30 Elements," an article describing another unique antenna design, one that could be rotated by rope for either horizontal or vertical polarization. Shown here is the antenna oriented in both positions.*

of his 2-meter signals. In the November 1950 issue of *CQ* magazine, Jim published "More Gain with 30 Elements," an article describing another unique design, one that could be rotated by rope for either horizontal or vertical polarization. This was necessary, since most eastern stations were vertically polarized at that time, while most western stations were horizontally polarized. Photo 11 shows this antenna oriented in both positions.

By July 1953 Jim was at the top of the 2-meter standings as published in *QST*. Photo 12 shows some familiar calls, including W2AZL and W2UK, both of whom lived nearby.

In September 1953 Ed Tilton, W1HDQ, did a write up in *QST* called "The Biggest Antenna?" in which he credited Jim with starting a new trend—that of increasing the size of already established arrays. Ed wrote: "Jim started it when he expanded the 'Brownie Beam' to 30 elements and the competition has been going ever since. W2UK went to 40 elements, adding another pair of 5-element arrays to the stack of 6 described by W2NLY." In 1954, Tommy Thomas, W2UK, and Paul Wilson, W4HHK, in Tennessee, were credited with the first-ever meteor-scatter QSO on 2 meters. In an effort to pick up Tennessee as a new state, Jim created a new 48-element antenna as shown in photo 13.

During the *Perseids* meteor shower of that year, both Jim and neighbor Carl, W2AZL, succeeded in completing QSOs with Paul, thus becoming perhaps the third and fourth stations in history to work 2 meters via meteor scatter.

The Lockheed Years

In the early years, Jim's work for Stavid would bring him back to Hadley Field, long since abandoned as an airmail terminal. Jim recalls how his first assignment was to clean out the terminal to make room for Stavid's manufacturing operation. He said there were lots of lanterns, searchlights, and other miscellaneous items left over from the airmail days. Hadley is where the operating shop and electromechanical work were done, and it was also where the first flight trainers were built for the US Navy. Over time the company grew, but when Jim had a chance to join Lockheed Electronics, in nearby North Plainfield, he jumped at the chance. Later, Stavid itself would be acquired by Lockheed and merged with it to become Lockheed Electronics.

While working at Lockheed, Jim was Project Engineer for various radar receivers and also worked on ships to resolve radar problems. One such problem was interference between ship radar and ship communications systems, because as Jim says, "Both had to work." The solution was to design a switch that disabled the radar as it rotated within the ship's superstructure, whenever it was directed toward the communications antennas.

Jim remarks how he got to work on some interesting projects. One such project involved the DEW line, a defense line of radar units positioned at the northern most outreaches of Canada and poised to detect the approach of Soviet jet bombers at the height of the Cold War. Bell Labs was in charge of this project and to save time, it contracted Lockheed Electronics to "militarize" commercial communications equipment from companies such as RCA and Zenith. For a time, Jim and some of his Lockheed coworkers worked out of the Bell Labs facility in Whippany, NJ, the

2-METER STANDINGS

	Call	States	Areas	Miles
	W1HDQ	18	6	850
	W1IZY	16	6	750
	W1RFU	15	7	1150
	W1MNF	14	5	600
	W1BCN	14	5	580
	W1DJK	13	5	520
	W1CTW	12	4	500
	W1KLC	12	4	500
	W2NLY	22	7	1050
	W2UK	21	7	1075
	W2QED	18	7	1020
	W2AZL	18	7	1050
	W2ORI	16	7	830
	W2PAU	16	6	740
	W2QNZ	14	5	400
	W2SFK	13	6	—
	W2DFV	13	5	350
	W2CET	13	5	405
	W2UTH	12	7	880
	W2DPB	12	5	500
	W2FHJ	12	5	—
	W2BVU	12	4	260
	W3RUE	19	7	760
	W3NKM	19	7	660
	W3QKI	17	7	820
	W3KWL	16	7	720
	W3LNA	16	7	720
	W3FPH	16	7	—
	W3GKP	15	6	650
	W3OWW	13	6	600
	W3KUX	12	5	575
	W3PGV	12	5	—
	W3LMC	11	4	400
	W4AO	20	7	950
	W4HHK	19	6	710
	W4JFV	18	7	830
	W4MKJ	16	7	665
	W4OXC	14	7	500
	W4IKZ	13	5	650
	W4JFU	13	5	720
	W4CLY	12	5	720
	W4JHC	12	5	720
	W4OLK	12	5	720
	W4FJ	12	5	700
	W4UMF	12	5	600
	W4LRR	5	2	900
	W5JTI	14	5	670
	W5RCI	14	4	790
	W5QNL	10	5	1400
	W5CVW	10	2	1180
	W5MWW	9	4	570
	W5AJQ	9	3	1260
	W5ML	9	3	700
	W5ERD	8	3	570
	W5ABN	8	2	780
	W5VX	7	4	—
	W5VY	7	3	1200
	W5FEK	7	2	580
	W5ONS	7	2	950
	W5SWV	7	2	—
	W5FBT	6	2	500
	W5IRP	6	2	410
	W5FSC	5	2	500
	W5DFU	5	2	275
	W6PJA	3	3	1300
	W6ZL	2	2	1400
	W6WSQ	2	2	1390
	W6NLZ	2	2	237
	W6GCG	2	2	210
	W6EXH	2	2	193
	W6ZEM/6	1	1	415
	W6GGM	1	1	300
	W6YYG	1	1	300
	W8WJC	21	7	775
	W8BFQ	21	7	775
	W8WRN	19	7	670
	W8WXV	18	8	1200
	W8UKS	18	7	720
	W8DX	17	7	675
	W8EP	17	7	—
	W8WSE	16	7	830
	W8RWW	16	7	500
	W8BAX	15	6	655
	W9FVJ	22	7	850
	W9EQC	21	8	820
	W9BPV	20	7	1000
	W9UCH	20	7	750
	W9LF	19	—	—
	W9WOK	17	6	600
	W9MBI	16	7	660
	W9BOV	15	6	—
	W9ZHL	15	6	—
	W9LEE	14	5	780
	W9FAN	13	—	680
	W9UIA	12	7	540
	W9GTA	11	5	540
	W9JBF	10	5	760
	W9DSP	10	4	700
	WØEMS	21	8	1175
	WNØGUD	20	7	1065
	WØIHD	16	6	725
	WØNFM	14	7	660
	WØZJB	12	7	1097
	WØINI	12	5	830
	WØWGZ	11	5	760
	WØOAC	11	5	725
	WØJHS	9	3	—
	WØHXY	9	3	—
	VE3AIB	17	7	850
	VE3DIR	14	7	790
	VE3BPB	12	6	715
	VE3AQG	11	7	800
	VE1QY	11	4	900
	VE3DER	10	6	800
	VE3BOW	8	5	520
	VE3QN	7	3	540
	VE3TN	7	4	480

Photo 12. By July 1953 Jim was at the top of the 2-meter standings as published in QST. *This shows some familiar calls, including W2AZL and W2UK.*

Photo 13. In 1954, Tommy Thomas, W2UK, and Paul Wilson, W4HHK, in Tennessee, were credited with the first-ever meteor-scatter QSO on 2 meters. In an effort to pick up Tennessee as a new state, Jim created the new 48-element antenna shown here.

same place that helped perfect the cavity magnetron years earlier. He even got to set up and describe the operation of a vintage SCR-268 radar unit to Bell Labs employees at Whippany.

Jim described how the first DEW line equipment had to be brought up to Canada by boat, then towed to the DEW line site using Caterpillar tractors that resembled a train going over the snowy landscape. DEW line training was done in Streator, Illinois, where a simulator station was built for training and equipment testing purposes. Jim's work involved vehicular communications, something that his W.E.R.S. experience no doubt prepared him for. An interesting communications problem that Jim worked on was unique to the Arctic environment—snow and ice static. Jim's solution was as effective as it was simple: Place the antenna elements inside plastic tubing! Another problem that Jim recalls, but was not personally involved in, was that of geese setting off the radar alarms!

Moonbounce, the 1950s

In the early 1950s, some of the more ambitious amateurs were looking to the moon as a reflector of their 2-meter signals. That this was even possible was first demonstrated in 1946 by the U.S. Army at Camp Evans, also in NJ. Using modified SCR-271 radar equipment, not unlike the familiar SCR-268 that Jim had worked on years earlier, the Army first detected echoes off the moon using military power levels. In 1953, two amateurs, W4AO and W3GKP, used stacked rhombics to detect the first amateur echoes off the moon using amateur power levels. At about the same time, Jim started working on long, long Yagis, impressive structures up to 40 feet long in some cases. When Jim discovered that a West Coast ham, Herb Johnson, W6QKI, was also working on such 2-meter designs, they decided to team up, comparing test results and verifying one another's work. Their classic article on the subject ("LONG Long Yagis") appeared in the January 1956 issue of *QST* and is perhaps responsible for the tremendous interest in Long Johns at that time, especially for those interested in moonbounce. Jim recalls

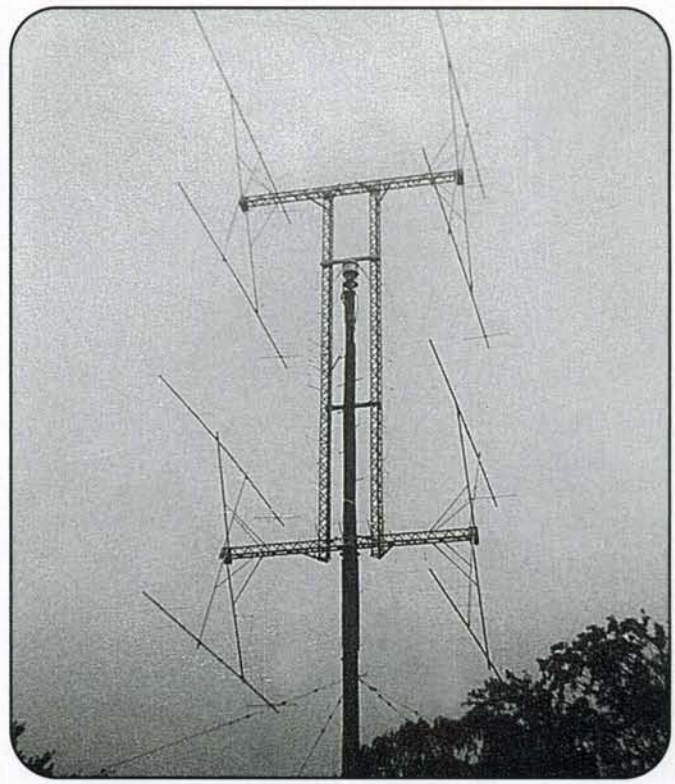

Photo 14. Jim's 2 over 4 moonbounce array in 1956.

how he and Herb together worked out many different designs, each with certain advantages. Then Herb, who worked for Gonset at the time, took their best design and made it into a commercial offering. Ralph Thomas, KH6UK, called this antenna "Big Bertha," and he appears to have used some while living in Kahuku, Hawaii.

In 1956 Jim and Herb embarked on Project "Jersey Bounce," an attempt to communicate coast to coast via the moon. Jim started with an array of four Long Johns, arranged 2 over 2, and later went to eight Long Johns, arranged 2 over 4. Photo 14 shows Jim's 2 over 4 moonbounce array in 1956.

As impressive as John's array was, Herb's array of 16 Long Johns mounted 8 over 2 was even bigger. Photo 15 shows the array supported by a wooden A frame.

When Jim reported hearing his own echoes off the moon in 1957, he started recording them. In an interesting experiment Jim pulsed his transmitter on and off, sending a single pulse every 5 seconds and listening for echoes in between. In one session, Jim succeeded in hearing 30 out of 120 pulses. He recalls how he thought someone was playing a joke on him, but when he adjusted his antenna azimuth he could see how the signal strength would change. In his book *The Exploration of Outer Space* first published in 1962, astronomer Sir Bernard Lovell described a similar experiment performed by radio astronomers using some of the largest radio telescopes at the time:

Ten years ago it was a difficult technological problem to transmit radio waves from earth and pick them up again 2½ seconds later after they had been reflected from the surface of the moon nearly a quarter of a million miles distant. Now, with the large radio telescopes, this is an easy technical task but, as so often happens with new scientific experiments, completely unexpected effects were encountered. The moon appears to be fairly uniformly bright to the eye, and it was assumed that if radio waves of uniform strength were transmitted to

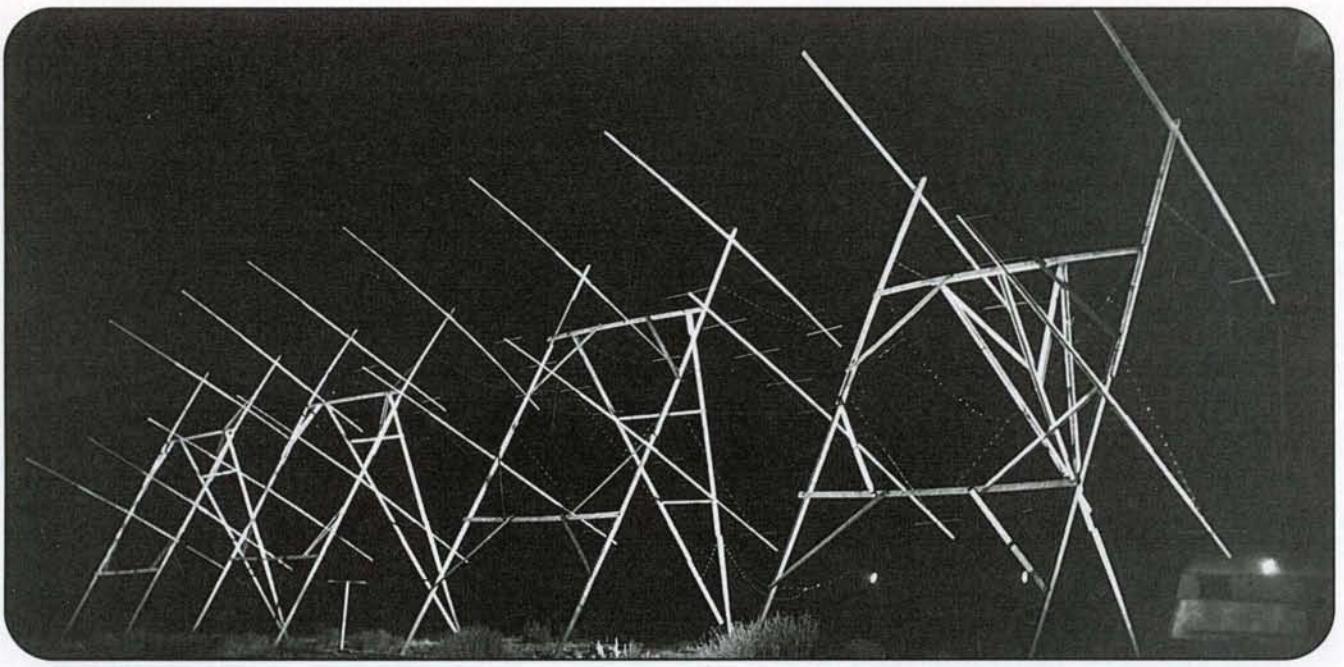

Photo 15. Jim's array supported by a wooden A frame. When Jim reported hearing his own echoes off the moon in 1957, he started recording them.

the moon, they would be scattered uniformly from the lunar surface so that the signal collected by the radio telescope and recorded as echoes on a cathode ray tube would always be of the same strength. It was surprising to find that this was not the situation. The transmissions from the telescope were made in the form of short pulses which were expected to be recorded as pulses of uniform strength after scattering from the lunar surface. In fact, very marked irregularities in the strength of the returned echoes were found. The individual pulses, separate in time by a second or so, varied in strength ... this fading is an effect of the libration of the moon.

In a way, Jim's experiment put him in a class with the best radio astronomers of the day, using equipment that he made himself! Jim sent a copy of his moon echo tape to Herb Johnson, W6QKI, in California. In a letter from Ralph Thomas, KH6UK, to Walt Morrison, W2CXY, that same year, Tommy remarked that John Chambers, W6NLZ, had heard Jim's tape and considered it good enough for a QSO.

Although both sides reportedly could hear their own echoes, a windstorm dashed all hopes of success as the California array was reduced to a pile of rubble. Photo 16 shows the "obituary" that Jim received shortly thereafter.

In September 1958, VHF pioneer Ralph Thomas, KH6UK, reported to Walt Morrison, W2CXY, that he was going to rebuild his 4 over 2 Long John array into a 2 over 4 configuration. This would have been very similar to Jim's array with the exception of it being tiltable. Perhaps Tommy was inspired by the reports of Jim's echoes from the West Coast gang with whom he was keeping schedules, not to mention the glowing reports in *QST* at the time.

The Latter Years

Unfortunately, when Jim moved from Oak Tree back to South Plainfield in 1979, it was not a favorable location for antennas and so he couldn't get back on the air. In that last move many of Jim's QSLs and audio tapes were lost, including that now famous moonbounce tape. All that remains of Jim's many years in VHF radio are his sharp memory, a few binders containing vintage QSLs, and a looseleaf scrapbook lovingly kept as a reminder of his "40 years of ham radio." Although the memories are all wonderful, one stands out in particular for the VHF enthusiast. Tucked away on page 43 of his scrapbook is a card that speaks volumes of the fraternity that existed among the VHF pioneers back then. That card, shown in photo 17, commemorates not only the 25th anniversary of Jim's historic meteor-scatter QSO with Paul on August 14, 1954, but also the long-time friendship that existed among VHF men as well as their families during the golden age of VHF radio. Imagine receiving such a card from someone you first met 25 years ago!

Oct. 24, 1956

At approximately 3 a.m. this morning the 208 element Moonbeam at San Fernando, Calif. was struck with a severe attack of violent air pressure and was mortally stricken. She fought bravely up until 7 a.m. when the end finally came. Her loss is felt deeply by all concerned with Project "Jersey Bounce". Services will be held at the home of K6EYN on Oct. 27. Burial will be handled by the V.H.F. Rubbish Removal Co. Please omit flowers. Hammers, saws, wrecking bars and muscle will be appreciated.

Pallbearers are: K6EYN, K6OUK, K6IVO, W6 ZAT, W6QKI, W6QED, W9QEP/6, W9QXP/6, and W2YPY/6. Pallbearer in absentia: W2NLY.

Photo 16. Jim sent a copy of his 1957 moon echo tape to Herb Johnson, W6QKI, in California. In a letter from Ralph Thomas, KH6UK, to Walt Morrison, W2CXY, Tommy remarked that John Chambers, W6NLZ, had heard Jim's tape and considered it good enough for a QSO. Although both sides reportedly could hear their own echoes, a windstorm dashed all hopes of success as the California array was reduced to a pile of rubble. This is the "obituary" that Jim received shortly thereafter.

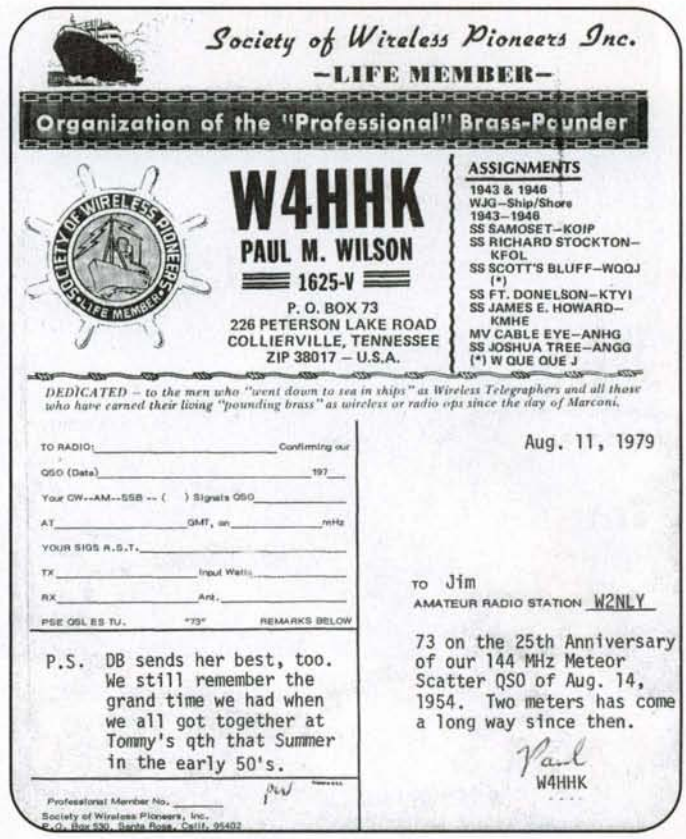

Photo 17. This card commemorates not only the 25th anniversary of Jim's historic meteor-scatter QSO with Paul, W4HHK, on August 14, 1954, but also the long-time friendship that existed among VHF men as well as their families during the golden age of VHF radio.

Note the last line on the card where Paul says, "Two meters has come a long way since then." Jim remarked how much 2 meters has changed even since then, with moonbounce now being possible using modest power and single Yagis with gains on the order of his own designs. I mentioned how some people challenge the newer modes for moonbounce communication based on not being able to hear the signal. To this Jim replied, "Yes, but you can see it!" In any case, moonbounce by any means is an exciting prospect.

I mentioned to Jim how all the articles on early meteor scatter invariably mention the same four calls; W2UK, W2AZL, W2NLY, and W4HHK. This got me to wondering if Tommy, Carl, and Jim might have been good friends. Jim answered with a simple story about a time when he, Tommy, and Carl were driving across Pennsylvania in the early 1950s and apparently having a really good time, when all of a sudden a police car pulled Tommy over for speeding. I can just imagine the three of them, all legends in their own right, traveling through Amish country, scoping out antenna locations and just having fun.

Since Jim has been off the air for a few years, I asked him if he had any hobbies other than ham radio. He replied, "No, it's all about family," as he pointed to some pictures in the front hallway. I like to think that's the way it's always been for Jim, from those early days at Hadley with his dad, to the time he and his father worked together on the South Plainfield W.E.R.S. station, to his immediate family, and to his amateur radio family. It's always been about family. I hope that by reading this, both his personal as well as ham radio family will come to recognize Jim as what he really is—a pioneer in the family. That's not something you can say about many people nowadays.

I would like to thank Jim for sharing all his wonderful memories and pictures with us. I will always consider it a great privilege to have met Jim and an even greater honor to have brought his story to the next generation of pioneers. ■

QUARTERLY CALENDAR OF EVENTS

Current Contests

June: ARRL June VHF QSO Party. The dates for this contest are 13–14 June. Complete rules are in the May issue of *QST*. Rules can also be found on the ARRL website (http://www.arrl.org). Many are making plans to activate rare grids. For the latest information on grid expeditions, check the VHF reflector (vhf@w6yx.stanford.edu) on the internet. For weeks in the run-up to the contest postings are made on the VHF reflector announcing rover operations and grid expeditions. It is a contest that will create for you plenty of opportunities to introduce the hobby to your friends who are not presently working the VHF plus bands or who are not hams.

SMIRK Contest. The SMIRK 2009 QSO Party, sponsored by the Six Meter International Radio Klub, will be held from 0000 UTC June 20 to2400 UTC June 21. This is a 6-meter only contest. Exchange SMIRK number and grid square. Score 2 points per QSO with SMIRK members and 1 point per QSO with nonmembers. Multiply points times grid squares for final score. Awards are given for the top scorer in each ARRL section and country. Logs and log requests should be sent to: David Craig, N3DB, 4931 Mariners Drive, Shadyside, MD 20764 USA. Logs may also be submitted via electronic mail to <davidhcraig@verizon.net> and must be received no later than 1 August, 2009. For more information see the URL <http://www.smirk.org> and click on the SMIRK Contest link at the top of the page.

Field Day. ARRL's classic, Field Day, will be held on June 27–28. Complete rules for this contest can also be found in *QST* and on its website: <http://www.arrl.org>. In years past tremendous European openings have occurred on 6 meters. Also, as happened in 1998, very large sporadic-*E* openings can occur. Certainly, this is one of the best club-related events to involve new people in the hobby.

July: CQ WW VHF Contest. This year's CQ WW VHF Contest will be held from 1800 UTC July 18 to 2100 UTC July 19. The rules for this contest can be found in the June issue of *CQ* magazine and on the *CQ* website: <www.cq-amateur-radio.com>

August: There are two important contests this month: The **ARRL UHF and Above Contest** is scheduled for 1–2 August. Complete rules can be found in the July issue of *QST*. The first weekend of the **ARRL 10 GHz** and above cumulative contest is scheduled for August 15–16. The second weekend is September 12–13. Complete rules for this contest also can be found in the July issue of *QST*.

Current Conferences and Conventions

May. Dayton Hamvention®. The Dayton Hamvention® will be held as usual at the Hara Arena in Dayton, Ohio, May 15–17. For more information, go to: <http://www.hamvention.org>.

June. The annual **Ham-Com Hamfest** will be held June 12–13, 2009, in Plano, Texas. As always, the North Texas Microwave Society will present a microwave forum. For more information, see the Ham-Com website at <http://www.hamcom.org/>.

July. This year's **Central States VHF Society Conference** will be held in Elk Grove, Illinois, July 23–25, at the Elk Grove Village Holiday Inn Hotel. For more information, please see the URL: <http://www.csvhfs.org/>.

Quarterly Calendar

The following is a list of important dates for EME enthusiasts:

May 1	Moon first quarter
May 5	*Eta Aquarids* meteor shower
May 9	Full Moon
May 14	Moon apogee
May 17	Moon last quarter
May 24	New Moon
May 26	Moon perigee
May 31	Moon first quarter
June 7	Full Moon
June 10	Moon apogee
June 15	Moon last quarter
June 21	Summer solstice
June 22	New Moon
June 23	Moon perigee
June 29	Moon first quarter
July 7	Moon apogee
July 7	Full Moon
July 7	Lunar eclipse
July 15	Moon last quarter
July 21	Moon perigee
July 22	New Moon
July 22	Solar eclipse
July 28	*Southern Delta Aquarids* meteor shower
July 28	Moon first quarter
August 4	Moon apogee
August 6	Full Moon
August 6	Lunar eclipse
August 12	Perseids Meteor Shower
August 13	Moon last quarter
August 19	Moon perigee
August 20	New Moon
August 27	Moon first quarter
August 31	Moon apogee

—EME conditions courtesy W5LUU

Calls for Papers

Calls for papers are issued in advance of forthcoming conferences either for presenters to be speakers, or for papers to be published in the conferences' *Proceedings*, or both. For more information, questions about format, media, hardcopy, e-mail, etc., please contact the person listed with the announcement. The following organization or conference organizer has announced a call for papers for its forthcoming conference:

Central States VHF Society Conference: Technical papers are solicited for the 43rd annual Central States VHF Society Conference to be held in Elk Grove, Illinois on July 23–25, 2009. Papers, presentations, and posters on all aspects of weak-signal VHF and above amateur radio are requested. You do not need to attend the conference, nor present your paper, to have it published in the *Proceedings*. Posters will be displayed during the two days of the conference. Non-weak signal topics such as FM, repeaters, packet radio, etc., generally are not considered acceptable. However, there are always exceptions. Please contact the folks below if you have any questions about the suitability of a topic. Strong editorial preference will be given to those papers that are written and formatted specifically for publication, rather than as visual presentation aids. Submissions may be made via the following: electronic formats (preferred); via e-mail; uploaded to a website for subsequent downloading; on media (3.5" floppy, CD, USB stick/thumb drive). Deadline for submissions: For the *Proceedings*, June 1; for presentations to be delivered at the conference, June 29; and for notifying them that you will have a poster to be displayed at the conference, June 29. Bring your poster with you on July 23 or 24. Contact information: Kermit Carlson, via e-mail: <w9xa@yahoo.com>, or snail mail: 1150 McKee St., Batavia, IL 60510.

Technical papers are solicited for presentation at the **28th Annual ARRL and TAPR Digital Communications Conference** to be held September 25–27 in Chicago, Illinois and publication in the conference *Proceedings*. Presentation at the conference is not required for publication. Submission of papers is due by July 31 and should be submitted to: Maty Weinberg, KB1EIB, ARRL, 225 Main Street, Newington, CT 06111, or via the internet to <maty@arrl.org>. For suitable topics and submission guidelines also contact Maty via e-mail; also check <http://www.arrl.org>.

Meteor Showers

May minor showers include the following and their possible radio peaks: *η-Aquarids*, May 6, 0000 UTC; *ε-Arietids*, May 9, 0800 UTC; May *Arietids*, May 16, 0900 UTC; and *o-Cetids*, May 20, 0800 UTC.

June: Between June 3 and 11, the *Arietids* meteor shower will once again be evident. This is a daytime shower with the peak predicted to occur on June 7, around 1100 UTC. Activity from this shower will be evident for around eight days, centered on the peak. At its peak, you can expect around 60 meteors per hour traveling at a velocity of around 37 km/sec (23 miles per second).

On June 9 the *Zeta Perseids* is expected to peak around 1100 UTC. At its maximum, it produces around 40 meteors per hour. The *Boötids* is expected to make a showing between June 27 and July 2, with a predicted peak on June 27, around 0830 UTC. On June 28 the *Beta Taurids* is expected to peak. Because it is a daytime shower, not much is known about the stream of activity. However, according to the book *Meteors* by Neil Bone, this and the *Arietids* are two of the more active *radio* showers of the year. Peak activity for this shower seems to favor a north-south path.

July: This month there are a number of minor showers. The *Piscis Austrinids* is expected to peak July 28. The *δ-Aquariids* is a southern latitude shower. It has produced in excess of 20 meteors per hour in the past. Its predicted peak is around July 27. The *Piscis Austrinids* is expected to peak around July 28. The *α-Capricornids* is expected to peak on July 30.

August: Beginning around July 17 and lasting until approximately August 24, you will see activity tied to the *Perseids* meteor shower. Its predicted peak is around 1730–2000 UTC on August 12. A possible tertiary peak may occur around 0900 UTC. The *κ-Cygnids* meteor shower is expected to peak on August 17. The visually-impossible *γ-Leonids* is expected to peak August 25, around 1000 UTC. The *α-Aurigids* is expected to peak on August 31.

For more information on the above meteor shower predictions see Tomas Hood, NW7US's propagation column. Also visit the International Meteor Organization's website: http://www.imo.net/calendar/2009.

VHF/UHF Weekly Net Successes

Many weak-signal nets continue to grow and flourish, where others struggle to stay alive. Here WB6NOA tells the story of John Kountz, KE6GFF, who makes a weekly trek to a hilltop overlooking Laguna Beach. From this QTH he regularly reaches out over 300 miles!

By Gordon West,* WB6NOA

Kenwood, Yaesu, and ICOM deserve credit from the VHF/UHF ham community for their small high-frequency transceivers, including multimode capabilities on 6 meters, 2 meters, and 440 MHz. It was not so many years ago when an HF rig did just that—high frequency, 3 –30 MHz! Six-meter enthusiasts campaigned long and hard for 50–54 MHz multimode and were singularly impressed when the ICOM IC-706 and Yaesu FT-100 included 6 meters, *plus* 2 meters and 440 MHz, multimode! Kenwood soon followed with the TS-2000, with yet one additional band option, 1.2 GHz.

Those of us running VHF/UHF weak-signal nets continuously encourage HF operators to put up a modest horizontal antenna and try out the world above 50 MHz.

"During our 2-meter and 440-MHz weak-signal sideband nets, I regularly switch over to a vertically polarized omni antenna and welcome aboard an HFer or two who might be curious to see what is happening on sideband at the bottom of these VHF/UHF bands," commented Bill Alber, WA6CAX, north of the San Francisco, California, bay area.

Bill's close friend, Larry, W6OMF, may also use the same technique, and his Sunday evening bay-area 144.250-MHz weak-signal net draws over a hundred check-ins! Yes, his location . . . location . . . location . . . gives him a nice shot to more than 10 grids, and his four-bay of 2-meter long boomers reaches out over 400 miles away, but on the air he has something going that weekly magnetizes regular and brand-new check-ins for a signal exchange.

Sharing this unique magnetizing skill (which I will describe shortly) in southern California is 432.120-MHz net control John Kountz, KE6GFF, well known for his 432 weak-signal net success, plus his multiple DX adventures to Afghanistan *(see the article "The Responsible Person: Bringing Amateur Radio Back to Afghanistan, by John Kountz (T6EE/KE6GFF), March 2008* CQ *magazine)*. John's success on 432 MHz requires a rigorous off-road half-hour drive to get to location, location, location!

"My home QTH is nestled in a Laguna Beach canyon, a stone's throw from the news events you read about with fires and landslides," commented John, KE6GFF. "I take my 1967 vintage rebuilt Land Rover and get onto a closed fire road between the top of the world and Moulton Meadows Park. I have the key to the gate because I'm the local emergency communications ham radio contact to the city," said John with a smile.

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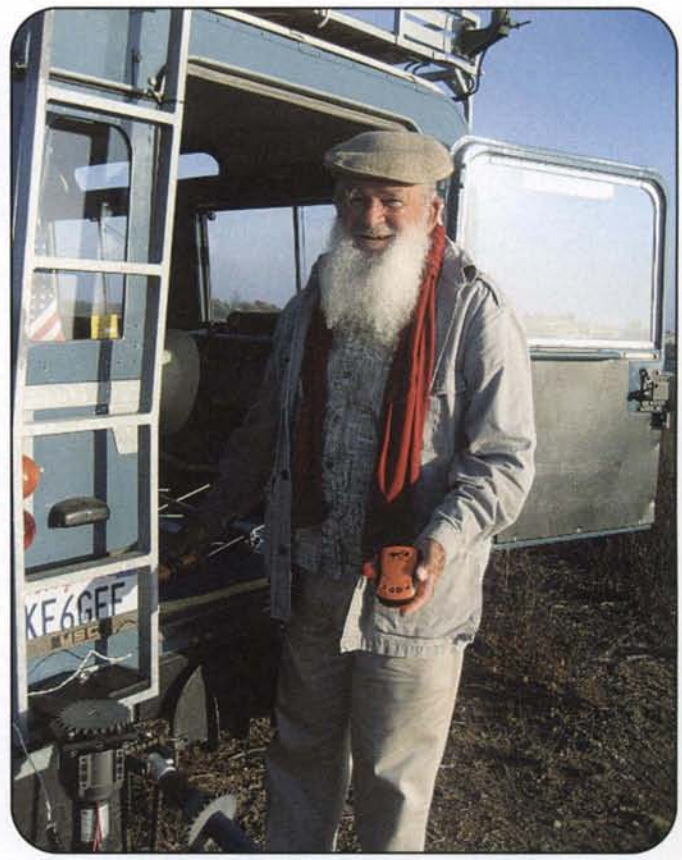


John Kountz, KE6GFF, getting ready to set up for his weekly 70-cm net at his hilltop location in Laguna Beach. (Photos by WB6NOA)

I rode with him one evening to the top of the 1000-foot hill with a clear view 360 degrees with no 432 obstructions. "Step to your left, Gordo, and that tarantula won't climb up your leg," commented the cool, calm, and very collected John.

John easily captured between ten and twenty 432-MHz check-ins almost immediately with his semi-homebrew 17-foot boom, K1FO, 25-element horizontal beam. It snaps together in 38 seconds, and there is no fiddling, with the insulated elements held perfectly in place with keepers.

"Laddie, N8EWU, provided the 3 1/6th material for the elements, and Mike, K6MYC, of M^2, swaged and drilled the boom

Rear view of the Land Rover used for KE6GFF's portable hilltop QTH. Kountz reaches out over 300 miles on many nights at this hilltop location, thus providing new operators a state away with predictable DX!

to my dimensions, and if it takes more than 45 seconds to get this 25 footer in place, something's wrong!" added John.

His mast can go up 28 feet and locks into a chain-driven, motorized mount firmly attached to the Land Rover with an upper support arm.

"My mast sections are several socketed pole-vault tubing pieces held together with Velcro™ and mounted via strap hinges to the ladder on the rear of my 109-inch '67 Land Rover," added John.

John flexed his elderly muscles and said he's tired of standing in the rain for "armstrong" rotation, so he contrived the chain-drive rotor which has reduced the number of reported head colds he has suffered after each Thursday mountaintop net event.

His rig is a vintage Yaesu FT-790 driving a TE Systems 100-watt amp, and depending on expected band conditions, he can feed his antenna with 9913 flex, or LMR 600 flex, and for some real serious tropo ducting, Andrews 5/8-inch hard line. The rig runs on a 105-amp/hour deep-cycle battery maintained by a 75-watt Siemens solar panel on the roof of the Land Rover, and absolutely independent of the vehicle starting battery.

"I know I'm on a hill, but I still don't like to pop the clutch if I should accidentally kill my only starting battery," said John, quite insistent that he has never had to come back down the hill in the dark without the engine running!

Net Success Stories

OK, now for the Larry, W6OMF, and John, KE6GFF, VHF/UHF net success stories, and there are likely hundreds more throughout the country where a single ham operator draws huge attention to the under-utilized weak-signal portion of our VHF and UHF bands.

Even more important than location, location, location, and a big antenna system is the capability of a single operator to hold the net together every week and keep the number of check-ins up.

What Larry and John do, with net control, is to get everyone's attention by becoming fun characters on the air! They run the net with a smile, and if you have ATV, you can see it! The successful nets (plus, I'm sure, hundreds of others) start out with news of the past week's weak-signal activities, band-opening reports from selected big-signal operators, propagation predictions for the upcoming week, and after a fast-paced 10-minute news routine, they stay exactly on schedule and roll the net.

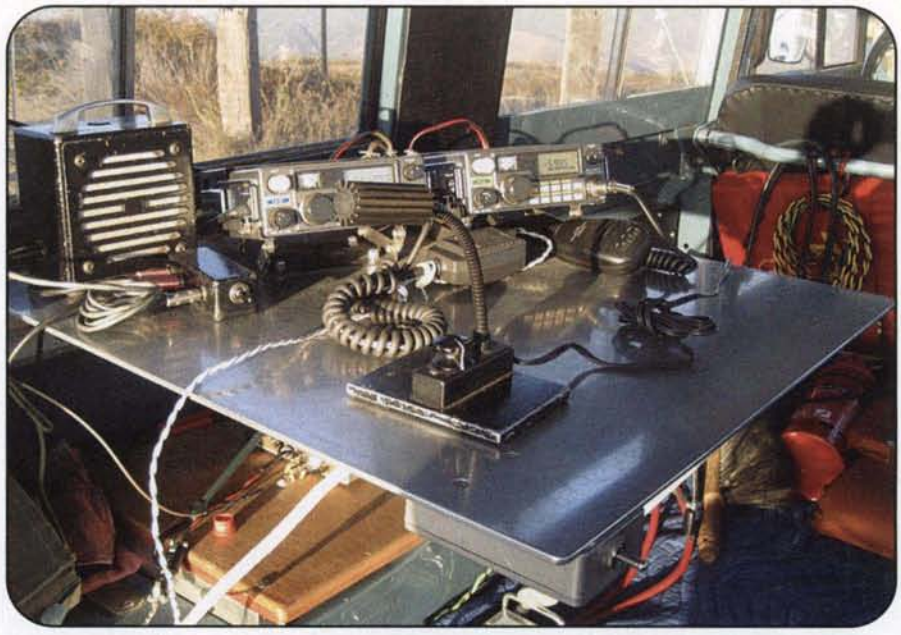
One approach, to a wide area net, has been adopted by Larry, W6OMF, and that

is to call specific stations known to be in selected 30-degree quadrants. Most know when their particular quadrant will be called, and there is usually an opportunity for missed and new check-ins to announce themselves before he swings away from that specific quadrant. John, on 432 MHz, does much the same thing, with distant, next-state-over stations knowing about when he plans to swing his beam in their general direction.

However, John and Larry have a unique technique that keeps both new and regular members coming back for more, every net week evening:

"Well, hi there, Jack, and no doubt you have Rosie sitting on your lap, and we all want to know how you got the long boomer to the tip of your mast without a gin-pole!" barks John, eliciting multiple responses from every station checking in, only now and then glancing at the scrawled notes he may have taken the week before.

"... Great signal from DM13, a nearly 300-mile shot down south, Sam. I hear the Hawaii beacon was in to So Cal last week, and if we imagined hard enough, we could hear some activity down on 144.170, coming across the pond. Did you make a Hawaii contact, Sam?" asks Larry.



The operating table for KE6GFF inside the Land Rover.

Both net controls manage these fun contacts and set the pace so a lengthy ragchew can't stall the net from going on to the next operator. Both of them regularly repeat the highlights, giving others well out of the area a heads up of how many southern California stations actually worked the 2500-mile path to Hawaii during a recent band opening.

"The professional lecturer will always repeat the question asked of him or her so everyone feels part of the discussion," commented Bill Alber, WA6CAX, retired from the teaching circuit.

Acknowledging stations with their callsign and their name give the operators a welcome feeling. By going further and asking that operator, by name, how last week's pet project is coming along, I can almost guarantee that the operator will be flattered that the net noticed and remembered the specific project, ensuring a return to the net the following week.

"WX6XYZ, you are 3 and 4 into the net, and you either have a problem with your mic cord, or your modulator stage is going south. Your signal is no good. Now who else was trying to get back to net control?" While this type of impersonal roll call may be suited for an emergency traffic net, the impersonal approach of barking on the net will probably cause newcomers, eager to check in, to back off from receiving a scathing signal report. "There is more to running a net than just exchanging callsigns," added another net controller on the East Coast.

No, I am not saying you have to be a *character* to run a weak-signal net. Even straight-faced, trying a little dialog with the other station just might make running a weak-signal net a little more personable.

Finally, if an unanticipated very weak-signal DX station should come on to the net during a tropo event that only occurs once a year, net control should encourage other stations who might be hearing this rare DX to make an exchange. As net control, even though you may have the biggest and best signal to this distant station, share the opportunity! If it's not a contest, take the time to tell the distant station that "Bernie, WX6YZX," is going to call him now.

It's rewarding to assist new weak-signal operators, with their new horizontal beams, to make that first big tropo contact right on the net. It makes you both feel good! Yes, this will slow down the net dramatically. However, I'll bet you will double the number of participants the next week.

This is fun! If your net has run out of steam, collaborate with another net controller on the same band and develop a new net with a good following. The whole idea is to increase our regular participation numbers on SSB and CW, plus weak-signal digital modes, to hold our own at the bottom of these bands.

Run your net with a smile! ■

The Story Behind the Book
Six Meters, A Guide to the Magic Band

The first edition of *Six Meters, A Guide to the Magic Band* was published nearly 15 years ago and was the first book dedicated to 6 meters. This article covers the story of its inception and subsequent editions.

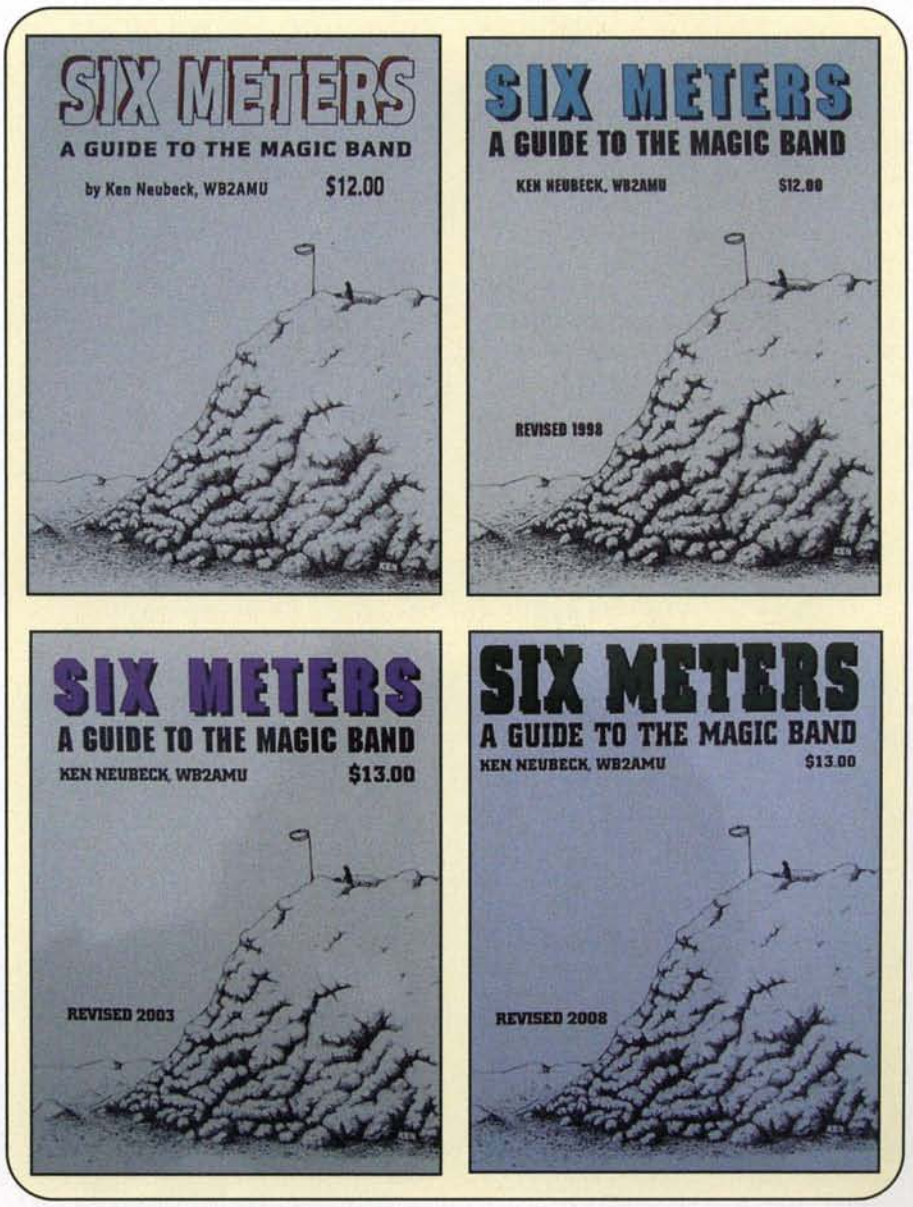
By Ken Neubeck,* WB2AMU

April 2009 will mark the 15th anniversary of the first edition of *Six Meters, A Guide to the Magic Band*, published by WorldRadio and the first book dedicated to 6 meters. Recently, the book underwent a fourth revision, its most complete version. This article covers the story of its beginnings and the various circumstances that led to the book.

Discovery of 6 Meters, The "Magic Band"

I became a ham in 1971, and I had always had a curiosity about the 6-meter band, but since most of the radios that were available were HF packages, I did not attempt it at that time. Also, I had heard that this band had particularly bad issues with TV interference, more so than the HF bands. I also remember finding the logs my father had from the 1960s that showed a contact he made with a VE5 station in Saskatchewan on 6 meters, and I wondered how he made a contact like that on a band that was supposedly used for local purposes such as Civil Defense work. Little did I know that I would eventually find out the answer some years later.

During August 1990, I was at a local flea market on Long Island, New York, when I came across a vintage Swan 250 6-meter transceiver. I took the plunge and was able to get the radio for $90. The deal included the radio, a microphone, and the operating manual, which included schematics. I was able to rig up a temporary antenna for the 6-meter band, but found little activity. Eventually, I found some local hams in the lower part of the band



The four editions of Six Meters, A Guide to the Magic Band *that were released in 1994, 1998, 2003, and 2008. (Photo by Ken, WB2AMU)*

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and they gave me a general primer as to where the activity was located. I set up a portable station in my back yard for the ARRL's September 1990 VHF contest and worked a couple of dozen stations via line-of-sight throughout the first day of the contest. However, I had to stop when a neighbor mentioned the next day that I was getting into his TV set.

Periodically I listened on that Swan 250 during the next few winter months, but found no activity on the band. There was not a lot of information about 6 meters from conventional sources, but it just a general overview about a propagation mode known as sporadic-*E*. I rigged up a vertical antenna for the January 1991 VHF contest and worked some line-of-sight stations, but it was not until the June 1991 VHF contest that I discovered the joys of the "Magic Band" and the mysterious propagation mode, sporadic-*E*.

During the first two hours of this contest on Saturday, the 6-meter band came alive with very loud signals and I worked a few dozen stations via sporadic-*E* from my home on Long Island into the deep south of the U.S. I could not believe the difference between the quiet band from which I had only heard line-of-sight stations and now was working many stations via skip! Then the band faded out after two hours and I thought that I wanted more. The next day, Sunday, the band was quiet until late evening, when Midwest stations from Minnesota came in, until I had to shut down because of TVI complaints from my XYL in our house. Throughout the rest of the summer, I caught a few more sporadic-*E* openings and worked a few DX stations, such as HH7PV in Haiti! In January 1992, I finally caught my first European opening and worked a number of western Europeans via *F2* propagation. Wow! During the course of the fall of 1992, I also heard my first aurora opening ever, and this too was another amazing revelation for me, when I heard distorted CW and SSB signals on 50 MHz.

I was hooked on these different propagation modes and started looking for every bit of information that I could find about 6 meters and also about both the sporadic-*E* and aurora phenomena. This included not only researching the ham literature, but also the scientific literature as well.

First, I started writing to hams who I was told knew a lot about the band, such as Tom Glaze, KC4SUS (now K4SUS), and Emil Pocock, W3EP. Emil was especially helpful, as he sent carefully typewritten letters about sporadic-*E*. (Remember that 1991 was before the internet and personal-computer phenomena really took off!) I also found out that 50.125 MHz was the important domestic calling frequency and 50.110 was the DX calling frequency. Tom Glaze was probably one of the first people who told me that 6 meters was also known as the "Magic Band."

Then I did research into what scientific literature was out there about the sporadic-*E* phenomenon, as well as the aurora phenomenon. This search eventually took me to the physics library of my alma mater, Stony Brook University, where I found scores of journals that had papers discussing sporadic-*E* and aurora. I found out that sporadic-*E* consists of ions that are compressed by wind-shear activity in the *E* region of the ionosphere. This collided with the theory presented by hams in past articles that sporadic-*E* was somehow weather related and correlated with thunderstorm activity.

Eventually I found that the published results from the rocket studies conducted during the 1960s had determined that the ions that made up the thin sporadic-*E* layers were metallic in nature, typically iron and magnesium, with origins traced to meteor ablation. Understanding the sporadic-*E* phenomenon was a significant key to understanding the major propagation mode that appears consistently on 6 meters on a yearly basis with a major summer season and a minor winter season.

Eventually, I realized that the Swan 250 was not going to serve me well in a practical sense if I was going to operate efficiently and often on the 6-meter band. The radio could not be cleaned up in terms of RF leakage, even with power reduction. Also, the radio had a tremendous drift problem, and the analog dial became unreliable at that point as to indicating where I really was on the band. I did a lot of searching and ended up purchasing a TS-670 quad-bander, a 10-watt radio that covered 40, 15, 10, and 6 meters. This radio solved a number of problems that I had with the Swan. It also allowed me to explore portable operations, because it could run off 12 volts. This would open up a new world for me as well, where I could be doing portable operations.

It became apparent to me that 6 meters was a fabulous band that hams had access to, but the information about it was very sketchy in the conventional ham radio sources and more information was needed to make hams aware of this interesting band. One problem that I noticed right away is that 50 MHz was always bundled up with all of the other VHF bands in VHF reference manuals. However, if you really come down to analyzing it, 6 meters is neither a pure-VHF band like 2 meters, nor is it a pure-HF band like 10 meters. It truly is a unique band that is the borderland territory between HF and VHF and stands out on its own. It seemed logical that the 6-meter band should be a topic covered all by itself in a major article, or in a book.

At this time in my life, I was doing a lot of writing in my job as well as writing about ham radio topics for various club newsletters, as well as a private newsletter that I circulated among friends known as the "Sporadic *E*." I then worked writing a short article for *QST* called "The Mysterious 6-Meter band," which was accepted for publication in the December 1992 issue, on my 40th birthday. In March of 1993, I wrote an in-depth article on sporadic-*E* and aurora propagation that was published in *WorldRadio*. But even more information needed to get out there about 6 meters and these propagation modes, but how?

The Book Becomes Reality

In the Spring 1993 issue of *WorldRadio* magazine, Publisher Armond Noble, N6WR, put out a request for hams to come up with some ideas on topics for books that could be published by WorldRadio, Inc. Immediately, I thought of an idea of a book dedicated to the 6-meter band and sent my proposal to Armond. With encouragement, I called Armond, and he told me that he had operated 6 meters from Wyoming in the late 1950s and had a lot of fun with the band. I immediately set out to work up an outline to do the project and start collecting material.

In 1993, there was a significant amount of information and material that I had to collect for this book project. I contacted Tom, KC4SUS, about the quad antenna that he used on 6 meters; Emil Pocock, W3EP, about different aspects of 6-meter propagation; and Frank, AA2DR, about vintage 6-meter radios and his amazing contact with Australia from Long Island on 6 meters in October 1992. In addition, Larry, WB5KYK, wrote back to my request for information with a major tutorial on meteor-scatter work on 6 meters.

Most of the book was written in May

1993. After getting some basic chapters done on propagation, equipment, and antennas, I integrated additional material that Frank, AA2DR, had spent significant effort in collecting regarding the interesting 6-meter equipment that was common during the 1960s. The antenna ads, particularly the Saturn Six Halo antenna really gave an esoteric feel to the book.

A major aspect that I wanted to convey in the book is the idea of having fun on 6 meters. This was promoted by the fact that different modes of propagation could occur at certain times on a normally quiet band and really change things. Also, because of the small wavelength of the band, portable operations to rare grid squares or to other countries were reasonably possible with modest effort and equipment.

Another important aspect of the book is that it was the published work that tied directly to scientific studies regarding sporadic-*E* and aurora propagation. A chart summarizes the results of various rocket studies that were conducted during the 1960s and 1970s, when the sporadic-*E* ions were determined to be metallic, typically iron and magnesium. Presenting scientific-based information in the book was a major step.

By late fall 1993, I had put together all of the material for the book and sent the final manuscript to Armond and his wife Helen. I realized that while the effort was pretty comprehensive, there was still some room for growth for future editions of the book.

The final form of the book clocked in at 80 pages. WorldRadio had planned on having copies available at the 1994 Dayton Hamvention®, which would coincide with an announcement in a sidebar of another 6-meter article that I wrote for the March 1994 issue of *QST*, "Getting Started on the Magic Band." However it took a bit longer, and the book came out in late April.

Opportunities

With the book being published in 1994, opportunities developed for me to speak about 6 meters at monthly amateur radio club meetings as well as ham radio conventions, and this has continued through the years. Things started changing after 1994, when more and more radios came out with HF plus 6 meters, or HF plus VHF packaged transceivers, with the ICOM IC-706 being one of the first in this group. The inclusion of 6 meters in these radios has led to a large influx of HF operators on the band, and they, too, have found many aspects of the band interesting.

Since the release of the 6-meter book in 1994, WB2AMU has been speaking about the topics covered in the book at different ham radio venues throughout the country. This photo shows Ken speaking about 6-meters at the recent PACIFICON ham convention that was held in San Ramon, California in October 2008. This was his first talk on 6 meters in California. (Photo by Fran Neubeck)

The first edition of the book sold out in early 1998. Since then there have been three more editions published by WorldRadio, each expanding the content. Many changes have occurred over the 15 years covered by the four editions of the 6-meter book in which the technology from the end of one century has changed with the arrival of the next.

I reflect back on the past 15 years and realize how lucky I was to have this opportunity to write about the band, as well the opportunity to meet many other 6-meter operators. I am eternally grateful to Armond and Helen Noble for the support they gave me. Also, I am grateful to all of those in the 6-meter community who responded to my request over the years for their input. AA2DR and K4SUS were a major source of information for the original book, and I am also grateful to Gordon West, WB6NOA, for his foreword used in later editions. I really hope that the 6-meter book has helped make this incredible band easier to understand and enjoy! ■

By Joe Moell,* KØOV

HOMING IN

Radio Direction Finding for Fun and Public Service

Ideas for Increasing Foxhunt Participation

"You're never alone when you're in a ham shack." Perhaps you remember those words by the late Roy Neal, K6DUE, in his narration of "The World of Amateur Radio," a promotional film from the late 1970s. For DXers, ragchewers, and contesters, a ham radio station can provide human contact when nobody is around, no matter where you are on the globe.

However, what if your favorite ham radio activity is hidden-transmitter hunting? Just like the game of hide-and-seek, that's not something you can easily do by yourself. How can you get others to join in the fun?

With a little luck, your family members may be interested in helping you test your RDF (radio direction finding) equipment by hiding a transmitter for you to find. That is what Nadia Scharlau and her husband Charles, NZØI, did in North Carolina as they trained for the 2006 ARDF World Championships in Bulgaria. "That summer, we would take a couple of transmitters to the park," Nadia recalls. "He would hide one transmitter and I would hide the other one. As soon as I would find his, I would move it. He would do the same and we would repeat five or six times. By then we felt dead because of the heat."

The next step for promotion is the local radio club. Two decades ago, Kevin Kelly, N6QAB, was an active mobile T-hunter in southern California, going on many of the All-Day Hunts (which often lasted all weekend) and taking videos with his vehicle-mounted "hunt cam." Then his employer transferred him to Albuquerque, New Mexico, where there had not been any transmitter-hunting activity for years.

Kevin wasted no time. He began talking up the sport on the local repeaters and at the Albuquerque Amateur Radio Club meetings. Before long, there were regular mobile T-hunts in the Duke City. Then

Encouragement by Kevin Kelly, N6QAB, brought a good turnout to the University of New Mexico campus for the start of this mobile T-hunt in 1995. (All photos by Joe Moell, KØOV)

At this on-foot foxhunting session at Topanga State Park in March 2009, nine hams assembled measuring-tape Yagis and attenuators and then tried international-rules ARDF for the first time. Marvin Johnston, KE6HTS (leaning over the big battery), provided the kits.

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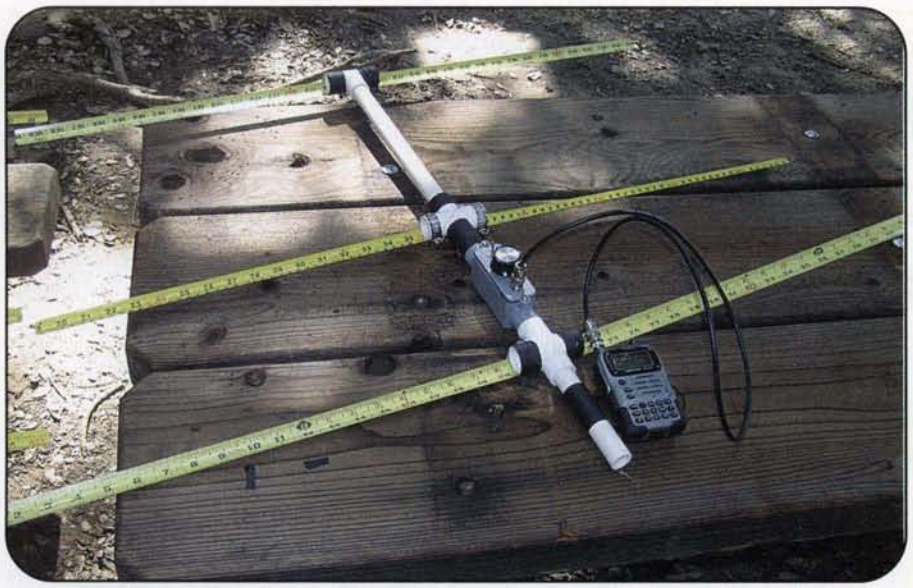
e-mail: <k0ov@homingin.com>



A completed measuring-tape Yagi with offset attenuator mounted in the PVC pipe boom. With the 2-meter handi-talkie, it's ready for on-foot foxhunting.

Kevin was transferred to the East Coast, where he began the promotion process again. Meanwhile, RDF contesting was becoming so popular in Albuquerque that the club agreed to organize the First USA ARDF Championships in 2001. AARC hosted again in 2005 and continues its regular mobile and on-foot events to this day.

Don't hide your interest in transmitter hunting. Talk it up on the local repeaters. Write an article for the club newsletter.[1] Offer to give a program or an RDF equipment show-and-tell at a club meeting. If you don't think you can put together your own talk, consider the excellent DVD about ARDF by Gary Pearce, KN4AQ.[2]

Like the "Field of Dreams" philosophy, I believe that "If you hide it, they will come." Schedule a beginner hunt and announce it at the beginning of your talk. That will make everyone pay better attention, realizing that they will need the information you're presenting to do their best on the hunt. The more follow-up sessions you have, the greater the chance that "critical mass" will be reached. On the other hand, without any starter sessions, nothing can develop.

Lowering the Barriers to Entry

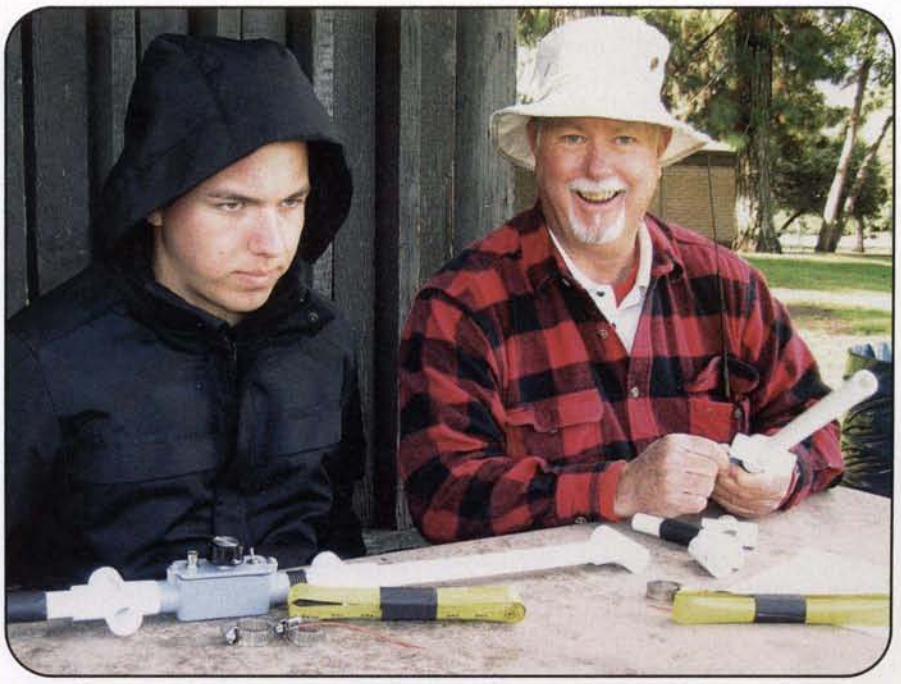
Some hams and potential hams may have an interest in RDF, but they need a little extra push. Perhaps they lack confidence that they can build their own RDF equipment or that they can master the techniques. With that in mind, Marvin Johnston, KE6HTS, and I have begun holding antenna building and testing clinics before each of our ARDF sessions in a park, which usually take place once a month.

In addition to kits for measuring-tape Yagis[3] and offset attenuators[4], ready to assemble, the park's picnic tables are furnished with tools and soldering irons. Putting together a one-piece Yagi/attenuator assembly takes only about an hour, and then it's time to connect it to a 2-meter hand-held or scanner and find the simple practice transmitters nearby.

As the newcomers are doing that, the local radio-orienteering experts are arriving and getting ready to go out on the main five-fox international-rules ARDF course. Many of the beginners, full of confidence after finding the practice foxes, will get some advice from the experts and then take on the main course themselves.

Our prehunt building sessions began last November and there has been a good turnout of newcomers every time. Our success has caught the attention of the vehicular RDF fans, too. Long-time mobile T-hunter Bob Thornburg, WB6JPI, attended our event at Bonelli Regional Park in February and became convinced that simple kits could reverse the sagging attendance at southern California mobile T-hunts.

Bob went home, booted EZNEC[5] on his computer, and came up with a simple 3-element Yagi that will withstand the rigors of mounting on a car or truck. EZNEC modeling showed that securing its feedline to the boom all the way back to the reflector would keep the gain and directional pattern excellent, regardless of the beam's orientation for polarization. That's important, because match-



Rob Preston, KI6KYX (left), and his dad Bill, KZ3G, built measuring-tape Yagis and offset attenuators at a recent park session in southern California.

Hamvention® Foxhunt Forum Returns

Bob Frey, WA6EZV, needed a bullhorn to address the large group of participants in the Hamvention® foxhunt of 1999. There will be a Foxhunting Forum at the 2009 Hamvention®, but a foxhunt has not been scheduled as of press time.

By popular demand, this year's Dayton Hamvention® has scheduled a Foxhunting Forum. For many years, this annual forum drew a full room of hams, eager to hear the latest about both mobile T-hunting and international-rules radio-orienteering. Recently it has been absent from the schedule, but Dick Arnett, WB4SUV, reports that he and Bob Frey, WA6EZV, will co-chair the forum in 2009. The list of guest speakers includes Brian DeYoung, K4BRI. All three have participated in the USA ARDF Championships, as has Brian's teenage daughter Emily, K4MLE.

The Foxhunting Forum is scheduled for 1445 to 1545 hours on Friday, May 15. Check the Hamvention® schedule for location.

Joe, KØOV

ing your VHF RDF antenna's polarization with that of the hidden transmitter gives you more precise direct bearings. It also minimizes false bearings from signal reflections.

Next, WB6JPI dreamed up a simple window mount using PVC pipe, cut to fit around the glass and frame. To complete the package, Bob kitted a toggle-switch resistive RF attenuator for closing in. It's similar to the one in my book,[6] but Bob thinks that 80 dB is plenty for mobile T-hunting with most VHF receivers. Thus, his model has fewer resistive sections.

Bob tested his system on some mobile hunts and he also used it for transmitting on one hunt. At this point, he has completed fabrication of five parts kits for beta testing. After optimizing his design based on user comments, he plans to have some in-the-park sessions for kit building, followed by simple mobile T-hunts. You can follow his progress on my website[7] and the Southern California T-Hunters site.[8]

Hunt Anytime

Local amateur radio internet mailing lists in several cities have been discussing a decline in mobile T-hunt activity. Gas prices below $4.00 per gallon have brought back some participants, but there is still concern about the old-timers fading away and fewer newcomers replacing them. There could be many reasons for the downturn. Some hams aren't available on the days and times of the hunts. Others don't like the hunt rules, wanting them to be either more stringent or more lenient. Newcomers may stay away

Bob Thornburg, WB6JPI, brought a prototype of his simple 3-element T-hunting Yagi and mobile mount to a recent ARDF session to get comments and suggestions.

because they don't have the self-confidence to compete against the local experts.

For these folks, a no-pressure hunt-anytime option is attractive. It was a regular activity of the Minuteman Repeater Association a decade ago. An e-mail would suddenly appear from one member of the group stating that the Boston Fox was on the air. The frequency and transmission rate were also given, as well as the deadline for finding it. The batteries would last for several days, so everyone could hunt for it when their schedules permitted. Some took bearings during their daily commute and errands, then hunted in earnest on a free evening.

Barry Fox, W1HFN, of Sterling, Massachusetts wants to bring back those days. (Yes, that's his real name!) "I was a real rabid foxhunter myself," he writes, "So I was quite disappointed when the local clubs lost interest in deploying their foxbox or letting anyone else do it. I decided to try to get the activity restarted by doing it myself. I bought a Squawkbox,[9] mounted it in a die-cast enclosure with a spike antenna, and started hiding it in nature preserves for others to find."

How is it going so far? "There has been some response from members of two local clubs, but nothing overwhelming," Barry reports. "One of our club members offered to hide it so I could find it. That was a very nice gesture on his part."

Bob Thornburg, WB6JPI, began his first southern California GeoHunt just before last Thanksgiving. He didn't publish any boundaries. All that anyone was told at first was to listen for an intermittent signal on 146.565 MHz, which is coordinated for transmitter hunting by the Two Meter Area Spectrum Management Association. It wasn't long before the first hunter announced he had found it, adding to the interest.

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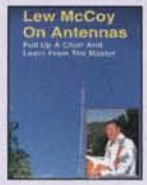

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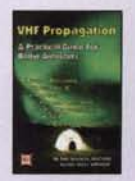

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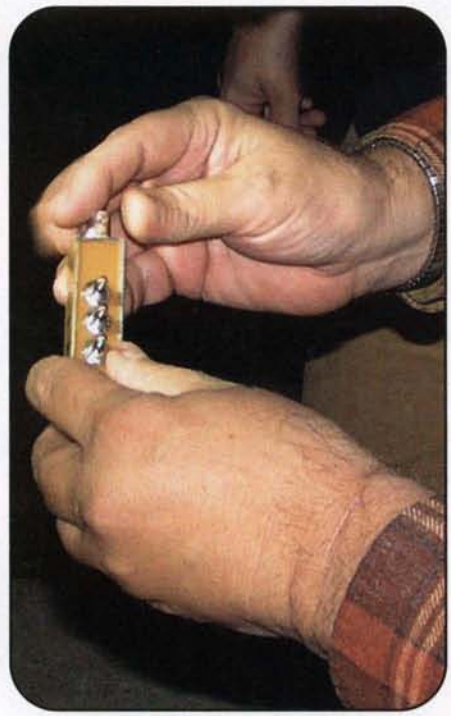

After a February mobile T-hunt, Steve Wallis, WA6PYE, examines a resistive step attenuator prototype by WB6JPI.

The heart of GeoTran, as WB6JPI calls his hunt-anytime transmitter, is a 50-milliwatt Squawk-box, cycling 24 hours a day. It sends a 15-second enticement in Bob's voice every three minutes. A 1.5-watt solar panel[10] provides power, which is stored for cloudy days and nighttime in a 3-ampere-hour pack of nickel-cadmium batteries, the inexpensive type sold to radio-controlled car enthusiasts. The panel sits atop a copper-pipe J antenna. Transmitter and batteries are inside a rugged and weatherproof Pelican case.

Bob puts on a fresh GeoHunt every few weeks. A commotion ensues on the GeoHunt Internet Forum[11] as everyone tries to figure out where to hear the transmitter in southern California. After that, it's an individual effort as the participants mount their mobile RDF gear, track it down when they can, and sign in. Bob considers GeoHunt a success because it has brought out some new T-hunters and brought back a few who have not been on a regularly scheduled hunt for a long time.

Look Benign and Secure

Any item of electronics left in a public place becomes a magnet for vandals. After his first GeoTran was moved by persons unknown, Bob increased the unit's self-protection and security measures. So far, GeoTran II has not disappeared or suffered any damage.

Unattended hidden transmitters should look as non-threatening as possible. Ham radio news services recently gave much attention to the story from Omaha about a suspicious package, found in a partially burned home, which caused a neighborhood evacuation. After blowing it up, police learned that it was a trap for a ham radio antenna.

Not reported as widely was a similar story from a Washington, DC suburb, detailed in *The Gaithersburg Gazette* two weeks later. This time it was a "PVC pipe with wires coming out of it" and inside were "electronic components similar to those in a ham radio." Protect your investment and put a label on your hidden transmitter with your contact information.

GeoFoxing Combines RDF and GPS

Although finding something unattended hasn't yet "gone viral" among hams, it certainly has among GPS owners. Just about every park, green belt, and wilderness area here in southern California has one or more geocaches within, attracting weekend visits from GPS-carrying persons of all ages. Geocaches are small containers filled with items for trade. GPS coordinates of caches are published on the web. More than once, I have had to explain to a ranger that our international-rules ARDF activities aren't the same as geocaching and that we won't be digging in the vegetation like some geocachers have done.

Hoping to take advantage of the geocaching craze, the North Bay Amateur Radio Club in California tried a combination game that they called GeoFoxing. Three temporary geocaches and two hidden transmitters were placed within the 72 acres of Youth Community Park in Santa Rosa. Participants were given geographical coordinates of Cache #1, which they located with their GPS receivers. There they found a tag with the frequency of Fox #1.

With their RDF gear, they tracked down that transmitter, whereupon they got the coordinates of Cache #2. At Cache #2, there was the frequency of Fox #2 and so on, until they got to Cache #3 next to the picnic lunch. This was a great way to introduce geocache fans to transmitter hunting and vice versa. Photos and more details of this event are at the NoBARC website <http://www.nobarc.com/activities/geofox/>. —*Joe, K0OV*

WB6JPI proudly stands beside GeoTran. Its solar panel is mounted atop a copper-pipe J antenna for 2 meters.

The GeoTran batteries and transmitter board are inside this heavy-duty plastic box.

GeoHunts started in southern California about the time that one of the regular weekend mobile T-hunts was discontinued. However, two monthly hunts on Saturday nights continue to have good attendance. One has "beginner" boundaries (radius approximately 13 miles from the starting point) plus requirements for one continuous transmission and closeness to a drivable road. The other has much larger boundaries (up to 40 miles from the start in some directions). It's not unusual for that one to have multiple transmitters with short transmissions, placed to require a considerable walk away from the vehicle.

The southern California "All-Day" hunts are still popular, too. With multiple transmitters and boundaries that permit just about any hidden location that doesn't require a seagoing boat to access, they can fill an entire weekend. If your club is just starting out, you will want to be much simpler than that. How about a brief hunt right after the weekly club repeater net?

From a hiding place, the fox makes frequent transmissions on the repeater input, urging every listener to get in the car and participate. It's best for the first hunt to have small boundaries, such as a county or part of it. After a while, help fledgling hunters by announcing yet smaller boundaries or giving other clues. Encourage members to pair up and to take ridealongs.

Your first mobile T-hunts should be easy enough that everyone is successful and encouraged. The signal should be strong and the transmitter should be in plain sight, perhaps in the parking lot of a restaurant or on a table in a city park. Give them a challenge, but don't make it "Mission Impossible." Some snacks for the fox finders would be nice, or everyone can get together for a meal or dessert at a restaurant afterwards.

After a few short hunt successes, everyone will be eager to try longer range hunts. On VHF/UHF, it's best to hold those on a simplex frequency, rather than tie up a repeater for long periods of time. Hiders will quickly learn to use tricks such as camouflage and controlled signal reflections.

A local park or school yard would be a good place for an all-on-foot foxhunt with little transmitters of 100 milliwatts or less. Imagine the fun of a dozen club members spread out in search of a half-dozen mini-foxes, all on different frequencies. How many can they find in a limited time period? Be sure that the kids, grandkids, nieces, and nephews of all members are invited. They don't need driver's licenses or ham licenses to receive and to hunt.

If the term "foxhunt" seems too intimidating, you don't have to call it that. This announcement appeared on the website of the Escondido Amateur Radio Society in California just before a *CQ*-sponsored Foxhunting Weekend: "EARS will be conducting a barbecue. Where is the barbecue you ask? That is for us to know and you to find out! The fox will begin transmitting on 146.595 on May 11 around 10 AM in the Escondido Area. When you find the transmitter, you will find the barbecue."

Head for Boston in June

Final preparations are now under way for the Ninth USA ARDF Championships near Boston on the first weekend of June. If you live in the northeast, this will be your first chance to attend our national championships of on-foot international-rules transmitter hunting without a long trip on the road or in a plane.

Foxhunting fans from all over the USA will gather at the Blue Hills Reservation, about ten miles south of downtown. We also expect participants to arrive from Sweden, Russia, Ukraine, Australia, China, and possibly some other countries, if visas can be arranged in time.

This year's USA championships are being combined with the biennial championships of International Amateur Radio Union Region 2 (IARU-R2), which encompasses North and South America. Radio-orienteers from Western Hemisphere nations will compete for IARU-R2 honors, while the others will compete as "visitors." There will be gold, silver, and bronze medals

in nine age categories, five for males and four for females, in accordance with standard IARU rules.

The championship courses will follow IARU standards. There will be five foxes on the air each day on the same frequency, 2-meter AM on Saturday and 80-meter CW on Sunday. Each transmits for one minute in rotating sequence, sending "MO" followed by a number of dits corresponding to the fox number, one to five. It's not necessary to know Morse code to tell which transmitter is on.

Competitors start at timed intervals and strive to find three, four, or all five of the foxes, depending on their categories. Then they rush to the finish, which is not in the same place as the start was. They find their way in the woods using a standard orienteering map, provided to them just before they start. They can also get help to the finish by tracking a transmitter there, which is on a different frequency in the same band.

Any person may enter the USA ARDF Championships if he or she is capable of safely navigating through the woods for five to ten kilometers. There is no age limit or requirement for a ham license. Contestants must provide their own RDF gear, which must not radiate any signals.

Organizing this year's championships is Boston resident Vadim Afonkin, KB1RLI. He won his first ARDF medal 25 years ago as a youth in his native Russia. His years of experience have made him an expert at championship-course design. Vadim will have assistance from members of the New England Orienteering Club, the Boston Amateur Radio Club, and other local organizations.

To encourage first-timers and overseas guests, the event entry fee will be waived for persons who are competing in the USA Championships for the first time and for persons arriving from outside North America. More information and registration forms are at the event website.[12] Plenty of lodging and meal options are available close by.

Vadim Afonkin, ex-UZ3AYT, wears a medal that he won at his first USA ARDF Championships near Cincinnati during 2003. He is now KB1RLI and has volunteered to be organizer and host for this year's national championships.

For a quick introduction to ARDF rules, techniques, and gear, visit my website at <www.homingin.com>. You will see equipment ideas for both 2 meters and 80 meters. Photo pages from previous championships will give you a good idea of what to expect in the woods of Massachusetts. Dress for high temperatures in the low 70s and a chance of rain.

I hope to see you there!

73, Joe, KØOV

Notes

1. My 1900-word article on mobile RDF titled "Transmitter Hunting, Southern California Style" at <http://www.homingin.com/SCalStyle.html> may be reprinted in ham club newsletters.
2. <http://www.homingin.com/video.html>
3. <http://home.att.net/~jleggio/projects/rdf/tape_bm.htm>
4. <http://www.homingin.com/joek0ov/offatten.html>
5. <http://www.eznec.com>
6. Moell and Curlee, "Transmitter Hunting — Radio Direction Finding Simplified," Chapter 6 <http://www.homingin.com/THRDFSinfo.html>
7. <http://www.homingin.com>
8. <http://www.thunter.org>
9. <http://www.silcom.com/~pelican2/PicoDopp/MICROHUNT.htm>
10. Harbor Freight 44768-4VGA <http://www.harborfreight.com>
11. <http://www.thunter.org/geothunt/>
12. <http://www.bostonardf.org>

By Bob Witte,* KØNR

FM

FM/Repeaters—Inside Amateur Radio's "Utility" Mode

VHF FM Equipment for Emergency Communications

The subtitle of this column refers to FM as the *Amateur Radio Utility Mode*. This applies to everyday radio operating as well as emergency communications (EmComm). The combination of compact, portable transceivers and wide-area FM repeaters is very effective for supporting both short-term and long-term disaster communications.

This column discusses preparing your FM VHF/UHF radio equipment so you are ready for emergencies. It does *not* cover the all of the items you should have in your "Go Kit," which can include everything from food and clothing to reference documents and identification. (See the sidebar "What About My Go Kit?" for more ideas on that.)

Check in Locally

This is a general discussion of radio equipment, so it is important for you to connect with your local emergency communications group to understand its specific requirements. Of course, if you intend to be useful during a real emergency, you'll need to be working with these EmComm groups anyway well before an incident occurs. The most common emergency communications groups are the Amateur Radio Emergency Service (ARES) and Radio Amateur Civil Emergency Service (RACES). For more information on these organizations, see the ARRL Public Service Communications web page listed in the references section at the end of this column.

Some EmComm groups insist on having multiple bands available, usually 2 meters and 70 cm, while others just stick with 2 meters FM. Some groups make extensive use of digital modes such as APRS, Winlink and D-STAR, while others are focused only on voice. You'll want to make sure you have the right equipment and have the specific frequencies that your local group uses programmed into your rig. An emergency is a poor time to start fiddling with the memory in your radio.

Photo 1. The Yaesu FT-60R is a typical 2m/70cm handheld transceiver for emergency use. (Photo via rigpix.com)

Handheld Radios

Handheld transceivers (HTs) are just great little rigs with a ton of capabilities jammed into them (photos 1 and 2). Their excellent portability makes them an important tool for EmComm use. What other ham shack can you wear on your belt? However, while HTs excel at portability, they tend to have some significant limitations: low output power, poor antennas, and easily overloaded receivers. Other than that they are great!

The typical "full power" handheld transceiver has about 5 watts of output power. For EmComm use, I would generally avoid the smaller mini-HTs that only run 1 to 2 watts unless you intend to use them only for short-range communication within a building or around a camp site. Of course, we can increase the transmit power by using an external amplifier, but that will reduce portability and make the HT function more like a mobile rig.

A better approach is to upgrade the antenna, which improves both transmit and receive range. The standard rubber-duck antenna that comes with most HTs is a very poor radiator of RF energy. Changing the antenna to something larger will help immensely. Most amateur handhelds have a BNC or SMA connector on the antenna port, so the rubber-duck

Photo 2. The ICOM IC-92AD is a dual-band transceiver that has both analog FM and D-STAR modulation capability. (Photo via rigpix.com)

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e-mail: <bob@k0nr.com>

Photo 3. The single-band 2-meter FM transceiver is the workhorse of VHF EmComm. Shown here is the ICOM IC-2100H. (Photo via rigpix.com)

can be replaced with something that really radiates. Ideally, we'd have a telescoping antenna with a half-wave radiator, which does not require a ground plane underneath it (e.g., the MFJ-1714 Long Ranger antenna). I've tested a number of these antennas and have found their performance to be far superior to the standard HT antenna.

A common approach is to use an HT with a magnetic-mount mobile antenna and a 12-VDC cigarette-lighter power cord. This creates a compact station that can be deployed in almost any vehicle on short notice.

This brings us to the topic of battery power. Most often HTs are supplied with a single battery pack, usually with lithium-ion or NiMH technology. You'll want to have a spare battery pack or two for EmComm use; otherwise, you'll find yourself running out of power during an incident. One approach is to use a battery pack that accepts AA batteries and have a box full of AA batteries available. Some people prefer alkaline AAs, even though they are not rechargeable, because of their excellent shelf life. A package of alkaline AAs can be kept in your Go Kit for years without having to worry about charging them. A more environmentally friendly approach is to use NiMH rechargeable AAs, but you'll have to stay on top of keeping them charged.

Photo 4. A dual-band transceiver with two independent receivers provides a high degree of flexibility for emergency communications. (Photo via rigpix.com)

What About My Go Kit?

The main article discusses the radio communication needed in an emergency. Most emergency communicators keep a "Go Kit" on hand which includes radio gear and the other items necessary to support an effective communicator.

This can get complicated, as there are so many things that can be included in a Go Kit. The list greatly depends on your local geography, climate, weather, and likely communication scenarios. Check with your local EmComm group for its recommendations.

Here is a short list of items, just to get you thinking: Copy of amateur radio license, ARES/ RACES ID, lists of important phone numbers, ARES/RACES documentation, GPS, medications, writing instruments, notebooks, first-aid kit, maps, compass, binoculars, watch, cash, electrical tape, water bottle, spare clothing, sleeping bag, food, cooking equipment, orange safety vest, toilet tissue, toothpaste, toothbrush, flashlight, backpack, tools, SWR meter, digital multimeter, etc.

One issue that is easy to overlook is managing the transmit and receive audio. A speaker-mic is convenient for clipping onto your shirt near your ear so you can hear incoming calls without having the volume turned up too high. Even better is an earphone or headset. You may be deployed to a noisy environment where it is difficult to hear the radio, or you might be in a quiet spot where the served agency doesn't want to be distracted by radio chatter.

Mobile Radio

As much as I like a good-quality handheld transceiver, it is difficult to beat the performance of a full-power mobile transceiver. Most of these rigs have about 50 watts of RF power on 2 meters and usually a bit less on 70 cm. This extra punch is very useful for marginal communication paths. The receiver performance is usually quite good as well, tolerating a bit more interference from nearby transmitters and adjacent-channel noise sources. The downside is that you give up HT portability and you must provide a power source, either a 12-VDC power supply (running off AC) or a reasonably large rechargeable battery.

One key decision is whether to go with a single-band or dual-band radio (photos 3 and 4). I usually recommend a *true dual-band* transceiver, one that can receive two frequencies at a time. (Some dual-band rigs cover two bands but only one frequency at a time.) Even if you only plan to use the 2-meter band, it is very handy to be able to monitor two frequencies simultaneously. For example, you might listen to the primary net frequency on one receiver and use the second receiver to monitor a different frequency for coordinating local activity.

Just like with the HT, we need to plan for managing the audio. Most likely with a mobile transceiver you'll use the standard hand microphone for transmit. The internal speaker can be used for listening to the receive audio, but you may want to plug in a pair of headphones to block out noise or keep the radio traffic from disturbing others.

Antennas

The choice of antenna depends on the location involved and how portable the station needs to be. We've already talked about upgrading the antenna of a handheld radio. You may have to live with the low performance of a rubber-duck if you need

Photo 5. This VHF/UHF amateur radio station is an excellent example of how to organize a portable EmComm station. (Photo courtesy of NC6T)

to move around without any encumbrance, but it is still advisable to have a more efficient antenna available.

A versatile antenna for EmComm use is the magnetic mount mobile (either 1/4-wave or 5/8-wave). The reason is obvious: Just plunk this antenna on the metal roof of any vehicle and you are ready to go. Magnetic mounts can also be used as a temporary fixed antenna; stick it on the top of a refrigerator or filing cabinet. You need some metal underneath it, since the antenna performance depends on having a ground plane, but it doesn't need to be a perfect ground plane. Just use whatever is handy and see if it works!

The twinlead J-pole antenna is another popular portable antenna. This antenna is made out of TV twinlead feedline, creating a 1/2-wave radiator fed using a 1/4-wave tuning stub. These antennas perform well and do not require a ground plane. I won't go into the construction details here, as there have been many articles written about the fine points of building one of these antennas. (See the web page by KB3KAI listed in the references section.)

Another approach is to use a base antenna mounted on a portable tripod. A modest-size (maybe 5 feet in length, plus or minus) antenna such as the Diamond X-50A, Comet GP-3, or the Cushcraft AR-270 provides some gain while maintaining an omnidirectional pattern. For most situations, an omnidirectional antenna is most flexible, allowing communication in all directions without needing to rotate the antenna. There may

Photo 6. Rear panel of the portable station. (Photo courtesy of NC6T)

be times when it is useful to have a directional antenna with a bit more gain. You might find yourself stationed in a poor radio location, not able to hit the local repeater. Having a small Yagi that you can point toward the repeater (or another station via simplex) might be just enough to establish communications. There are many commercially available Yagi antennas available, or see the WA5VJB "Cheap Yagi" web page listed in the references to learn how to build your own.

Power Sources

Ensuring that we have a sufficient power source is critical for EmComm operating, since line power has a nasty habit of going away during disasters.

I've already mentioned having sufficient batteries for a handheld transceiver. Some radio amateurs deal with the power problem by using a humongous battery such as a 12-volt deep-cycle marine battery. When fully charged, these batteries can support a typical ham transceiver for several days, depending on how often you transmit. The obvious advantage is that this makes your radio equipment totally independent of AC power. Most amateur radio gear runs off 12 volts, naturally compatible with a 12-volt source. One problem you can run into is that some radio equipment does not work well when the battery voltage drops below 12 volts. Be sure to check out your radios to verify how long they last on a particular battery as it drops off in voltage.

The classic Field Day power source is the gasoline-powered AC generator. These generators can power a ham station almost indefinitely—at least until the fuel supply runs out. Having AC power available is especially handy for powering other equipment: computers, HT chargers, lighting, etc.

One final thought: You may be able to rely on a power source from the served agency. For example, our local fire department has a diesel generator for backup power to keep the fire station operational during power outages.

The NC6T Portable Station

Some hams have created a portable EmComm station by packaging their mobile transceiver, power supply and external speaker into an enclosure. Done correctly, this type of portable station can look very professional and leave a positive impression with the served agency. (On the other hand, hacking it together with duct tape will look like a second-rate installation.) A good example of a quality station is the one put together by Christopher, NC6T, shown in photo 5. This station has four radios packed into a portable 19-inch rack case. It has two single-frequency-at-time dual-band transceivers for 146 MHz and 440 MHz and a single-band radio for 222 MHz (top shelf). To support packet radio operations, there is a single-band 2-meter rig and a TNC (not visible in the photo).

Photo 6 shows the rear panel of this station, which is well organized and neatly constructed. Across the top are the antenna connectors, clearly labeled. The SWR meter has its connections brought out to the rear panel so it can be inserted in line to check the antenna system. While the station includes an Alinco power supply, Christopher also provided a means for powering the station from an external 12-VDC power source (see the Anderson Powerpole connectors at the lower right). At the lower left, the computer connections for packet radio are shown.

Other Gear

There are a number of other items that can be critical to effective emergency communications. It makes sense to *be prepared* for unexpected situations. Several lengths of coaxial cable with appropriate connectors will come in handy when it is time to install the antennas. A few coaxial adapters (PL-259 to BNC, BNC to SMA, etc.) are good to have along in case you need to adapt to someone else's equipment. Some basic test equipment such as an SWR meter and a digital multimeter can help troubleshoot unexpected problems. Some hams choose to carry a complete toolbox, but another option is to just carry the basics. One of the multipurpose tools from Gerber or Leatherman provides pliers, wire cutter, knife, and screw drivers in one compact tool.

For this article, I have not gone very deep into the digital modes, as each one would consume many pages. For transmitting large amounts of detailed data such as supply lists or detailed status reports, digital communication is faster and more accurate than voice methods. A number of EmComm organizations have adopted VHF packet radio (AX.25) as a means of transmitting digital data on VHF. As an alternative, APRS can be used for transmitting location information and short digital messages. The Winlink system, essentially a "radio e-mail" system, has proved to be very effective at routing messages in and out of a disaster area, passing e-mail messages onto the internet. D-STAR is gaining traction with some EmComm groups due to its converged approach to voice and data. For all of these systems, you'll want to find out what your local EmComm group is using and align with their communication plan.

Tnx and 73

As I wrap up this column, I realize that if you collect every piece of equipment mentioned in this article you'll have a truckload full of radio gear. Although there are some hardcore EmComm folks who do that, most of us will be equipped with a much smaller set of gear, so I don't want to imply that you need all of this equipment. Again, get in touch with your local EmComm group, find out what's in its communication plan, and tailor your plan accordingly.

Thanks for taking the time to read another one of my columns on the *Utility Mode*. I always enjoy hearing from readers, so stop by my blog at <http://www.k0nr.com/blog> or drop me an e-mail.

73, Bob, KØNR

References

ARRL Public Service Communications Manual: <http://www.arrl.org/FandES/field/pscm/>

ARRL Sections (to find ARES Emergency Coordinator): <http://www.arrl.org/sections/index.html>

Winlink System: <http://www.winlink.org/>

APRS Automatic Packet Reporting System: <http://www.aprs.org/>

D-STAR Amateur Radio (Wikipedia): <http://en.wikipedia.org/wiki/D-STAR>

Portable Roll-Up 2-Meter J-Pole Antenna, KB3KAI: <http://www.kb3kai.com/j-pole.php>

Kent Britain, WA5VJB, Cheap Yagi Antennas: <http://www.wa5vjb.com/yagi-pdf/cheapyagi.pdf>

By Bill Brown,* WB8ELK

UP IN THE AIR

New Heights for Amateur Radio

Kentucky Space Balloon-1

Last July 14th, Kentucky students from over six different colleges and universities launched a balloon payload dubbed Balloon-1 to the very edge of space from the Bowling Green, KY airport. The Kentucky Space program is a consortium of universities along with public and private organizations that collaborate to design and lead innovative space missions. The program allows a select group of students to design and build experiments that will end up on an orbiting spacecraft in the very near future (www.kentuckyspace.com).

Last July's Kentucky Space student payload carried APRS on 144.39 MHz; numerous still cameras for horizon, up, and down photos; and a low-power SAW transmitter circuit for CW telemetry on 434 MHz (see photo 1).

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Photo 1. Student Jessamyn Delgado buttons up the Balloon-1 payload while Dr. James Lumpp observes on the right.

Since one of the primary goals of this first flight for the Kentucky Space program was to demonstrate the use of high-altitude balloons for emergency communications, I included a simplex repeater payload on 144.34 MHz using an Alinco DJ-S11T connected to a simplex repeater module along with a secondary APRS transmitter. Near the bottom of the flight train I also included a FindMeSpot GPS tracker that sends position data up to the orbiting GlobalStar network every 10 minutes. The FindMeSpot is a neat backup GPS unit that will actually transmit its position to the satellites (and from there to a website) even while upside down on the ground. It's a handy device that can save the day if the APRS units are out of range of local digipeaters after the payload has landed following its flight into the stratosphere. Check out <http://www.findmespot.com> for more info on this 7-ounce wonder.

Thanks to Hank Cantrell, W4HTB's efforts we were able to inflate the balloon inside the Fruit of the Loom jet hangar at the Bowling Green airport. We had a large crowd of onlookers and even managed to have the kids in attendance build some ping-pong-ball experiments that are called PearlSats, a concept developed by Dr. Bob Twiggs, who came up with the idea as a neat way to send up very small student experiments on a balloon. Each kid's experiment is strung on the flight line like a string of pearls (see photo 2). In addition, Hank W4HTB, Shane Wilson, N4XWC, and I designed a 1255-MHz FM Amateur Television (ATV) transmitter to provide real-time, live camera video from the balloon during its flight.

Photo 2. Teacher Flo Bower helps the kids make PearlSat experiments out of ping-pong balls.

Photo 3. The launch of Balloon-1.

We managed to get everything off the ground, even after Mother Nature huffed and puffed as we brought the balloon outside of the hangar. The launch went well in the breeze with the exception of nearly taking out one of the news cameramen who got a extreme close-up of the launch before one of the payloads made a close encounter with his camera and knocked it (and him) to the ground (see photo 3).

We were fortunate that the Kentucky Emergency Management van (as well as the Kentucky National Guard van) had decided to participate in the launch as an exercise of their equipment and capabilities. We were able to set up the command station inside a spacious and air-conditioned van (very handy to have on a hot and steamy July day) that had an operating area that was a ham's dream station. Several VHF and HF radios were at our fingertips, along with a high-speed satellite internet connection to relay streaming video from our ground station. The van had a pneumatic mast antenna for its command radios that also sported a bird's-eye view of the launch site from a steerable video camera perched at the top of the mast (photo 4).

From the air-conditioned comfort of our ATV station inside the van we had snow-free reception from the FM ATV transmitter on 1255 MHz throughout

Photo 4. The ground station was located inside the Kentucky Emergency Management vehicle.

Photo 5. Hank Cantrell, W4HTB, mans the ATV and 2-meter simplex repeater ground station inside the van.

most of the flight, while operating net control for the simplex 2-meter repeater experiment (photo 5).

The 2-meter simplex repeater payload worked great and demonstrated the wide-coverage possibility of a balloon-borne repeater for emergency and disaster communications. We had numerous contacts with stations in Ohio, Indiana, Illinois, Kentucky, Tennessee, Georgia, and Alabama. Some were able to contact us from their mobile rigs from hundreds of miles away. The potential for a two-way contact between stations over 700 miles apart is possible when the balloon is at peak altitude (over 90,000 feet).

The flight reached its peak altitude about 90 minutes after launch and parachuted down about 28 miles to the southeast of Bowling Green. It turns out that the FindMeSpot unit saved the day, since both APRS trackers dropped out of digipeater range before sending back the final landing spot. Fortunately, as we were plotting the FindMeSpot landing coordinates, we got a phone call from a woman who had just found everything lying neatly in her front yard near her driveway a few minutes before the student chase team arrived (photo 6). No tree-climbing or hiking into the wilderness this time!

A fun time was had by all, and we plan to fly more payloads on the 23-cm band in the future. The next flight may carry aloft a simplex ATV repeater relay which could potentially allow ATV operators in several states the ability to contact each other through the balloon repeater.

Check out my website (www.wb8elk.com) for future flight announcements and payload details. In the coming months, I'll be trying some long-duration flights that may also have some SSTV transmissions from them as well as a variety of digital modes on HF and VHF. You can also check <www.arhab.org> to see flight announcements from other balloon groups across the country, as well as around the world. 73, Bill, WB8ELK

Photo 6. The student chase team makes a successful recovery.

By Mitch Gill, NA7US

EMERGENCY COMMUNICATIONS

The Role of VHF in EmComm

Introducing NA7US and a New Column

Hello fellow lovers of VHF. When I was asked by *CQ VHF* magazine editor, Joe Lynch, N6CL, if I would be interested in writing a column on emergency communications, I jumped at the opportunity. For those of you who do not know me I will give you a brief autobiography. OK, the truth is I will try to be brief, but I make no promises.

Personally, I think that writing a short autobiography is not half as bad as having to read it. Just think of some syrupy medicine that you hated as a child. Hold your breath and swallow it fast, because you are going to have to endure it anyway.

It is hard for me to believe that I was first licensed 40 years ago at the tender age of 14. From 1969–1973 my love of CW grew. It became a second language for me, but girls and college soon moved me in a different direction until I joined the USAF in 1976 and became a radio operator. I stayed in until 1984, having served as the Base VHF Communications Chief, European MARS Director, and NCO in charge of Emergency Communications. I also passed my General Class amateur radio test while stationed at Rhein-Main Air Base, Germany from 1978–1983.

From 1984 to 2003 I worked with various companies in high-tech and communications contracts, but 9/11 affected me as it did all of us. In addition to the patriotism we all felt, I longed to go back into the service. I thought they could use an old sergeant like me in the rear.

NA7US posing at his emergency communications setup.

The Army? Iraq? At My Age?

In 2002, I became an Amateur Extra, and in 2003 I rejoined the service at 49 years old. I joined the Washington Army National Guard, as it was the only one that said I was not too old. In 2006, instead of the rear, I went to the front lines in Iraq. While I was there I did get a chance to operate for a few months as YI9TU, but it was sporadic, as we worked 7 days a week, 12 hours a day. I did manage to make over 1000 contacts. It was odd working stations during a mortar attack, but there really was nowhere to hide from them. To tell you the truth, amateur radio helped me relax almost as much as talking to my family on the phone.

Other than a year in Iraq, I have worked for the past six years in the Joint Operations Center as the Operations NCO and Subject Matter Expert (SME) in Communications. In a future column I will give you a tour of our communications system. Prior to my being there, they had one HF radio, but now we have five. They also had no VHF stations, and now we have three, two digital modems, GPS-enabled handhelds, and more. Some officers think I am building a ham radio station rather than an emergency communications center. The truth is that I am looking forward to the 12-element 2-meter beams that will be mounted on our 80-foot tower. Since contests fall on weekends, I just might have to test and see how far we can communicate with a hundred watts. Hey, it's for the good of the service!

Don't Let Me Fool You; It's a Brag Tape

Let's get back to emergency communications before I start talking about my attempt at 2-meter EME from Iraq, which I will save for a later time. I have worked in ARES (Amateur Radio Emergency Service), held the position of Emergency Operations Officer in MARS, and was involved in emergency communications for the 52 hostages taken in 1979 in Iran, the attempts by the Russians to stop Poland from breaking away (SOLIDARITY), dozens of emergency exercises, one earthquake, one volcano eruption, two hurricanes (deployed to Louisiana during Katrina and Rita), and one war. I have known friends whose lives depended on VHF communications and those whose lives were made a little easier during a trying time.

If I sound like I am bragging, I apologize. I just happened to be in the wrong place, or right place, at the right time, and yes, I admit that I am proud to have served my country and continue to do so to this day. My most interesting times have been while I was in the service.

I have always had a passion for emergency communications. Part of my job today is to look at the worst-case scenarios and figure out how we can still communicate. At that time I decide

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what equipment to purchase, and if the colonel agrees, we buy it. I have always chosen amateur radio, as it is less expensive but has more capabilities that fit our needs. It would never survive a ride in the desert in a HUMVEE, but to get it "battle hardened" would be costly—about ten times the cost of an ICOM 756 Pro. Another part of my job is Homeland Security and Force Protection. The combination gives me a unique opportunity to see more than the average citizen, and the commanders allow me the leeway to influence how we will operate in the event of a catastrophe. It is humbling at times, as I am no smarter than any of you. Again, I just happen to be in the right place at the right time.

Some Final Thoughts

In a future column I will be showing you a state Emergency Operations Center (EOC), its communications capabilities, and its relationship with ARES. Together we will explore some of the county EOCs, as well as some small and large city EOCs with an emphasis on their VHF capabilities. As many of you are aware, VHF plays a major role in the EOCs.

Therefore, let me start with a question for you to think about. If interoperability is the key today to communicate between services such as police and fire, how can we incorporate amateur radio? I have not seen a real push in that area, although I have seen the government stating that they want to incorporate hams and MARS into its planning, but I believe there are issues surrounding our regulations. What do you think?

I am hoping that those of you who work in ARES, RACES, MARS, and those who volunteer when an emergency arises will provide me with your thoughts on emergency communications. I would also like pictures of any "fly away" kits that you have built. I need high-resolution photos if you want to see them printed; 600K or more in size will work well. Send them to me directly at <NA7US@arrl.net>.

That's all for this first issue. I look forward to hearing from you and also look forward to mutually delving into emergency communications and how VHF plays a major role. Until the next time, follow the Boy Scout motto: Be Prepared!

73, Mitch, NA7US

By Keith Pugh,* W5IU

SATELLITES

Artificially Propagating Signals Through Space

ARISS – Amateur Radio on the International Space Station

In my last column in the Winter 2009 issue of *CQ VHF*, I mentioned the 10th anniversary of ARISS (Amateur Radio on the International Space Station) and the 25th anniversary of amateur radio in human space flight. Having just completed a tour of duty as an ARISS Operations Lead, I have gained additional insight into the purpose, organization, and operations of ARISS. I would like to share this insight with all members of the amateur radio community. This column will be limited to my observations and opinions. Additional details (such as names of current personnel) are available at <http://www.ariss.org> and other sources. This column will lean heavily towards portraying the day-to-day operations of ARISS.

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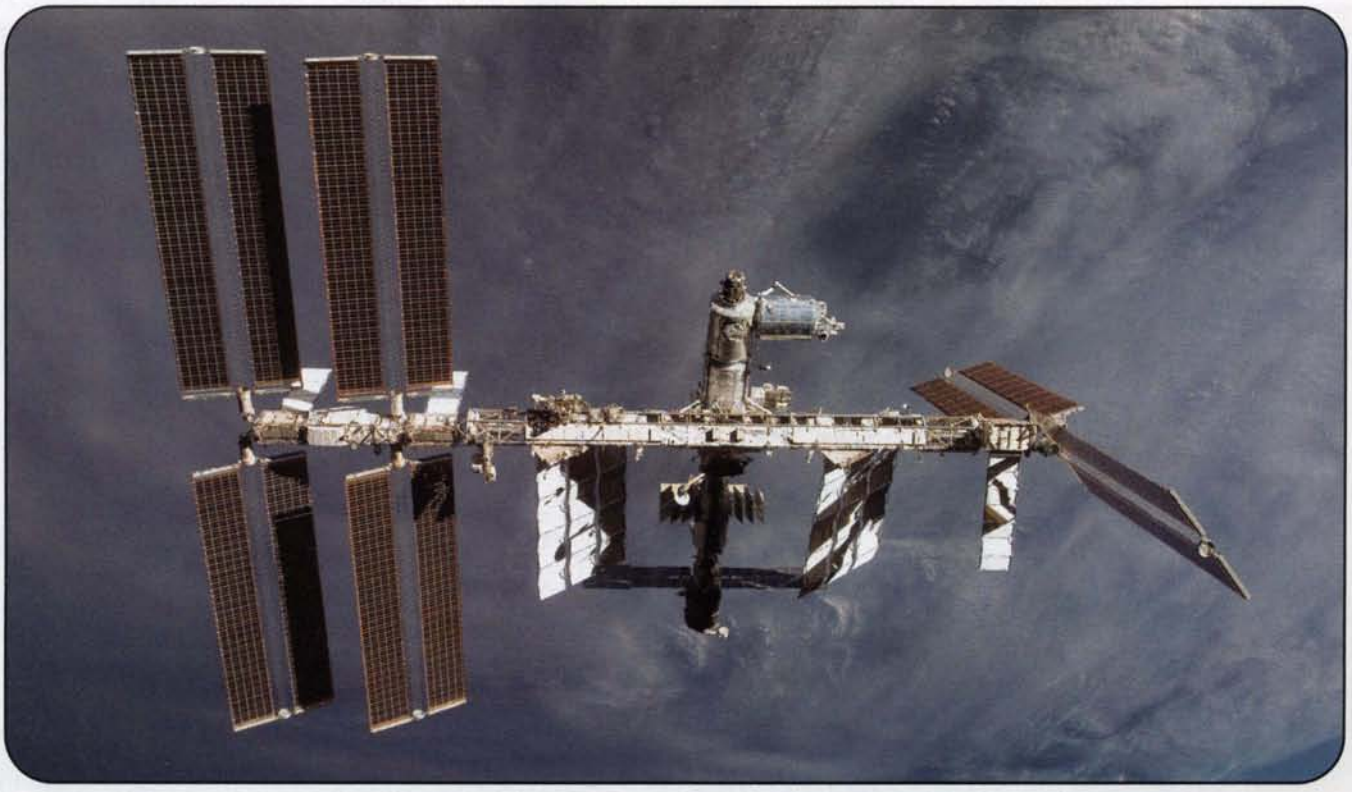
ARISS's Purpose

The primary purpose of ARISS is to promote education of our youth in math, the sciences, engineering, and technology through exposure to the International Space Station Program. A secondary purpose is to expose students and others to the world of amateur radio and the many benefits of this fascinating avocation.

Working with professional educators worldwide and with the space agencies of the world, ARISS provides opportunities for students of all ages to talk and exchange ideas with astronauts on board the ISS (International Space Station) while in orbit. Amateur radio provides the medium for this exchange to occur and the volunteers who facilitate the primary purpose.

ARISS Organization

Based on a proud legacy of human space flight dating back to 1983 and Owen Garriott's STS-9 flight, including SAREX (the Shuttle Amateur Radio Experiment) and MIR, ARISS was formed in 1996. the founders were Roy Neal (SK), K6DUE; Frank Bauer, KA3HDO; Rosalie White, K1STO; and Matt Bordelon, KC5BTL. The team is governed by a group of ARISS International Working Group delegates from Canada, Europe, Japan, Russia, and the United States. Delegates are chosen



Backdropped by a cloud-covered part of Earth, the International Space Station is seen from Space Shuttle Atlantis as the two spacecraft begin their relative separation. Earlier, the STS-122 and Expedition 16 crews concluded almost nine days of cooperative work on-board the shuttle and station. Undocking of the two spacecraft occurred at 3:24 AM (CST) on February 18, 2008. (NASA photo)

from the AMSATs (Amateur Radio Satellite Corporation) of the world, the national amateur radio organizations (such as the ARRL), and the space agencies of the world. These delegates meet via monthly telephone conferences and about once a year at face-to-face meetings (last year's was in Moscow, this year's in the Netherlands). In between, activities are coordinated by e-mail and additional telephone conferences as necessary. These delegates set the policy (with advice from the space agencies) for operation, coordinate equipment for the ISS, coordinate with education organizations, coordinate school selection for contacts, and provide oversight to the ARISS Operations Team, the other major ARISS group.

The ARISS Operations Team is made up of ARISS mentors, scheduling/technical representatives, and an orbital prediction specialist. An ARISS Operations Lead is selected from within the ranks on a periodic basis. This group meets weekly by telephone conference and much more frequently via e-mail and individual telephone conversations. ARISS mentors are the volunteers who work with the schools, teachers, and local amateur radio groups that actually make the contacts with the ISS. Scheduling/technical representatives work within the space agencies, primarily NASA in the USA and the Russian Space Agency, to secure the final schedules for the contacts. These scheduling representatives also coordinate training of the astronauts in the use of the equipment on-board the ISS and procedures for its use. The orbital prediction specialist does the long- and short-term predictions necessary to support the scheduling of all of the contacts. I will talk more about these functions and their relationships to each other in subsequent paragraphs outlining the scheduling and performance of the contacts.

ARISS Operations

The wheels start rolling with the submission of an ARISS application for an ISS contact. Ideally, a teacher hears about the possibility of a contact through professional societies, from other teachers, from amateur radio operators within the community, or by many other routes. The teacher, with the help of local amateur radio operators, fills out the multiple-part application and submits it to the regional ARISS organization. The regional organization reviews the application, obtains clarification if necessary, ensures the application is forwarded to the ARISS international education committee, and enters it into the list of applications in the order in which it was received. A separate list is maintained for each region of the world, and candidates are picked from each region in proportion to the number of applicants on the list. Another list is maintained for "Crew Pick" contacts. These contacts are with schools that are picked by the astronauts for their own reasons and are usually separate from the main list. Astronauts are allocated "Crew Pick" contacts based on their interest in the program and willingness to support contacts from the main list.

The main list can be quite long and the waiting period can be correspondingly lengthy. Currently, the wait for U.S. applicants is about one year. Every effort is made to keep the wait to a minimum, but contacts generally are limited to somewhere between one and four a week, depending upon the crew's willingness to support contacts and the workload on the ISS.

Another factor to consider is whether the contact is to be "direct" or via "telebridge." For a "direct" contact, a ground station is set up at the school and the contact proceeds directly through that station with the station on-board the ISS. For a "telebridge" contact, the ground station is located remotely

(possibly half way around the world) from the school and the ground station is connected to the school and other elements through a telephone conference bridge. ARISS Operations has developed and maintains a list of acceptable telebridge stations around the world (these are currently in the mainland U.S., Hawaii, Australia, Argentina, Belgium, and South Africa).

The school expresses a preference for the type of contact in its application and ARISS Operations will honor this preference whenever possible. A telebridge contact requires much less equipment at the school and is much more flexible on timing of the contact than a direct contact; however, it actually requires more coordination on the part of ARISS Operations to carry it out. A list of requirements for each contact follows:

1. The ground station must be within the footprint of the ISS during the time of the contact and the ISS should have a peak elevation at the ground station of more than about 15 degrees. Higher passes are more desirable to maximize the contact time and minimize effects of local obstructions on the contact.
2. The pass selected must occur during normal school hours as stated on the application or within an acceptable alternate time.
3. The pass time selected must be within the crew's normal off-duty but awake time. Exceptions must be approved by the Space Agency medical personnel. Crew sleep periods normally are fixed, but can be "sleep shifted" during special work periods that coincide with Space Shuttle or other activities.

Picking and approving passes that satisfy the above requirements involve several steps that are outlined below:

1. A list of possible contacts is selected from the prioritized list of contacts maintained by ARISS over a period of time (usually for an ISS expedition).
2. ARISS mentors are assigned to each school as soon as possible. The ARISS mentor establishes contact with the school and local ham volunteers, and verifies the content of the application. (Often things change at a school after the original application was prepared.)
3. The list of candidates is broken up into direct vs. telebridge contacts.
4. Direct candidates are submitted to the orbital prediction specialist for processing into the "best weeks" list. Best weeks are long-term predictions that will permit selection of schools that have passes within a certain time frame that satisfy all of the nominal contact requirements above. A school may have several different "best weeks" within the overall time frame.
5. Selections are made based on contact priority and best weeks for each school, and the ARISS mentors obtain preferences for the available weeks from each school.
6. The ARISS mentor continues the dialog with the school to firm up the requirements for the station, answer questions from the teacher and the local amateur radio operators, assist the teacher with resources for lesson plans, solicit names of the students and questions, and obtain a short description of the school and its activities for forwarding to the astronauts. The ARISS mentor also prepares the school for filling out a post-contact survey for ARISS and NASA.
7. About four or five weeks before the week selected for a school, detailed pass predictions for the contact are requested from the orbital prediction specialist. These predictions are verified by the ARISS Operations Lead and sent to the ARISS mentor for forwarding to the school for prioritization within its

CQ's 6 Meter and Satellite WAZ Awards

(As of March 1, 2009)

By Floyd Gerald,* N5FG, CQ WAZ Award Manager

Satellite Worked All Zones

No.	Callsign	Issue date	Zones Needed to have all 40 confirmed
1	KL7GRF	8 Mar. 93	None
2	VE6LQ	31 Mar. 93	None
3	KD6PY	1 June 93	None
4	OH5LK	23 June 93	None
5	AA6PJ	21 July 93	None
6	K7HDK	9 Sept. 93	None
7	W1NU	13 Oct. 93	None
8	DC8TS	29 Oct. 93	None
9	DG2SBW	12 Jan. 94	None
10	N4SU	20 Jan. 94	None
11	PAØAND	17 Feb. 94	None
12	VE3NPC	16 Mar. 94	None
13	WB4MLE	31 Mar. 94	None
14	OE3JIS	28 Feb. 95	None
15	JA1BLC	10 Apr. 97	None
16	F5ETM	30 Oct. 97	None
17	KE4SCY	15 Apr. 01	10,18,19,22,23, 24,26,27,28, 29,34,35,37,39
18	N6KK	15 Dec. 02	None
19	DL2AYK	7 May 03	2,10,19,29,34
20	N1HOQ	31 Jan. 04	10,13,18,19,23, 24,26,27,28,29, 33,34,36,37,39
21	AA6NP	12 Feb. 04	None
22	9V1XE	14 Aug. 04	2,5,7,8,9,10,12,13, 23,34,35,36,37,40
23	VR2XMT	01 May 06	2,5,8,9,10,11,12,13,23,34,40
24	XE1MEX	19 Mar. 09	2,17,18,19,21,22,23,26,34,37,40

CQ offers the Satellite Work All Zones award for stations who confirm a minimum of 25 zones worked via amateur radio satellite. In 2001 we "lowered the bar" from the original 40 zone requirement to encourage participation in this very difficult award. A Satellite WAZ certificate will indicate the number of zones that are confirmed when the applicant first applies for the award.

Endorsement stickers are not offered for this award. However, an embossed, gold seal will be issued to you when you finally confirm that last zone.

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to the WAZ Award Manager: Floyd Gerald, N5FG, 17 Green Hollow Rd., Wiggins, MS 39577. The processing fee for all CQ awards is $6.00 for subscribers (please include your most recent *CQ* or *CQ VHF* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Floyd Gerald. Applicants sending QSL cards to a CQ Checkpoint or the Award Manager must include return postage. N5FG may also be reached via e-mail: <n5fg@cq-amateur-radio.com>.

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own school schedule. The passes are ranked #1 through #n by the school and the local amateur radio operators and sent back to ARISS Operations.

8. At this point, the pass ranking, student names, questions, and school description are passed on to the NASA planners by the ARISS scheduling representative for final determination of the selected pass. Usually this final pass time is available one to two weeks before the contact. In the case of Russian contacts, a similar process is performed with the Russian Space Agency.

9. Before the contact time, a final uplink message is sent to the astronaut containing the time, station callsigns, frequency information, school description, and students' questions (along with the students' first names) in the order the questions are expected to be asked.

10. At this point, the contact is ready to go from a planning standpoint.

For telebridge contacts this process is modified somewhat. Telebridge contacts are usually fit into the schedule between the "best weeks" for direct contacts, or are scheduled during special times that are specified by the school or event and agreed to by ARISS Operations. Telebridge contacts are usually reserved for schools that either cannot obtain local ham club support for a direct contact or have time requirements that are not flexible. The modified steps for a telebridge contact follow:

1. Telebridge contacts are prioritized by the same process as direct contacts, but they are usually done when direct contacts are not possible.

2. For telebridge contacts, the orbital prediction specialist prepares a list of the passes for each telebridge station that can support a contact during the dates/time frames requested by the school and within crew constraints. This list can contain many passes and multiple stations.

3. The ARISS Lead pares down the list when possible and sends the remaining passes to all of the telebridge stations that have passes on the list for verification of support.

4. The ARISS Lead receives the responses from the telebridge stations and prepares a list of available passes for further prioritization by the school. This list is sent to the ARISS mentor and he/she forwards this list to the school.

5. Once the prioritized list is returned by the school, the process continues in much the same manner as for a direct contact.

6. One other step is added: a contact moderator is selected by the ARISS Lead to oversee final readiness verification at the school and at the telebridge station. The moderator also makes sure school personnel and any audience are aware of how the contact will be done and the amateur radio involvement in the contact. A moderator is added, since many times the level of expertise at the school during the contact is less than it would be during a direct contact.

7. At the appropriate time, the moderator turns over control to the telebridge station to establish contact with the ISS.

8. Control is then maintained by the telebridge station operator and the school contact supervisor until the pass is over.

9. The moderator then completes the process with a closing statement.

In recent years, ARISS has succeeded in including distribution of the audio from the contact over the internet by utilizing EchoLink and IRLP. These are two methods of including many more listeners worldwide in the distribution. Doing this with a telebridge contact is relatively easy. With a direct contact it is a little more difficult, but recently success has been achieved by feeding the audio into a PC at the school and utilizing Skype (an internet telephone) to forward the resulting information to the operator who completes the conversion to EchoLink or IRLP. These operations are also carried out by ARISS volunteers.

The last thing that happens in an ARISS contact is the enthusiastic response of the school kids, and their increased interest in science and ham radio when the contact is successfully completed. This is the "pay" the volunteers cherish for their efforts and is the reason we eagerly volunteer for this duty.

Summary

I hope this column has given you some additional insight into ARISS and the process of scheduling and conducting ARISS contacts. I also hope no one is scared away by all of the details involved. After all, ARISS is always looking for a few more good volunteers and a few more enthusiastic school teachers to "share the wealth."

Since the ISS was launched, over 400 of these school contacts have been conducted and over 40 have taken place on Expedition 18 during the last six months. Many more are planned in the future. The 400 number does not include all of the SAREX and MIR contacts that preceded ISS operations.

Don't forget to support ARISS in its education efforts. Also, please support AMSAT in its fund-raising efforts so that they can continue to put more "birds" on the air. 'Til next time . . .

73, Keith, W5IU

By Miguel Enriquez, KD7RPP

ATV

Amateur Television for Fun and Education

ATV, ARRL's Teacher Institute, and Ham Radio in Public School Curriculum

A philosopher once wrote, "Against our will comes wisdom." At first glance one might ask what this statement might have to do with amateur radio and ATV. Well, recent circumstances and activities surrounding the Pueblo Amateur Radio Club have everything to do with the statement.

For the last two years, the Pueblo Amateur Radio Club has been busy exploring many different facets of radio. Some of our students are working on underwater robots controlled via RF. Others are busy building antennas and testing them. Still others have been working on basic electronics and math classes to be taught via ATV for the benefit of elementary school children in southern Arizona and in London, England. In addition, our radio club has now begun taking images of celestial bodies such as planets, nebulas, and galaxies through remote-imaging telescopes in New Mexico and Pengally, Western Australia. All of these activities are in pursuit of bettering knowledge, understanding, and test scores in mathematics and science.

It would be nice to be able to report that as the students demonstrate improved test scores and general enthusiasm for the projects in which they are involved, the resources necessary to accomplish the goals that will add to their education would become more available. However, because of the economic climate we all face, and especially in Arizona where state funding for education is now 50th in the nation, available resources are drying up quickly. It would be natural to expect the students to give up or slow down their enthusiasm for the projects they are working on. However, just the opposite is taking place.

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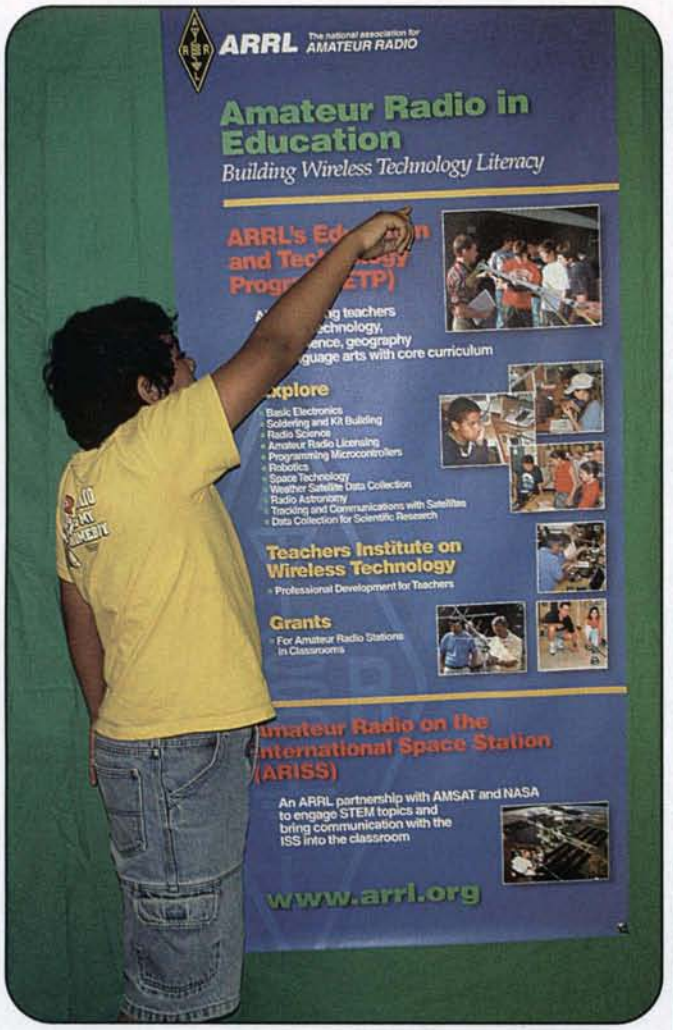
Tiernan Walker, a fourth-grade student from Jefferson Park Elementary school, poses in front of a chromo green screen with satellite antenna and HT to demonstrate correct emergency communication procedures. Pictures are to be used for development of ATV video vignettes.

Our radio club motto is "Touch the Sky." Our students have concluded that touching the sky can happen as long as one absolute requirement is present—imagination. Therefore, instead of the students complaining about the radio club not having the $300 for the application fees to the underwater tournament this year, they will continue working on the robot and make it a better one for next year's competition. Instead of griping that the radio license fees are not there for the students to take their Technician amateur radio test, they will just keep moving along and take the test when they finish studying for their General exam, hoping the fees will be available someday.

Something else very positive has come out of these trying times. Last year Pueblo Magnet High School was one of six sites that hosted an ARRL's Teacher Institute. The ARRL Teacher Institute (TI) is a program presented by the ARRL for teachers with the objective of assisting, enhancing, and improving science and mathematics comprehension for American students. The program is run exclusively through philanthropic support, and thanks to the magnificent contributions of Mark Spencer, WA8SME, the program is an overwhelming success every time it is presented.

This year, because general economic conditions are difficult and resources are becoming more limited, and because many of the Pueblo faculty are witnessing the obvious successes my math and radio club students are demonstrating, the 2009 ARRL TI at Pueblo High School will be filled exclusively with math, science,



Tiernan uses the ARRL Teacher Institute Banner to communicate the ARRL educational services to teachers via ATV.

career and technology, and special education teachers from Pueblo High School. The teachers will attend the TI June 15 –18. Plans are already under way to "pool" the resources that the ARRL provides to individual teachers and to create a "class set" of materials and equipment that can then be shared by the different departments and classrooms to provide exciting "hands-on" opportunities for students to add more relevance to their daily lessons.

Students will be able to use tools provided by the ARRL to receive and process images from weather satellites to add to their study of earth science. Learning scientific notation takes on a whole different meaning when students are able to employ Ohm's law to predict the reading on the multi-meter readout panel as they vary resistance in a circuit. A greater number of students will be able to apply their learning in a laboratory setting while having fun experimenting with math and science.

Another exciting development at Pueblo Magnet High School is that a new radio/video course has been added to the Pueblo curriculum to teach radio, space, and wireless technologies. The course must meet Arizona State Standards that will employ amateur radio, robotics, radio astronomy, and amateur television as course content. The students will prepare for their FCC amateur radio licenses as part of the class curriculum. The students will be required to meet a minimum of 80% of the Class State Standards and pass qualifying exams. The program is being funded through the Pima County Joint Technological Education Program and should provide resources for equipment and materials. Furthermore, I am currently taking the course work to add Career and Technology Education to my teaching certification.

Several of the Pueblo faculty members who will attend the Teacher Institute have expressed an interest in obtaining an amateur radio license. If this were to happen, only bigger and better opportunities await the Pueblo Amateur Radio Club.

In addition, ATV will be at the Pueblo Magnet High School 2009 ARRL Teacher Institute to record these auspicious events, and if we ever do get enough bandwidth to the internet connectivity at Pueblo, we will provide those videos through the Arizona Amateur Television Network.

If you are a teacher or know teachers somewhere, suggest they look into attending the ARRL Teacher Institute. It is designed primarily for teachers who are not ham radio operators.

Therefore, returning to Aeschylus' quotation at the beginning of this column, if it were not that present economic and political situations locally provide never-before-seen challenges, the Pueblo Amateur Radio Club and ATV would not have the magnificent opportunities before us. If the new radio/video class is to be the success I envision, a tested and successful amateur radio/video curriculum would be made available to other teachers around the country for their use.

Hope is a good thing. 73, Miquel, KD7RPP

By Kent Britain,* WA5VJB

ANTENNAS

Connecting the Radio to the Sky

Stacking Broadband Antennas

One common question from our readers is how to stack log periodic or other broadband antennas. The wide variation of wavelengths used in antennas such as the ones in photo 1 creates a multitude of problems, not the least of which is evenly dividing power between the two antennas. However, there are several ways to divide the RF power between two antennas even over a broad range of frequencies.

Quarter Wave: In photo 2 we have the classic 1/4-wave power divider, two sections of coax 1/4-wave long and 72-ohm impedance. While this is the usual way of stacking two antennas, the power divider has a bandwidth of about ±10 percent. This means a power divider for 2 meters works fairly well as a power divider from 130 MHz to 160 MHz. This is fine for 2 meters, but it is not going to hack it for multiband antennas.

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Multi-Stage Quarter Wave: Sometimes known as a "multi-section inline hybrid," a series of stepped quarter-wave sections with different load resistors can give a pretty good bandwidth of 2 to 1 or more depending on the number of stages. Specifications of 1 to 2 GHz, or even 2 to 8 GHz, are often seen on surplus power dividers. This is good for microwave use but kind of big for VHF antennas. In photo 3 you can see the small chip resistors at the junctions. I sacrificed another power divider on the altar of knowledge so I could cut it up and measured the 100-, 220-, and 450-ohm resistor values.

Ferrite: These simple two-way splitters designed for use with televisions (photo 4) are very handy little splitters or combiners. First, they are *not 75 ohms!* Rather, they are transformers and are quite happy with all three ports at 30 ohms, 50 ohms, or even 100 ohms. Again, they are transformers and just need all three connections at the same impedance. With adapters on the F-connectors, or taking out the transformer and putting it in your own box will make a handy splitter/combiner with 50-ohm coax systems.

Yes, some electronics stores sell them for $10 or more, but the ones at the dollar stores for $1 work just as well! Furthermore, you can take them apart and put the ferrite transformer directly into your projects. The first time I tried this, I exclaimed, "Boy, look at those long leads. I can made it work much better by using shorter leads!"

That turned out to be another one of those brilliant ideas that didn't work out very well. The inductance in the long leads is part of the device impedance matching, and you really need to keep the leads the same length as much as possible.

The frequency range depends on the type of ferrite used, its size, and the number of turns. TV splitters work pretty well from 50 MHz to 1000 MHz. A quick scan of the MiniCircuits catalog shows other variations for use from 50 kHz to 2 GHz. Again, the ferrite splitter/transformers

Photo 1. Wide-bandwidth antennas.

are good when the antennas are used to receive, but the ferrite saturates at about 1 watt, so is not so good for transmitting.

Tapered or Infinity Balun: If you change impedances quickly—that is, go from 50 ohms to 100 ohms—the impedance change causes the wave to reflect. In the case of a 50- to 100-ohm change or impedance bump, you would see a 2 to 1 SWR. However, let's say we didn't have a sudden change, but rather just a slow change from 50 to 100 ohms. There wouldn't be a sudden impedance bump and there would be no change in the SWR. This is the idea behind the tapered balun—just a slow change in impedance over a modest distance. Shown in photo 5 are the top and bottom sides of a tapered balun I am using with an Archimedean Spiral array that goes from 50-ohm to

Photo 2. Quarter-wave antenna phasing lines.

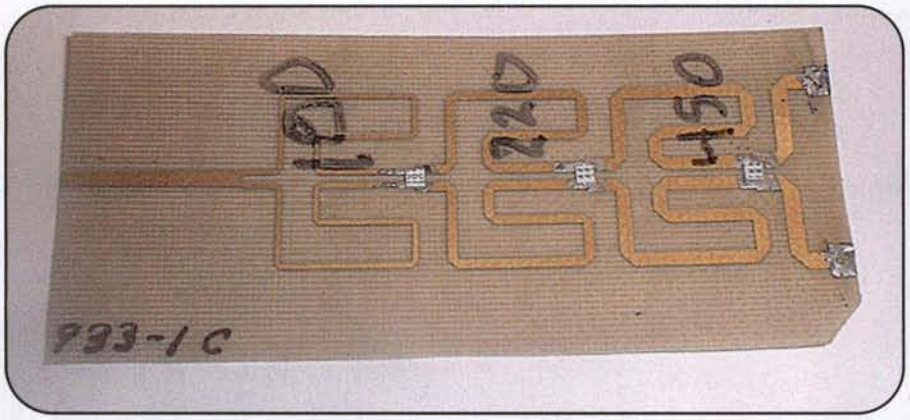

Photo 3. Multi-stage quarter-wave Wilkinson power dividers.

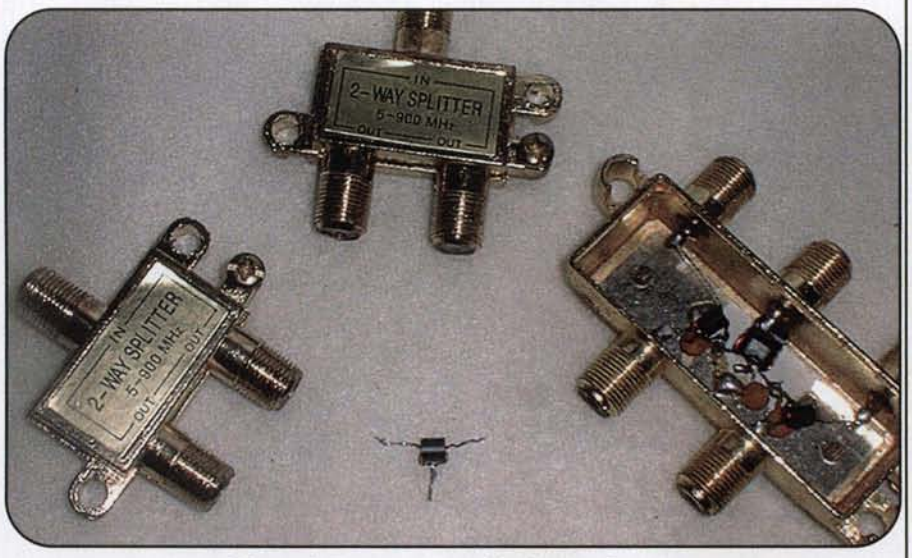

Photo 4. Ferrite power divider/combiner.

110-ohm balanced line, or 110-ohm twin lead. The taper needs to be at least 1/2-wave long, and longer if you have room.

In photo 6 is a tapered power divider for a UWB, or ultra-wideband antenna array. Note how the lines are narrow at the junction and fatten up at the antennas. The lines are 72-ohm impedance at the junction, widening to 50 ohms for the individual antennas. For UWB, the normal 1/4-wave matching lines were just not going to work. There is too much frequency spread, especially for the pulse UWB modulations. As soon as I get my technique down, I'll show you how you can make one of these tapered power dividers out of semi-rigid coax or small hardline.

T-Connector: Perhaps the lowest loss power divider is just a T-connector like the ones in photo 7. Redesigning an antenna such as a log periodic for 100-ohm impedance is quite easy, as log periodics naturally like to be just over 100 ohms. Use two feedlines the same length and the two 100-ohm antennas parallel to 50 ohms. This is the lowest loss way and widest bandwidth way to combine antennas, but redesigning the antennas

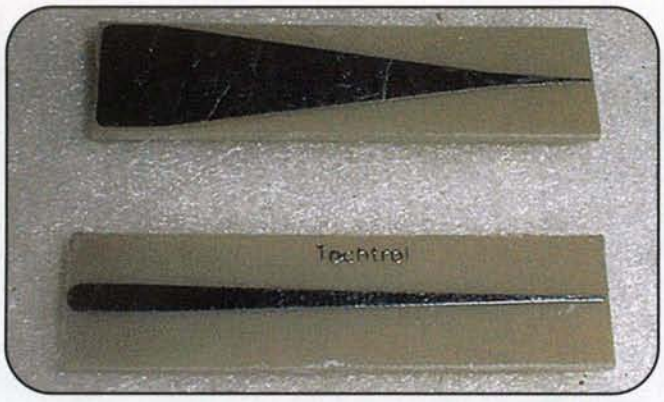

Photo 5. Tapered impedance-matching lines.

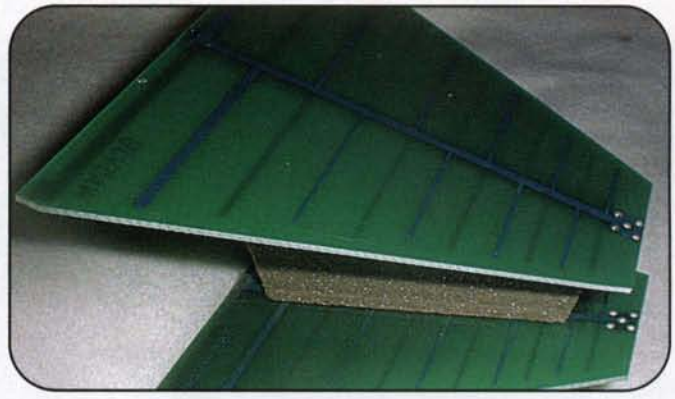

Photo 8. Stacking.

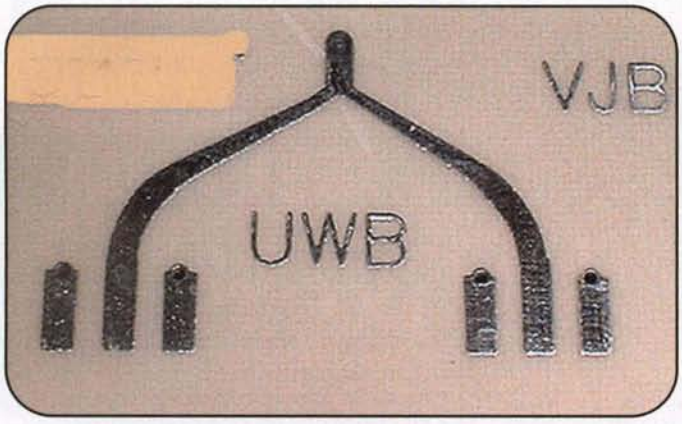

Photo 6. Tapered power divider.

Photo 7. T-connectors.

Photo 9. Big beacon antennas.

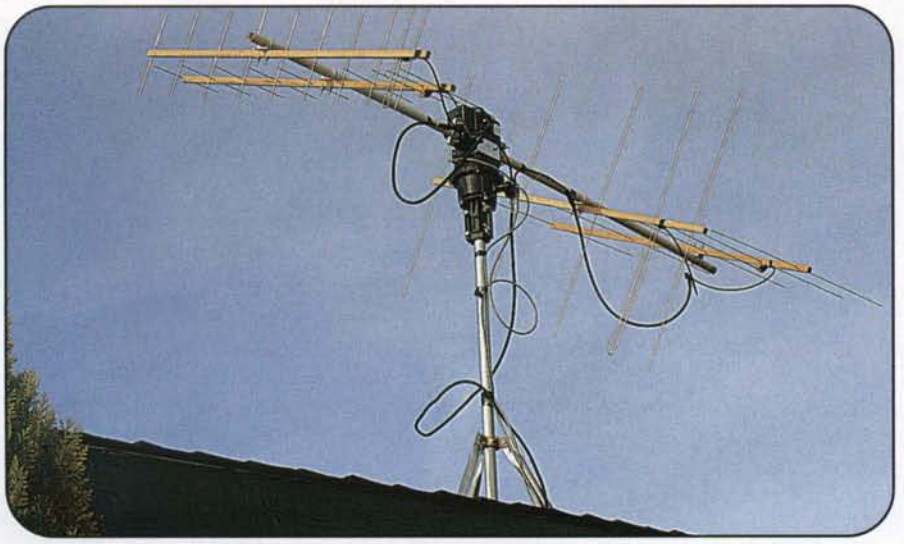

Photo 10. Jim, KI6WJ's homebrew AO51 antennas. (KI6WJ photo)

is not always easier. Often designing the radio stages to 25 ohms is easier.

Resistors: A pair of 50-ohm resistors makes an excellent broadband power divider, but you do have the tiny detail that you will lose half of the power in those resistors. There may be an advantage in that you have a narrower antenna pattern, but this is a rarely used technique and for good reason.

Spacing: When stacking Yagis or dipoles, you have a preferred stacking distance. For Yagis the best stacking distance is about 1/2 the length of the booms. For dipoles it's usually about 1/2 wavelength. To maintain the proper stacking distance with antennas such as log periodics, you end up with something like the spacing in photo 8. It looks kind of strange at first, but the low-frequency elements and the high-frequency elements of the log periodic are the same distance apart in wavelengths.

Big Beacons Anyone?

It looks like we will have an opportunity for some fantastic beacon antennas in the Dallas, Texas area, and something you might look into in your area. After June 12, 2009, about 5000 analog TV stations will go dark. That means about 5000 fantastic beacon antennas will be unused, including the one in photo 9. Like all fantastic deals, there are a few points in the fine print. It varies from location to location, but most TV stations pay about $10,000 a month in tower rent, so they will be highly motivated to get those antennas off the towers! However, at the same time there are not enough tower crews to go around, and it will be many months before they all come down. It's during this window that we have been invited by the director of engineering for one network to use its Dallas antenna. We can have some fantastic propagation beacons. Here are some quick notes on using TV antennas with ham rigs:

1. Most VHF low and VHF high/low antennas will work on any ham band. Yes, a TV Channel 3 antenna will have the gain and pattern of a bent coat hanger on 2 meters, but it's a bent coat hanger at over 1,000 ft!

2. UHF slot arrays can only be used on 902 MHz and up. The antenna slots and waveguide feedlines will not pass signals below the channel assignment—well, a few MHz perhaps, but not down to 432 MHz or lower.

3. Isolate your transmitter. It's not unusual for a TV antenna to collects *watts* of power from other nearby TV and FM stations. This power can mix in the final of your transmitter, creating high-power spurs or mixing products all over the spectrum. Your transmitter may be very clean on the bench, but with being bombarded by all those strong signals, you can really trash an area. Yes, a 50-watt transistor can function as an active mixer! Isolate your beacon transmitter with a passband filter, or better yet a ferrite isolator. If you know the frequency of a high-power transmitter just a few feet away, an additional notch filter is a good idea.

Letters, Letters . . . We Get Letters

The Cheap Yagi HDTV antenna has produced a tremendous number of e-mails. Yes, a higher gain UHF and a version incorporating VHF high elements are in the works. I hope to have these working before June 12th.

From KI6WJ: Jim sent us photo 10 of his homebrew AMSAT AO51 antennas. He calls them his "WA5VJB Pairs." It looks like the 5-element Cheap Yagis for 145 MHz and the 11-element Cheap Yagis for 435 MHz.

As always, we enjoy your input and suggestions for future topics. You can snail mail or e-mail your antenna questions and suggestions to my addresses on the first page of this column, and visit <http://www.wa5vjb.com> for additional antenna projects. 73, Kent, WA5VJB

By Tomas Hood,* NW7US

VHF PROPAGATION

The Science of Predicting VHF-and-Above Radio Conditions

More New Space Weather Discoveries

In the Winter 2009 issue we began to explore some of the new scientific discoveries and efforts being made in space weather and radio propagation during solar Cycle 23's approximately eleven years. Many new satellites and other research space craft have been launched and exciting research conducted that is leading to a deeper, better understanding of our Earth, the Sun, and the interaction between them. We looked specifically at one of the amazing discoveries made by the THEMIS (Time History of Events and Macroscale Interactions during Substorms) mission. This time, let's continue to look at more of the new science being pursued by solar scientists.

The THEMIS Mission

THEMIS is a mission to investigate what causes auroras in the Earth's atmosphere to dramatically change from slowly shimmering waves of light to wildly shifting streaks of color. Discovering what causes auroras to change will provide scientists with important details about how the planet's magnetosphere works and the important Sun-Earth connection. During February 2007, NASA launched the five space craft that make up the THEMIS fleet. The University of California, Berkeley's Space Sciences Laboratory managed the project development and is currently operating the THEMIS mission. Swales Aerospace, of Beltsville, Maryland, built the THEMIS satellites.

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Geomagnetic Substorms

Substorms are atmospheric events visible in the Northern Hemisphere as a sudden brightening of the Northern Lights, or aurora borealis. These substorms are more accurately termed "geomagnetic substorms," a description of the time-dependent build-up and release of magnetic energy in Earth's magnetosphere.

We know that space is not a vacuum, at least in our solar system. The Sun's atmosphere actually extends very far out from the Sun. Space in our system is filled with plasma, a low-density gas in which the individual atoms are charged. The temperature of the Sun's atmosphere is so high that the Sun's gravity cannot hold on to it. The plasma streams off the Sun in all directions at speeds of about 400 kilometers per second (about 1-million miles per hour). This is known as the "solar wind."

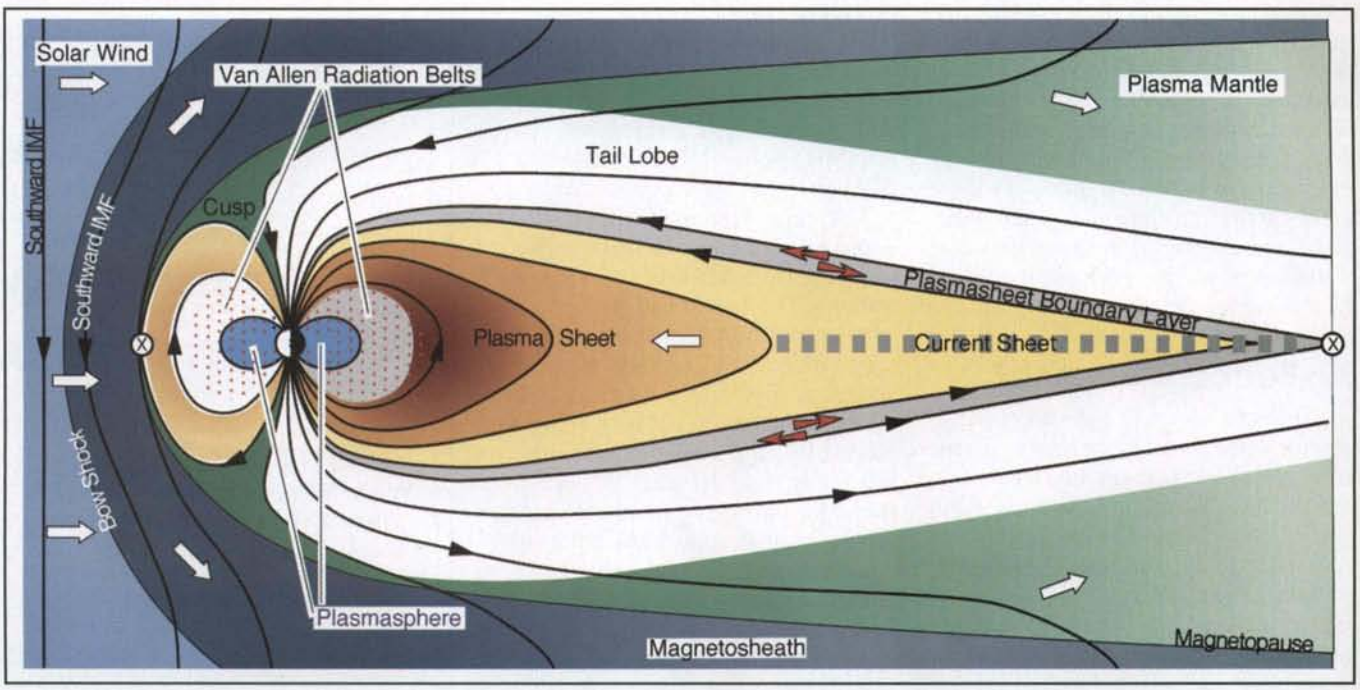

Figure 1. Schematic of the Earth's magnetosphere. The direction to the Sun is to the left. The IMF (interplanetary magnetic field), imbedded in the solar wind, impinges upon the magnetopause. If southward, as here, it connects to the Earth's magnetic field at the X-line (shown as circle with X inside), resulting in a region of field lines connecting from the Earth to deep space. Plasma from the solar wind enters via the cusp, becomes trapped in the plasma sheets, and eventually precipitates to Earth or is lost down the magnetotail. (Source: NASA)

The solar wind buffets the Earth's magnetic field and can produce storms, or more properly substorms, in the Earth's magnetosphere. Until this explosion was witnessed first-hand by THEMIS, however, scientists did not understand the full mechanisms of how substorms occurred.

The Earth has a magnetic field with a north and a south pole that is enclosed within a region surrounding the Earth called the "magnetosphere." As the Earth rotates, its hot core generates strong electric currents that produce these magnetic fields, which reach 36,000 miles into space. The solar wind distorts the shape of the magnetosphere by compressing it at the front and causing a long tail to form on the side away from the Sun. This tail is called the magnetotail (figure 1), and on average is a million kilometers long.

The ionosphere is affected by these solar-induced changes, either by an increase of ionization, or a decrease or even a depletion of ionization. Depressions in ionospheric density cause major communications problems, because radio frequencies that previously had been refracting off the ionosphere now punch through. The MUF (maximum usable frequency) on a given radio signal path can be decreased by a factor of two during a substorm event. Storm effects are more pronounced at high latitudes.

When these substorms occur, they are often accompanied by auroral "eruptions." The aurora is a dynamic and visual phenomenon caused by solar-induced geomagnetic storms (figure 2). When the solar wind interacts with the magnetosphere, under certain conditions the solar wind energizes the electrons and ions in the magnetosphere, causing solar plasma particles to enter the Earth's upper atmosphere. These particles ride down the Earth's magnetic field lines which arch toward the north and south magnetic poles. When these particles strike the molecules and atoms of the thin, high atmosphere, photons are released, creating a light show consisting of different colors.

To understand why, take a look at a neon light. When a neon light is energized, you are looking at an interaction of electrons with the gases inside the tube, resulting in plasma. Plasma conducts electricity and is also steered by magnetic fields. The color of the neon light depends on the gas that fills the tube. On a much larger scale, the solar plasma riding the solar wind is shaped by the magnetic field lines found in the magnetosphere, and produces colors depending on the gases found at the various altitudes through which the plasma passes.

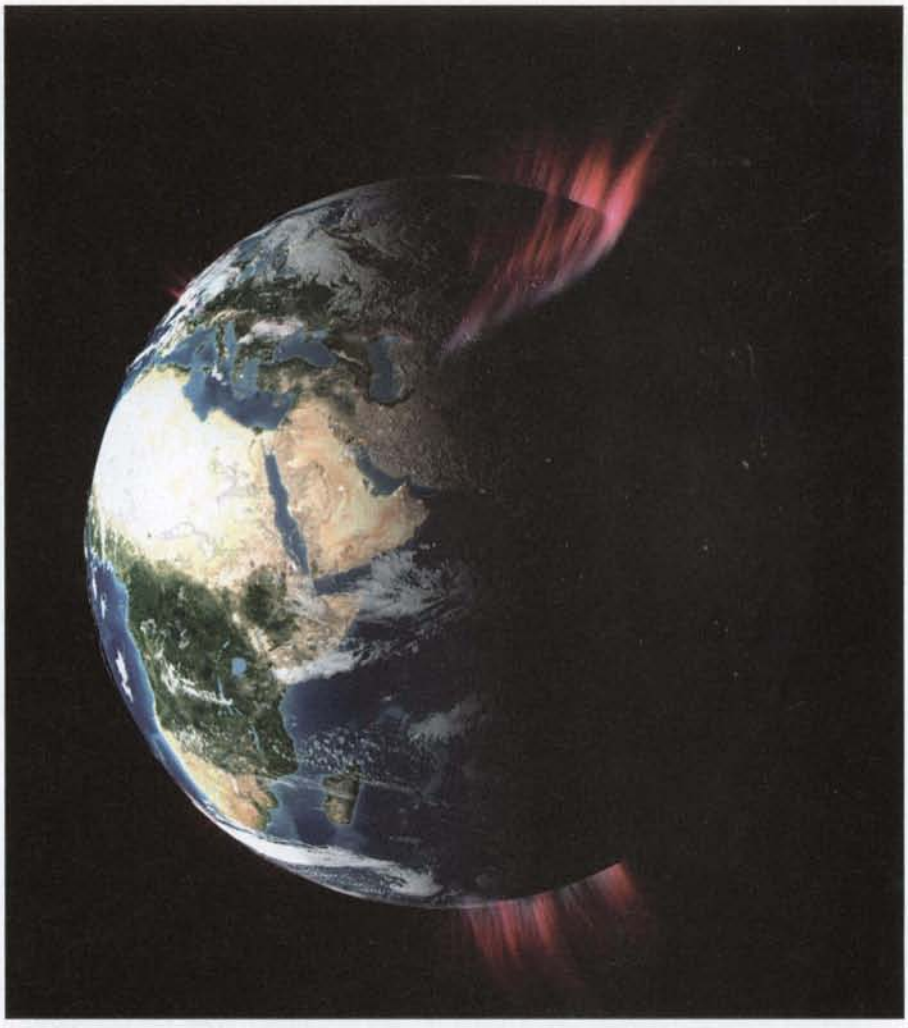

Figure 2. Artist's rendition of a substorm. (Source: NASA)

Substorms produce dynamic changes in these auroral displays seen near Earth's northern and southern magnetic poles, causing a burst of light and movement in the Northern and Southern Lights. These changes transform auroral displays into auroral eruptions. Aurora normally occurs between 60 and 80 degrees latitude, but during intense substorms, the auroral oval spreads toward the equator. During the most intense substorms, aurora has been observed all the way down to the equator, and the light show is intense with rapidly changing curtains, arcs, and other manifestations.

Substorms generally have three phases. The first is the growth phase, followed by the expansion phase, then finally the recovery phase. Because the substorm process involves the entire solar-terrestrial system (which includes the solar wind and interplanetary magnetic fields, the magnetosphere and geomagnetic field, the atmosphere and ionosphere, and so forth), intense research, such as THEMIS, is being conducted on these storms. As more facts come to light, the models used to explain this complex system are refined and tested against real data.

Plasma Bullets

During 2008 the five THEMIS satellites revealed an amazing phenomenon. While the arctic skies were dark and Earth's magnetic field was quiet with very little activity, the five THEMIS satellites had just arranged themselves in a line down the middle of Earth's magnetotail (figure 3).

Suddenly, an explosion occurred that released about 1015 joules of energy (about as much energy as a magnitude 5 earthquake) half way up the THEMIS line. The blast launched two "plasma bullets," huge clouds of protons and elec-

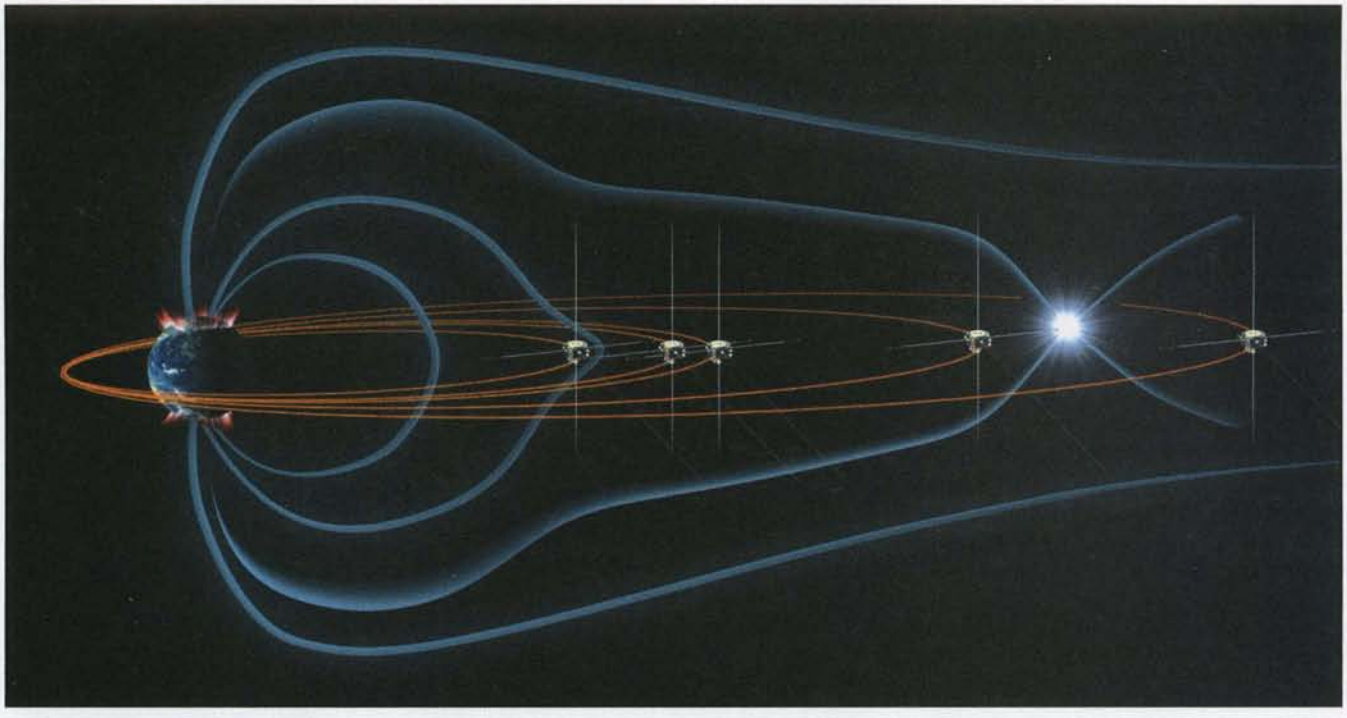

Figure 3. An artist's rendition of the THEMIS satellites lined up inside Earth's magnetotail with an explosion between the fourth and fifth satellites. (Credit: NASA/THEMIS)

trons. One bullet was shot straight toward Earth, and the other away. When the Earth-bound plasma bullet hit Earth, it triggered aurora.

The explosion observed in February 2008 happened inside Earth's magnetic field, but it was actually a release of energy from the Sun. When the solar wind stretches Earth's magnetic field, it stores energy there, in much the same way energy is stored in a rubber band when you stretch it between thumb and forefinger.

Bend your forefinger and *crack!* The rubber band snaps back on your thumb. Something similar happened inside the magnetotail. Over-stretched magnetic fields snapped back, producing a powerful explosion. This process is called "magnetic reconnection," and it is thought to be common in stellar and planetary magnetic fields.

Solving the mystery of where, when, and how substorms occur will allow scientists to construct more realistic substorm models and better predict a magnetic storm's intensity and effects.

"We had bulls-eyes on our solar panels," says THEMIS project scientist David Sibeck of NASA's Goddard Space Flight Center. "Four of the satellites were hit by the Earth-directed cloud, while the opposite cloud hit the fifth satellite." Simple geometry pinpointed the site of the blast between the fourth and fifth satellite, or "about one third of the way to the Moon."

No damage was done to the satellites. Plasma bullets are vast gossamer structures less dense than the gentlest wisp of Earth's upper atmosphere. As they pass by the satellites, THEMIS instruments sample the cloud's internal particles and fields without any damage to satellites.

This peaceful encounter on the small scale of a spacecraft, however, belies the energy deposited on the large scale of a planet. The bullet-shaped clouds are half as wide as Earth and 10 times as long, traveling hundreds of km/sec.

"For the first time, THEMIS has shown us the whole process in action—from magnetic reconnection to aurora borealis," says Sibeck. "We are finally solving the puzzle of substorms."

Scientists directly observe the beginning of substorms using five THEMIS satellites and a network of 20 ground observatories located throughout Canada and Alaska. Launched in February 2007, the five identical satellites line up once every four days along the equator and take observations synchronized with the ground observatories.

Each ground station uses a magnetometer and a camera pointed upward to determine where and when an auroral substorm will begin. Instruments measure the auroral light from particles flowing along Earth's magnetic field and the electrical currents these particles generate.

During each alignment, the satellites capture data that allow scientists to precisely pinpoint where, when, and how substorms measured on the ground develop in space. The explosion observed on February 26, 2008 confirms for the first time that magnetic reconnection triggers the onset of substorms. The discovery supports the reconnection model of substorms, which asserts a substorm starting to occur follows a particular pattern.

The THEMIS mission is scheduled to continue for more than another year, and during that time Angelopoulos expects to catch lots more substorms: "dozens of them," he says. "This will give us a chance to study plasma bullets in greater detail and learn how they can help us predict space weather."

In the next issue, we will continue to look at the results of the intense research pursued throughout sunspot Cycle 23 and into Cycle 24. Feel free to write to me with your questions and observations.

Spring 2009 VHF Propagation

As we move into May, short-distance (only short when compared to long-haul DX of thousands of miles often experienced on the high-frequency spectrum)

propagation opens up in the VHF and sometimes UHF spectrum. These openings provide propagation of radio signals for hundreds of miles and occur almost as if a switch is turned on. This is a mostly summer-time phenomenon called "sporadic-*E*."

Sporadic-*E* (*Es*) is the term given to the mode of propagation where clouds of highly dense ionization develop in the *E*-layer of the ionosphere. These clouds might be very small, but regardless of their size, they seem to drift and move about, making the propagation off these clouds short and unpredictable. It is well documented that *Es* occurs most often in the summer, with a secondary peak in the winter. These peaks are centered very close to the solstices. The winter peak can be characterized as being five to eight times less than the summer *Es* peak.

Ten-meter operators have known *Es* propagation as the summertime "short skip." These "clouds" appear unpredictably, but they are most common over North America during the daylight hours of late spring and summer. *Es* events may last for just a few minutes to several hours, and usually provide an opening to a very small area of the country at any one time.

During periods of intense and widespread *Es* ionization, two-hop openings considerably beyond 1400 miles should be possible on 6 meters. Short-skip openings between about 1200 and 1400 miles may also be possible on 2 meters.

How can we know when a sporadic-*E* opening is occurring? Several e-mail reflectors have been created to provide an alerting service using e-mail. One is found at <http://www.vhfdx.net/sendspots/>. Sporadic-*E* alerting services rely on live reports of current activity on VHF. When you begin hearing an opening, you send out details so that everyone on the distribution list will be alerted that something is happening. They, in turn, join in on the opening, making for a high level of participation. Of course, the greater the number of operators on the air, the more we learn the extent and intensity of the opening. The bottom line is that you cannot work sporadic-*E* if you are not on the air when it occurs.

Speaking of being on the air, check out PropNET on 6 meters. This network of stations monitors the current propagation occurring on a given band, such as 6 meters, in an active way. Rather than just listening for stations, each station sends a beacon that allows the other participating stations to "catch" the beacon and then report the reception in real-time to a map that plots all of the paths that have been "caught." By participating, you add to the working, real-time knowledge of the band's conditions. PropNET is located at <http://www.propnet.org/>.

In addition to live reporting, there is a very powerful resource available on the internet. Check out <http://superdarn.jhuapl.edu/>. SuperDARN (Super Dual Auroral Radar Network) is an international radar network for studying the Earth's upper atmosphere and ionosphere. Using the SuperDARN real-time data 24-hour overview, you can view the day's ionization activity at the northern polar region. You can also view live radar displays of the same area. These graphs help identify *Es* clouds existing in the higher latitudes. One use for this would be the detection of a variation of *Es* known as auroral-*E*.

For a great introduction to mid-latitude sporadic-*E* propagation, visit the AM-FM DX Resource website <http://www.amfmdx.net/propagation/Es.html>.

Tropospheric Ducting

Most propagation on VHF and above occurs in the troposphere. There are a number of well-documented modes of tropospheric propagation. The most common is line-of-sight propagation, which can, depending on the height of the transmitting and the receiving antennas, extend to about 25 miles. When you work simplex FM or FM repeaters in your local area, you are hearing typical line-of-sight tropospheric propagation.

Another possible mode of propagation is by "tropospheric ducting." This term refers to the stratification of the air within the troposphere. These ducts are created by inversion layers formed from solar warming of the ground and the atmosphere immediately above it.

Under perfect conditions, the troposphere is characterized by a steady decrease in both temperature and pressure as height increases. When layers form within this region of air, the refractive index between each layer causes a refraction of VHF and UHF radio waves. If the layers form in just the right way and at the right height, a natural wave-guide is created. A tropospheric duct develops. A VHF signal can be ducted hundreds, if not thousands, of miles. It is common for California stations to work Hawaii stations during tropospheric ducting between the islands and the mainland.

It is worth watching for this mode of propagation. The spring weather season may well be violent and eventful this year, as has already been the case. Advanced visual and infrared weather maps can be a real aid in detecting the undisturbed low clouds between the West Coast and Hawaii or farther during periods of intense subsidence-inversion band openings. This condition occurs also over the Atlantic. There is a great resource on the internet that provides a look into current conditions. Bill Hepburn has created forecast maps and presents them at <http://www.dxinfocentre.com/tropo.html>, including maps for the Pacific, Atlantic, and other regions.

If you know that conditions are favorable for tropospheric ducting in your area, try tuning around the 162-MHz weather channels to see if you can hear stations way beyond your normal line-of-sight reception. It is possible to hear stations over 800 miles away. Amateur radio repeaters are another source of DX that you might hear from the other end of the duct.

These openings can last for several days, and signals will remain stable and strong for long periods during the opening. The duct may, however, move slowly, causing you to hear one signal well for a few hours, to then have it fade out and another station take its place from another area altogether.

Meteor Showers

For most of the spring season, very little meteor activity is expected. June has a possible strong shower, the *Boötids*, but no forecast has been offered for 2009. This shower is active from June 22 through July 2, with the peak occurring on June 27. The hourly visual rate can reach as high as 100 or more. The source of the *Boötids* is periodic comet 7P/Pons-Winnecke. *Boötid* meteoroids hit Earth's atmosphere with a velocity of 18 km/sec (40,000 mph).They are considered slow-moving meteors, making for strong VHF signal reflections off the plasma trails of the burning-up debris. It is worthwhile to give this one a try.

May and July have only minor showers or showers in the Southern Hemisphere. These showers typically have not yielded much radio activity. For more information on these, take a look at <http://www.imo.net/calendar/2009/>.

TE Propagation

A seasonal decline in TE (transequatorial) propagation is expected during May. An occasional opening may still be pos-

sible on VHF. The best time to check for VHF TE openings is between 9 and 11 PM local daylight time. These TE openings will be north-south paths that cross the geomagnetic equator at an approximate right angle.

The Solar Cycle Pulse

The observed sunspot numbers from December 2008 through February 2009 are 0.8, 1.5, and 1.4. Notice that the record of 0.8 for December 2008 is higher than the 0.5 recorded for both July and August of 2008. Statistically, it appears at this time that August 2008 is the lowest point of the minimum between Cycle 23 and Cycle 24. The smoothed sunspot counts for June, July, and August 2008 are 3.2, 2.7 and 2.6, rspectively.

The monthly 10.7-cm (preliminary) numbers from December 2008 through February 2009 are 69.2, 69.8, and 70.1. The smoothed 10.7-cm radio flux numbers for June through August 2008 are 69.2, 68.8, and 68.6.

The smoothed planetary *A*-index (*Ap*) numbers for June through August 2008 are 6.8, 6.6, and 6.2. The monthly readings for December 2008 through February 2009 are 2, 3, and 4.

The smoothed monthly sunspot numbers forecast for May through July 2009 are 12.6, 15.1, and 18.1. These predictions, however, may be too optimistic.

The smoothed monthly 10.7-cm numbers are predicted to be 71.5, 73.3, and 75.4 for the same months. If we take these numbers, we still see that Cycle 24 is upon us. Give or take about 12 points for all predictions.

(Note that these are preliminary figures. Solar scientists make minor adjustments after publishing, by careful review).

Feedback, Comments, Observations Solicited!

I look forward to hearing from you about your observations of VHF and UHF propagation. Please send your reports to me via e-mail, or drop me a letter about your VHF/UHF experiences. I'll create summaries and share them with the readership. Up-to-date propagation information can be found at my propagation center, <http://prop.hfradio.org/> and via cell phone at <http://wap.hfradio.org/>.

Until the next issue, happy weak-signal DXing.

73, Tomas, NW7US

By Rich Arland,* K7SZ

BEGINNER'S GUIDE

All you need to know but were afraid to ask . . .

Creating Your Station Setup

Welcome back to my column! I am writing this from the lanai at my daughter, Gwen's, new home in Tampa, Florida. The weather here in Tampa is in the mid-70s, sunny with a light breeze blowing in from the north. Rough duty, but somebody's gotta do it!

Florida weather is amazing. VHF+ operating is fantastic with all the FM repeaters available, not to mention what seems to be a DX pipeline that appears to terminate here in the middle of the state. While Gwen and her husband, Kyle, are both licensed hams, the CC&Rs of the housing area prohibit external antennas, so their on-the-air operations are relegated to whatever they can do while mobile. However, Florida is basically a flat topography, and a modest 40–50 foot tower and some Yagi antennas would make for some great DXing opportunities for terrestrial weak-signal work from Gwen's new home.

Ops Desks 101

Gwen is not the only one with a new QTH. Pat and I moved from Wilkes-Barre, Pennsylvania to Dacula, Georgia (about 40 miles ENE of Atlanta) just before Thanksgiving last year (2008). With each new QTH come challenges when setting up a ham station. Over the years, traveling the globe with the USAF, I have had ham shacks in closets, spare rooms, basements, attics, bedrooms, hall closets, in our 1978 VW van . . . just about anywhere you could imagine. After 20 years in our home in Pennsylvania, two things became immediately apparent as we prepared for our move south. First, "We have too much junk!" Man, it is mind-blowing how much "stuff" one can accumulate in a 20-year span in one location. Second, no matter how much thought is given to preparing the shack, shacks (like model-railroad layouts) are never finished. There are always improvements of one kind or another that can be made to facilitate operating efficiency, workbench area, test equipment bays, etc. Let's not forget the usual mess of coaxial cable, power cabling, and the occasional open-wire/ladder line. This adventure was no different.

We had lots of land on which to place antennas at our new Georgia location, but the trees were not placed correctly (imagine that!). I liberated one room (a small 9 × 14 foot room in the renovated former garage area) and proclaimed it "*The Shack.*" This will be my last shack, most probably, as I do not relish moving again, and therefore I decided early on to put some creative thought into preparing the room that would house my radios and my operating position. Pat was more than satisfied, as that room was one of two rooms on the very end of the house away from the normal foot traffic and entertainment areas of the new home. That meant that the normal rat's nest of wires, coaxial cables, and power leads, along with all the station accessories that are associated with a well-appointed ham shack, would not be visible to guests (and her) on a regular basis.

Me? *I love* the new shack. It's on a ground floor! The shack in our old home was on the third floor, so establishing a good RF ground (especially on HF) was a bit of an adventure. Gone are the days of having to negotiate several stairways every time I want to "play radio."

My operating position in my last shack was courtesy of Ikea. It had a nice computer-desk/console that I used for over ten years. I really liked that table. Not only was it relatively spacious, I could stack and position equipment for easy use and have a small computer with a 9-inch monitor (thanks to a recycled FedEx Power Ship I picked up at a hamfest) right at my elbow. Although the tiny FedEx computer was only a 386 processor and a very small drive (by today's standards), it worked well for logging, crunching satellite orbital data for working the OSCAR birds, as a packet radio terminal, and for general shack housekeeping chores. Oh, yeah . . . it was cheap, too! I hated to leave that ops desk at the old place, but we had run out of space to pack things in our large Penske truck and small covered trailer during our move.

Working with What You Have

The new shack was crying out for a new operating table/console/desk. My 40-plus years as a ham radio operator had taught me a few lessons regarding making versus buying to include homebrewed equipment, accessories, and operating/test benches. My goal this time around was to be as frugal as possible and assemble my shack using gear I already had on hand—ditto for the antennas and the test bench. This tack was used for several reasons: First, since retiring, Pat and I are living on a fixed income which leaves almost no discretionary funds for hobbies. Second, the state of the economy is, in a word, tenuous at the very least. The less money spent on shack accoutrements, the more money available for upgrading radio gear, test equipment, along with antennas and feedlines.

Initially, Pat and I agreed on spending no more than $99.99 on a new operating bench. Why $99.99? I thought it would be fun to claim that the new shack ops position was procured for under a hundred dollars! After researching various office-supply dealers such as Staples and Office Max, I settled on a nicely styled computer desk/console from Wal-Mart for only $69. On the surface, it initially fulfilled my basic needs and was a nice style (black desk writing surface and shelf over a silver metal framework) and came with a matching black-on-silver three-shelf bookcase for under $70! The great thing about this new desk is that it fits in the corner very nicely, and with a little "remodeling" has more room than initially thought (more on this in a moment).

Don't let FSS get a Foothold in Your Shack!

Flat Surface Syndrome (or FSS) is the scourge of every ham shack and/or work area. FSS is a corollary to Murphy's Law: Anything can and will go wrong at the

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least opportune moment. When dealing with FSS it is important to remember that it is entirely preventable, or so my CPA says. Of course, she is extremely anal retentive and I am not. Ergo, I have a seemingly un-winnable war in the progress of fighting FSS at the new shack.

Exactly what is FSS? In a nutshell, it is the ability of a stationary, flat surface to gather/collect all sorts of "stuff," which in turn makes that flat surface totally incapable of performing its original mission—in this case, functioning as my new operating table.

Dealing with FSS is simple: Keep it uncluttered, which is easier said than done, especially at the "Arland Ranch." However, my CPA (God bless her) has a simple secret: Handle each piece of paper, picture, book, etc, *only once*, putting the offending article of clutter in its proper place (bookshelf, receipt binder, filing cabinet, CD/DVD rack, etc). Again, that is easier said than done. However, with a bit of practice and an overwhelming desire to keep a tidy shack/work area, I have been able to make a huge dent in our ongoing war against FSS.

All kidding aside, if you want to have fun working the world via ham radio, you are going to have to be constantly on guard against the perplexing desire to dump/drop "stuff" wherever is handy. Just keeping a tidy shack area will actually make you want to go into the shack and operate/build. After all, ham radio is a hobby, right? Hobbies should be fun and not drudgery.

The purpose of sharing all of this seemingly nonsensical information is to guide you through the process of initially setting up your shack. Throwing money away on unnecessary "stuff" is almost a criminal act in today's economic upheaval. You want the "biggest bang for your buck," and that is where I come in. Obviously, for our shack the Wal-Mart desk/bookcase was a have-to-buy item, as we did not have an old desk or small table to convert into an operating position. However, if you do have access to a desk/table that you can press into service in your shack, by all means do so. Don't like desks? Have an old door or sliding doors from a bedroom remodeling exercise? These make great op and test benches by just nailing a 2×4 to the wall for rear support and adding a couple of front legs. Cheap, dirty, and fast, not to mention cheap . . . oh, I guess I did already!

KISS: Keep It Simple . . . Silly!

In the immortal words of Commander Scott, Chief Engineer of the starship Enterprise, NCC-1701, "The more complex they make the plumbing, the easier it is to plug up the toilet!" Words to live by. Thanks, Scotty!

This idea not only applies to starships, but to just about everything you do in life. Therefore, some real planning must go into your new shack area before you plop yourself in front of a radio and start calling "CQ."

Using the KISS principle, draw up an outline and a simple wiring diagram of your new shack. Show the routing of power cables, power supplies, coaxial cables, feedlines, etc. This allows you to quickly make changes and upgrades to your shack without a lot of hassle, because you will have diagrams at your immediate disposal.

In the interest of pre-planning, grab a sheet of graph paper or two and lay out your shack and yard in scale on the graph paper. That way you can visualize the shack and proposed antenna farm and position things for optimal efficiency and the shortest feedline runs. Remember, we are now playing in the VHF/UHF arena, so using short feedlines to reduce system losses and keep system noise in check is a must. Unlike HF operating, VHF+ is unique in that the feedline requirements are much more stringent, and that equates to more expensive per foot. By plotting your antenna farm in detail on graph paper, you can accurately calculate the length of feedline runs, so when you are at the point of procuring coaxial cable you won't waste money buying extra feedline you won't use. It's always good to be able to plot the final placement of your gear, antennas, and accessories.

Putting all (and I do mean *all*) of your equipment manuals into a binder(s), along with any modifications and station wiring schematics, will create what we in the military communications arena call a "Station Engineering Manual," which is worth its weight in gold. I have done this for over 20 years, and it is very easy to find manuals when the rig or an accessory goes belly up. Ditto with quickly swapping out gear: It's always nice to know which coaxial cable goes where to prevent miss wiring a piece of expensive gear.

A Station Engineering Manual does not have to be an extensive work of art, just the basics of how your shack is put together and one location for all of your operating and maintenance manuals. Besides, the professional communicators do it for a reason, and their methodology is worth incorporating into your shack. Believe me, you won't regret the effort.

Antennas Anyone?

With a new QTH comes the ever-present task of placing and erecting antennas. Thankfully VHF+ antennas are small, easily handled by one person while erecting them, and they are relatively easy to homebrew with basic hand tools. This is a "win-win-win" situation for the VHF operator.

Our new home was originally constructed in 1987, so it is a relatively new-style construction. One of my primary missions is to ensure this shack is going to be not only functional, but will look great, too.

Having used inside antennas before at several locations, I did a quick survey of our new attic area. I was surprised to find that it was totally empty (except for insulation and power wiring), and there was a lot of headroom at the apex of the roof—perfect for an indoor dipole for HF. If the house was only 5 feet longer, a full-size 40-meter halfwave dipole would fit perfectly. This time, however, I had to bend each end down to secure the last two feet of each end of the dipole. I am feeding this HF dipole with 300-ohm ladder line so it will perform over the majority of the HF spectrum.

I know, I know . . . you really don't care about my HF antennas, but you want to know how I tackled the VHF+ antenna situation. OK, here goes.

Initially I had decided to run all the RF feedlines down to the shack inside the walls and not just bore holes in the side of the house (similar to how the satellite TV installers do). Of course, there area several commercial vendors, MFJ is one, that offer a through-window antenna feed through. I had one and it was more than adequate for the job at hand. However, this time I wanted to do a more professional installation by running the RF cabling from the roof area down to the shack inside the walls. In the attic, I drilled down (after several trips up and down the ladder) and hit the header 2×4 dead center with a 1-inch wood bit. After punching four holes in the wall header, I used a wire "snake" to bring up four runs of masonry twine from inside the shack via a rectangular opening in the shack wall that I had previously cut through the dry wall. Each piece of twine was secured to a length of either RG-213 or Belden 9913/F7 coaxial feedline. An additional run of 300-ohm transmission line for the HF dipole was

added, as was a run of RG-58/U for an indoor 2-meter beam for FM repeater work.

I know what you're thinking: "What are you going do with that big rectangular hole in your shack wall, Arland?" That is where an 8×8 piece of 1/8-inch aluminum comes in. I had this piece of metal kicking around the shack for a couple of years, so after drilling several 5/8-inch holes to accommodate SO-239 feed-through connectors, some insulated jacks for the ladder line, and one ground lug, I secured this to the wall using dry-wall anchors and screws. The coaxial cables come in from the roof, down the wall of the shack, and terminate in PL-259s behind the panel. These are mated with the SO-239 feed-throughs and a coaxial jumper is then attached to the shack side of the feed-throughs, going to a specific radio set. All in all, a very nice, tidy, and professional-looking installation, and easy to access for more feedlines, should the need arise. Once I get the tripod on the roof with the rotator and the VHF stack functional, I will bring the rotator cabling down the wall just like the feedlines and terminate it in a Molex connector on the aluminum panel. The rotator control box will plug into the Molex connector to finish the installation.

Antenna Thoughts

Initially my idea was to obtain an 8-foot Glen Martin roof tower on which to mount my VHF+ and OSCAR antennas. Then reality set in and I realized that it would be a while before I could afford to implement this antenna farm. In keeping with the "less is more" concept, I decided to use what I had on hand to get some VHF+ antennas in the air before the ARRL VHF Sweepstakes in January.

Six 4-foot sections of fiberglass military antenna mast affixed to the back porch roof joists, and three Halo antennas for 6, 2, and 70 cm would at least get me on the air for the contest. Although my ultimate VHF+ stack would consist of 5-over-5 for 2 meters, a 3-element 6-meter Yagi, and a Quagi for 70 cm, sitting atop the roof, I was quite content to erect these three omni antennas as an interim measure. Total cost for this down-and-dirty VHF+ installation: $0.00, as everything was on-hand, left over from various other antenna installations over the years. How well does this antenna stack work? The ARRL VHF Sweepstakes will give me a good indication of efficiency. In the meantime, I will be saving my pennies for that Glen Martin roof-tower! 73, Rich, K7SZ

CQ's 6 Meter and Satellite WAZ Awards

(As of March 1, 2009)

By Floyd Gerald,* N5FG, CQ WAZ Award Manager

6 Meter Worked All Zones

No.	Callsign	Zones needed to have all 40 confirmed
1	N4CH	16,17,18,19,20,21,22,23,24,25,26,28,29,34,39
2	N4MM	17,18,19,21,22,23,24,26.28.29,34
3	JI1CQA	2,18,34,40
4	K5UR	2,16,17,18,19,21,22,23,24,26,27,28,29,34,39
5	EH7KW	1,2,6,18,19,23
6	K6EID	17,18,19,21,22,23,24,26,28,29,34,39
7	K0FF	16,17,18,19,20,21,22,23,24,26,27,28,29,34
8	JF1IRW	2,40
9	K2ZD	2,16,17,18,19,21,22,23,24,26, 28,29,34
10	W4VHF	16,17,18,19,21,22,23,24,25,26,28,29,34,39
11	GØLCS	1,6,7,12,18,19,22,23,28,31
12	JR2AUE	2,18,34,40
13	K2MUB	16,17,18,19,21,22,23,24,26,28,29,34
14	AE4RO	16,17,18,19,21,22,23,24,26,28,29,34,37
15	DL3DXX	18,19,23,31,32
16	W5OZI	2,16,17,18,19,20,21,22,23,24,26,28,34,39,40
17	WA6PEV	3,4,16,17,18,19,20,21,22,23,24,26,29,34,39
18	9A8A	1,2,3,6,7,10,12,18,19,23,31
19	9A3JI	1,2,3,4,6,7,10,12,18,19,23,26,29,31,32
20	SP5EWY	1,2,3,4,6,9,10,12,18,19,23,26,31,32
21	W8PAT	16,17,18,19,20,21,22,23,24,26,28,29,30,34,39
22	K4CKS	16,17,18,19,21,22,23,24,26,28,29,34,36,39
23	HB9RUZ	1,2,3,6,7,9,10,18,19,23,31,32
24	JA3IW	2,5,18,34,40
25	IK1GPG	1,2,3,6,10,12,18,19,23,32
26	W1AIM	16,17,18,19,20,21,22,23,24,26,28,29,30,34
27	K1LPS	16,17,18,19,21,22,23,24,26,27,28,29,30,34,37
28	W3NZL	17,18,19,21,22,23,24,26,27,28,29,34
29	K1AE	2,16,17,18,19,21,22,23,24,25,26,28,29,30,34,36
30	IW9CER	1,2,6,18,19,23,26,29,32
31	IT9IPQ	1,2,3,6,18,19,23,26,29,32
32	G4BWP	1,2,3,6,12,18,19,22,23,24,30,31,32
33	LZ2CC	1
34	K6MIO/KH6	16,17,18,19,23,26,34,35,37,40
35	K3KYR	17,18,19,21,22,23,24,25,26,28,29,30,34
36	YV1DIG	1,2,17,18,19,21,23,24,26,27,29,34,40
37	KØAZ	16,17,18,19,21,22,23,24,26,28,29,34,39
38	WB8XX	17,18,19,21,22,23,24,26,28,29,34,37,39
39	K1MS	2,17,18,19,21,22,23,24,25,26,28,29,30,34
40	ES2RJ	1,2,3,10,12,13,19,23,32,39
41	NW5E	17,18,19,21,22,23,24,26,27,28,29,30,34,37,39
42	ON4AOI	1,18,19,23,32
43	N3DB	17,18,19,21,22,23,24,25,26,27,28,29,30,34,36
44	K4ZOO	2,16,17,18,19,21,22,23,24,25,26,27,28,29,34
45	G3VOF	1,3,12,18,19,23,28,29,31,32
46	ES2WX	1,2,3,10,12,13,19,31,32,39
47	IW2CAM	1,2,3,6,9,10,12,18,19,22,23,27,28,29,32
48	OE4WHG	1,2,3,6,7,10,12,13,18,19,23,28,32,40
49	TI5KD	2,17,18,19,21,22,23,26,27,34,35,37,38,39
50	W9RPM	2,17,18,19,21,22,23,24,26,29,34,37
51	N8KOL	17,18,19,21,22,23,24,26,28,29,30,34,35,39
52	K2YOF	17,18,19,21,22,23,24,25,26,28,29,30,32,34
53	WA1ECF	17,18,19,21,23,24,25,26,27,28,29,30,34,36
54	W4TJ	17,18,19,21,22,23,24,25,26,27,28,29,34,39
55	JM1SZY	2,18,34,40
56	SM6FHZ	1,2,3,6,12,18,19,23,31,32
57	N6KK	15,16,17,18,19,20,21,22,23,24,34,35,37,38,40
58	NH7RO	1,2,17,18,19,21,22,23,28,34,35,37,38,39,40
59	OK1MP	1,2,3,10,13,18,19,23,28,32
60	W9JUV	2,17,18,19,21,22,23,24,26,28,29,30,34
61	K9AB	2,16,17,18,19,21,22,23,24,26,28,29,30,34
62	W2MPK	2,12,17,18,19,21,22,23,24,26,28,29,30,34,36
63	K3XA	17,18,19,21,22,23,24,25,26,27,28,29,30,34,36
64	KB4CRT	2,17,18,19,21,22,23,24,26,28,29,34,36,37,39
65	JH7IFR	2,5,9,10,18,23,34,36,38,40
66	KØSQ	16,17,18,19,20,21,22,23,24,26,28,29,34
67	W3TC	17,18,19,21,22,23,24,26,28,29,30,34
68	IKØPEA	1,2,3,6,7,10,18,19,22,23,26,28,29,31,32
69	W4UDH	16,17,18,19,21,22,23,24,26,27,28,29,30,34,39
70	VR2XMT	2,5,6,9,18,23,40
71	EH9IB	1,2,3,6,10,17,18,19,23,27,28
72	K4MQG	17,18,19,21,22,23,24,25,26,28,29,30,34,39
73	JF6EZY	2,4,5,6,9,19,34,35,36,40
74	VE1YX	17,18,19,23,24,26,28,29,30,34
75	OK1VBN	1,2,3,6,7,10,12,18,19,22,23,24,32,34
76	UT7QF	1,2,3,6,10,12,13,19,24,26,30,31
77	K5NA	16,17,18,19,21,22,23,24,26,28,29,33,37,39
78	I4EAT	1,2,6,10,18,19,23,32
79	W3BTX	17,18,19,22,23,26,34,37,38
80	JH1HHC	2,5,7,9,18,34,35,37,40.
81	PY2RO	1,2,17,18,19,21,22,23,26,28,29,30,38,39,40
82	W4UM	18,19,21,22,23,24,26,27,28,29,34,37,39
83	I5KG	1,2,3,6,10,18,19,23,27,29,32.
84	DF3CB	1,2,12,18,19,32
85	K4PI	17,18,19,21,22,23,24,26,28,29,30,34,37,38,39

*17 Green Hollow Rd., Wiggins, MS 39577; e-mail: <n5fg@cq-amateur-radio.com>

By Mark Thompson, WB9QZB

DIGITAL RADIO

Digital Technology on VHF, UHF, and Microwaves

Digital Modes
They're Not Just About Data Anymore

Until recently, when ham radio operators considered operating the digital modes, that usually meant some form of data transmission.

Hams became involved in digital in the late 1040s by using surplus Baudot-format mechanical teletype equipment. The teletype machines were large, heavy, and noisy. They printed on yellow roll-type paper. Some machines had the optional paper tape punch. With it you could record material in advance on paper tape. The paper tape could then be transmitted at full speed later. This was especially useful for bulletin transmissions.

Ham radio teletype was called RTTY. RTTY equipment was used on HF to make keyboard QSOs and receive bulletins, such as those from the ARRL. RTTY had no error correction, so signal fading and noise on HF could cause many errors.

In the 1970s some hams interfaced their RTTY equipment to 2-meter FM transceivers to monitor messages from local hams in a mode called *auto-start*. In some areas FM repeaters were used to extend the range of RTTY auto-start activity and to disseminate bulletins.

For those more than 30 years, Baudot RTTY is what digital meant in ham radio. Up until the early the 1980s five-bit Baudot was the only mode the FCC allowed on ham radio. Baudot only contained upper-case letters. You might have seen a copy of a Western Union telegram or an AT&T Telex printed using Baudot.

However, with the advent of personal computers, in the 1970s hams wanted to use ASCII. ASCII code has more characters, including lower case and additional punctuation. Hams appealed to the FCC, which approved the use of ASCII in the early 1980s. They used more modern teletype and computer terminals to transmit and receive ASCII RTTY. Some hams at the time also developed programs for the early PCs to transmit and receive both Baudot and ASCII RTTY.

In the 1980s a group of hams invented packet radio, which used the ASCII code. Packet radio required that a packet be received correctly or it was retransmitted. On the VHF/UHF bands this led to very accurate transmission of data. However, noise and signal fading on HF caused packets to be retransmitted over and over again, resulting in the 300-baud transmission speed dropping dramatically.

Hams developed BBS (bulletin board systems) accessible on VHF and UHF in most areas of the country. Terrestrial forwarding networks were developed to forward e-mails across the country and the world. HF gateways were developed to allow long-distance forwarding of messages between BBSes.

In the late 1980s and early 1990s many of the packet radio TNCs (terminal node controllers) were extended to include other ASCII-based text modes such as AMTOR, Pactor, and G-TOR. Modes such as AMTOR had error correction, which RTTY did not.

In the mid-1990s the internet became available. Many hams abandoned packet radio to use the internet. As a result, the BBSes and forwarding networks fell into disuse and many were taken off the air.

In the late 1990s major developments occurred in ham radio data modes. PSK31 was developed. It performed much better in weak-signal conditions on HF than the other data modes. In addition, it was the first mode to use a PC soundcard with a computer program and did not require dedicated hardware customized for a specific mode.

Over the next few years numerous soundcard data modes were developed for many different uses. Eventually hams began to develop digital voice modes using PC programs and soundcards. These are the typical digital voice modes used on HF radio today.

HF digital voice modes currently are evolving. HF has many unique, or more pronounced, problems than VHF/UHF, such as QRN, QRM, fading, and multipath. These are the same problems that historically caused problems for RTTY. As the technologies advance, I expect many of these problems will be solved. In my opinion, an SDR radio should be an ideal platform for the deployment of HF digital voice modes, since it can be easily upgraded in software as technology improves and eliminates the requirement of a PC with a soundcard to use digital voice. Building digital voice into as SSB or FM transceiver would cause digital voice to become much more popular and easy to use.

VHF/UHF Digital Voice

On VHF and UHF digital voice developed differently. A company named DVSI developed and patented vocoder technology using the names IMBE and AMBE. DVSI's digital technologies were adopted by the public-safety organization APCO and commercial manufacturers such as Motorola, Kenwood, Vertex, and ICOM. APCO has designated P25 as a standard for digital voice transmission in the pubic-safety world. P25 can be used in both simplex and with a traditional repeater. P25 can also be the basis of expensive and complicated trunking technologies which conserve spectrum and provide new capabilities.

Early adopters of digital voice on VHF/UHF often used surplus P25 radios. While P25 has the inherent advantage of all digital voice modes—the lack of path noise—the radios tended to be expensive and were not easily frequency-agile, since most did not have a VFO. P25 radios and repeaters are designed for public safety, not ham radio, and therefore do not have some capabilities desirable in ham radio, such as callsign identification of radio transmissions and built-in internet networking.

The first ham radio rig designed for

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ham radio was produced by Alinco. However, since it did not have a compatible repeater or other system capabilities, it never gained much popularity.

Enter D-STAR

A few years ago the JARL in Japan developed the open protocol D-STAR. ICOM was the first manufacturer to make D-STAR radios, repeaters, and an internet-based gateway to connect users and repeaters together worldwide. Any manufacturer can make D-STAR radios, and it is expected another will enter the market.

Since all D-STAR radio transmissions are uniquely identified by a callsign programmed into the radio, transmissions can be routed by the system. In addition, the D-STAR protocol and radios allow for concurrent transmission of low-speed, approximately 1-kb/sec ansynchronous data with a digital voice transmission. This low-speed data capability built into every D-STAR digital voice radio allows for the transmission of GPS data, text messages, small text files and low-resolution web-cam pictures. Hams have extended the D-STAR environment to include repeater-to-repeater linking such as IRLP and access to the D-STAR network from a PC using a DV-Dongle. More technologies have been developed to adapt narrow-band analog FM rigs with a 9600-baud data port to transmit and receive D-STAR.

Advantages of Digital Voice

Digital voice on both HF and VHF/UHF has the advantages of narrower bandwidth and no path noise. As a signal gets weaker or fluctuates, it does not get noisy like an analog FM signal does. This results in greater effective range on VHF/UHF than traditional FM. Many hams who have never used digital voice mistakenly believe digital voice can't work as well as FM because their cell phones get garbled when weak. There are several recordings available that compare weak digital voice to weak FM. The weak digital voice signal is clear with no noise, whereas the weak FM signal has a lot of path noise to the extent that the voice audio can hardly be heard.

Where to go to Learn More

At the ARRL/TAPR DCC (Digital Communications Conference) in 2008 in Chicago digital voice was well covered. We had presentations in both the technical and introductory tracks about HF and VHF/UHF digital voice. We had the first-ever D-STAR get-together on Friday evening with many D-STAR technology innovators making presentations. At the DCC, D-STAR 70-cm and 23-cm digital voice repeaters were running connected to the internet gateway for use by DCC attendees.

I encourage everyone who has an interest in digital voice and data communications to attend both the Dayton Hamvention® and the Digital Communication Conference.

At the Hamvention®, TAPR sponsors a digital forum and a joint AMSAT/TAPR evening banquet. DARA (Dayton Amateur Radio Association), sponsor of the Hamvention®, now has D-STAR repeaters on the air in Dayton, and ICOM demonstrates D-STAR radios and repeaters at the Hamvention®.

The DCC will again be back in Chicago in 2009. It is a great way for both experienced and new operators of the digital modes to learn more about the technologies. If you have experience using digital data or voice technology or innovating a new digital technology, please consider submitting a paper to be included in the *Proceedings* and perhaps present your paper at the DCC. You can learn more about the 2009 DCC at <http://www.tapr.org/dcc.html>.

I look forward to seeing many of you in May at the Dayton Hamvention® at the digital forums, at the DCC in Chicago in September 2009, and on the D-STAR worldwide network using digital voice.

73, Mark, WB9QZB

By Dr. H. Paul Shuch,* N6TX

DR. SETI'S STARSHIP

Searching For The Ultimate DX

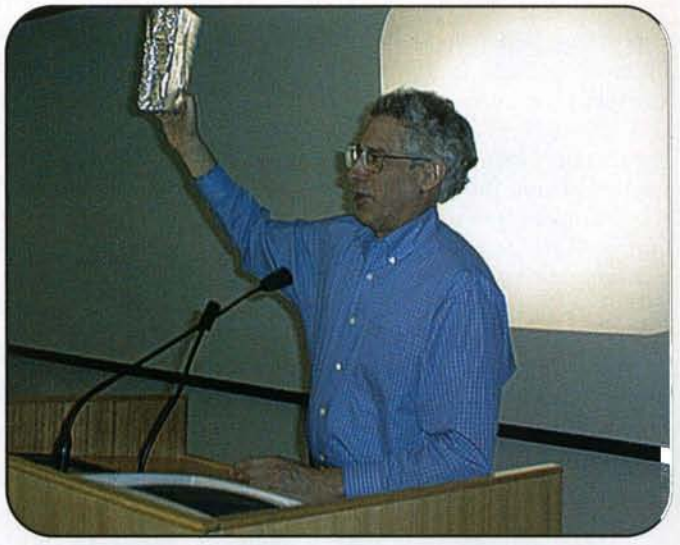
Betting on SETI Success

If I were a betting man (I am) and had money to put down on the table (I don't), I'd wager that our first encounter with alien intelligence will be via interstellar microwave contact. Perhaps that's because of my ham radio background. It just stands to reason that photons are not only the fastest spaceship in the universe, but also the cheapest. Microwave photons (the substance of electromagnetic communications) are both massless and relatively energetic. They traverse the interstellar medium at the fastest speed that Einstein would allow, relatively unimpeded, while carrying information from point A to point B. For practical purposes, the power requirement for transiting the interstellar gulf can be measured in kilowatts.

Contrast this with interstellar flight, our most likely alternative search strategy. Fermions (the stuff of which we, and our machines, are made) have mass, and both Newton and Einstein agree that accelerating mass to great velocity requires great energy. Thus, sending a cosmic message in a physical bottle will require not kilowatts, but billions of Terawatts of energy. No advanced technology that I can imagine is capable of overcoming this barrier. As Mr. Scott (my favorite engineer) told Kirk in *Star Trek*, "Captain, I canna' change the laws of nature."

Allen Tough believes otherwise. You have met Prof. Tough previously in these columns. He's the futurist from the University of Toronto who founded Invitation to ETI (extraterrestrial intelligence), the web-based project designed to stimulate dialog between us and our cosmic companions. Allen envisions an advanced nano-robotic technology that will permit low-cost, possibly self-replicating, autonomous interstellar probes. Based upon the undisputable fact that humanity is well on its way to developing such technology, Allen reasons that a more advanced civilization by now will have launched a fleet of such miniature robot probes, some of which may already have reached our solar system. It is with these probes, rather than their creators, that Allen is betting we will first communicate.

Allen Tough and I have long debated whether it is interstellar photons, or interstellar probes, that will give us our first taste of interstellar contact. Now comes Long Bets (www.longbets.org), the Arena for Accountable Predictions, a web-based wagering facility launched by the futures-oriented Long Now Foundation. The purpose of Long Bets is to improve long-term thinking. Long Bets is a public arena for enjoyably competitive predictions, of interest to society, with philanthropic money at stake. The Long Now Foundation furnishes the continuity to see even the longest bets through to public resolution. Its website provides a forum for discussion about what may be learned from the bets and their eventual outcomes. Allen threw down the gauntlet at Long Bets, and I picked it up. His prediction: "Evidence of extraterrestrial intelligence within the solar system will be confirmed before evidence from several light-years away."



It may indeed look like a tissue box covered with aluminum foil, but the object Allen Tough is holding up, he assures us, is a prototype interstellar robotic nano-probe.

Even though I personally disagree, there is some logic behind Allen's prediction. Here is his rationale:

> Most SETI scientists agree that any ETI we detect will likely be thousands or millions of years ahead of us (because our sun and our science are so young). Such an advanced society will likely have the *capacity* to build and launch cheap, smart autonomous probes to explore the galaxy. This statement is supported by our recent theoretical and engineering advances in robotics (Ray Kurzweil, Hans Moravec), molecular manufacturing (nanotechnology), and interstellar propulsion (beam propulsion and even more radical possibilities). Also, an advanced society will likely be *motivated* to send out exploratory probes, judging by our own society, which sends spacecraft to explore everything within reach.
>
> If such a probe were sent a few centuries ago to explore Earth, it would likely be here by now. We might stumble on it somewhere on Earth by accident. Or we might find it through the ongoing monitoring carried on by scientists, security and intelligence agencies, and the military. Or one report in the flood of UFO and abduction reports might turn out to be a genuine alien. Or one of our space exploration programs might find some alien artifact somewhere in the solar system. Or ETI might reply to the Invitation to ETI issued by 100 scientists, artists, and others at <http://www. ieti.org>. (As the founder and Chief Scientist of this innovative SETI project, I am naturally optimistic about its chances of success.)

I've gone on record as betting against my respected colleague, not because I think Allen is wrong about interstellar probes, but

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because we don't yet know how to detect them. It's a matter of instrumentation. Although we've gotten very good at intercepting electromagnetic waves, our record for detecting even nearby natural space debris is not too stellar (pun completely intentional).

Although I do not at all question the likely existence of interstellar probes within our solar system, I consider interstellar electromagnetic (EM) leakage (or, if we are extremely fortunate, deliberate radio or optical beacons) much easier to detect with our present level of technology. Thus, selectivity factors in the instrumentation favor detection of interstellar EM artifacts first. (As our techniques improve, the odds of detection will ultimately shift. Therefore, I guess by betting on interstellar EM signals, I'm siding with those who believe contact will occur in the short term.)

Allen has argued (most convincingly, I might add) that any super-smart alien robot that is sophisticated enough to come here will be quite capable of initiating contact, or even of responding to our joint invitation at <http://ieti.org>. Although I certainly hope this is the case, it does put us in the role of passive communications partners, waiting for ETI to take the first step. Being no wallflower, I personally advocate a more proactive approach, preferring to put our eventual entry into the galactic community squarely in the hands of humanity. Assuming the existence of extraterrestrial intelligence (without it, this bet can neither be won nor lost), traditional interstellar SETI makes us solely responsible for the success or failure of our efforts. Should ETI decide to step in and shortcut the process, I for one will be delighted at the contact, although dismayed that my friend Allen will end up winning this bet!

Prof. Tough and I each have put a couple of hundred dollars on the line with Long Bets. The rules of Long Bets specify that once a bet is settled, it is a designated charity, rather than the parties to a wager, that will receive the funds on deposit. Allen has generously stated that if he prevails in his bet, the winnings will be contributed to the nonprofit SETI League, a ham radio organization near and dear to my heart. In putting up money against him, I too have designated that worthy grassroots organization as recipient of any funds, once the bet is settled. That way, either way, this will be a no-lose bet! 73, Paul, N6TX

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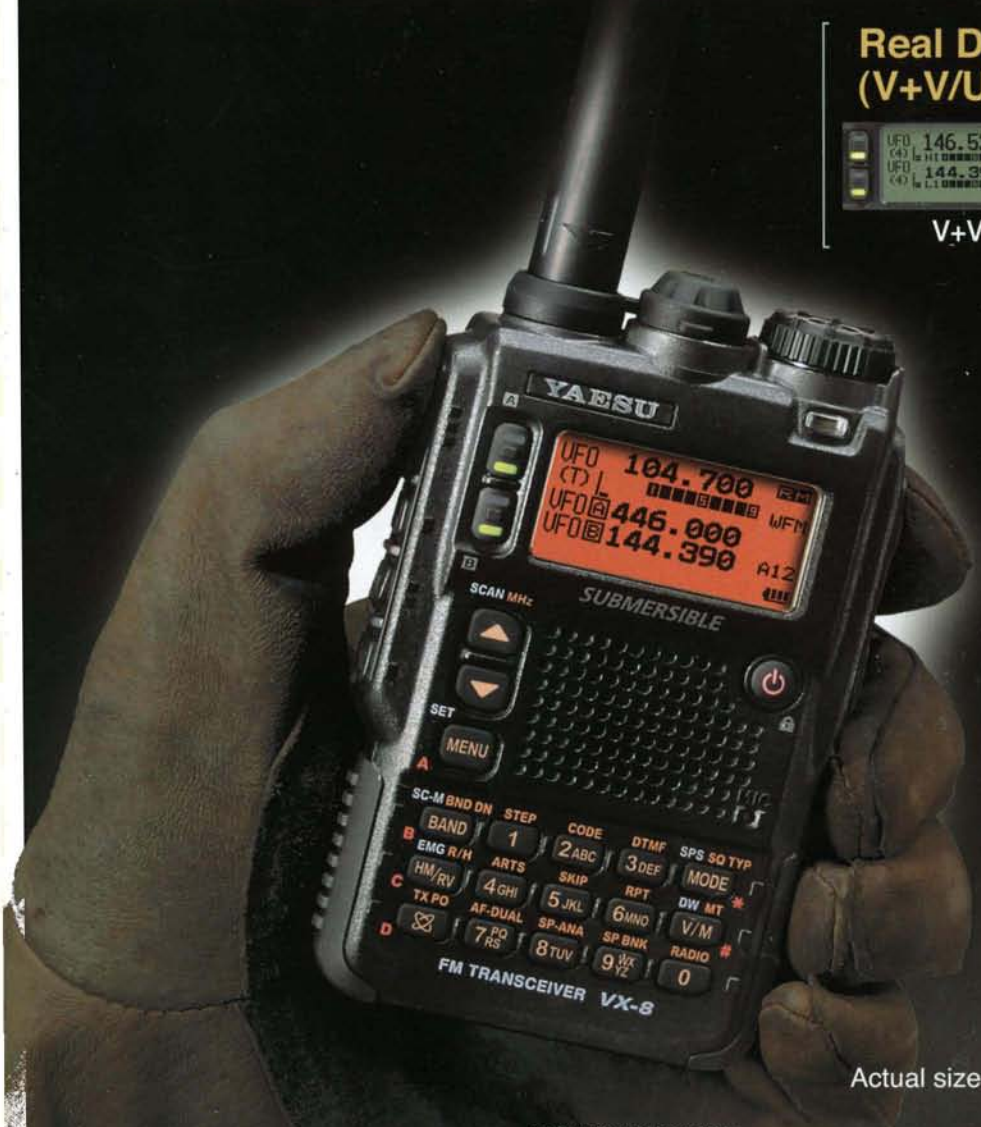

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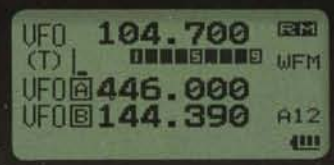

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