As I write this note, I am mindful that when you read it you will have celebrated the arrival of a new year. So please accept my heartfelt wishes that 2015 will find you and yours in good health, and enjoying happiness.

I congratulate PARC's past president, Dennis (KD6TUJ) for superb execution of his Presidential responsibilities. Dennis brought enthusiasm to all his actions, and helped put PARC on the map of local amateur radio activities.

It is my hope that I will be skilled enough to continue that path. First, I thank many of you for your strong support through a hotly contested election for the PARC Presidential seat! I hope not to disappoint you.

I must comment on some things I believe are worthy objectives for the continued success that PARC is having in the ham radio hobby, or as some would say, art. If you have other things you believe we should be doing, please let me know. You can always reach me at NN3V@arrl.net.

We must encourage greater participation of our members in the activities planned by the club. From Field Day, through operating days, to the club picnic and activities that support teaching others about technology and our hobby, none of those efforts are successful without participation of more members. It is nice to have a volunteer lead an activity, but the activity has little value if others do not participate. Ask yourself when the last time was when you "Elmered" a new ham? Most club activities gear themselves to Elmering opportunities if we go the extra mile to attract new hams.

Club members also must be aware that the ham radio technology world is moving ahead, and some of our infrastructure is getting a bit "long in the tooth". The PARC Board is moving forward with plans to upgrade our repeaters to the new world of digital technology. Do you know what that means and how you will use it? I have an objective of making ham radio's digital world something you appreciate and look forward to using. The technology update will go a long way in refreshing the Club's repeater site, and that is needed if we are to continue enjoying the services of the infrastructure that you pay for.

And along the lines of infrastructure care and maintenance, those things cost money. I will devote attention to looking at ways to cut the costs of running the Club. The things we do cost money. So judicious management of those funds is important. I hope you find that the measures we undertake give you greater understanding of the expenses, and an opportunity to contribute where you can.

73 de NN3V
Charlie

Save the Date

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

The Ham Radio Lunch Bunch meets Fridays for lunch and socializing at any one of a number of restaurants on a rotating schedule.
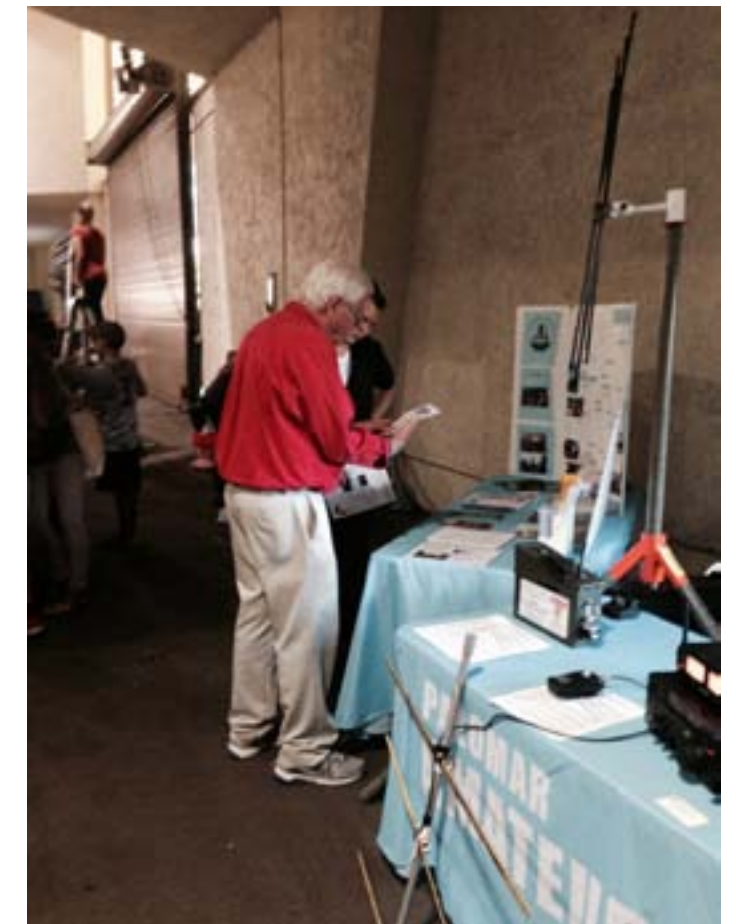
The Lunch Bunch signup is

http://w0ni.com

Reminders are sent out on Wednesdays.

All are welcome for food and fun!

Some of the restaurants on the schedule are Fuddruckers, UTC Food Court, Spices Thai, Savory Buffet, Denny's, Callahan's Pub and Grill, and Phil's BBQ.

STEAM Maker Fest - PARC Booth

STEAM Maker Faire 2014 - video from the floor

The Great Shoot-Out of 2014
Part 2

Dennis N6KI

Howard was told repeatedly that the receiver comparisons would be done by "ear" only.

The receiver test was never intended to be "scientific" and when the FLEX radio couldn't hear signals any better than the Elecraft K3, ICOM 7800 or Elecraft KX3, Howard had to fill the air with smoke and hyperbole to hide his embarrassment of failure.

The non-scientific audio recordings of the four receivers, presented here in the digital issue of the Scope, show that the signals received by the FLEX had no brilliance and were slightly muffled compared to the other radios mentioned above.

Howard had every opportunity to tweak and peak the FLEX radio to produce recordable CLEAR audio that would show that the FLEX could hear weak SSB signals better than the three other contender receivers mentioned above by the four other hams who attended the test session.

The only thing Howard won was the "Generation of HOT AIR", Contest!

Therefore, this is my official response: https://www.youtube.com/watch?v=67qScvVrEP8

Howard arrived late as usual and with the help of Dick K6KAL and John W6JBR, spent just over an hour reassembling Howard's FLEX station. So when Howard was happy with setup and was out of my way, I then came in and got the K3, KX3 and ICOM IC-7800 set up. Did I have some technical difficulty for a few moments? Well, yes, some of my contest club Ops had mucked up some of the dozens of configuration menus of my K3 and IC-7800, unlike Howard's ready to go FLEX, which he alone diddles at home with for hours on end trying to make the vapor-ware driven radio work like some of our top notch rigs, BUT, ACCORDING TO Dr. White, "we have only OBSOLETE LEGACY RADIOS"

Howard or I then tuned in the weakest SSB station we could find on whatever frequency band was most active at the moment, insuring the maximum amount of QRM from adjacent stations.

I told Howard to tune that station in and tune any interference out with all the resources available to him with his FLEX 6700. After Howard was satisfied that he had done everything in his FLEX's system to make that weak station understandable by anyone who was on site and desired to listen in, (we had four sets of headsets available, 3 Heils and whatever brand Howard brought for his challenged hearing condition) I then tuned in the same station on a K3, KX3 and an ICOM IC-7800 and quickly determined that the K3 consistently won out over the KX3 and IC-7800 in its ability to hear a weak station with QRM and QRN.

Receive audio to all the radios under test was controlled with the use of a Berringer audio control panel/mixer and a Berringer 1 to 4 output variable amplitude headset splitter to account for impedance difference in any of the headsets and a very well isolated antenna splitter so the Flex and K3 always received simultaneously with the same antenna.

Well, the FLEX, at best, could equal the K3's signal strength and but the signal clarity or brilliance just wasn't to be attained by the FLEX, meaning that the FLEX had a slightly hollow muffled sounding audio, most likely due to "over-processing" when Howard would make adjustments to the FLEX.

It turned out the K3 had the best clarity 90 percent of the time for test stations signals that Howard had "tuned" in. So, feeling sorry knowing that Howard was not really someone one could call a "proficient" radio operator, I and sometimes John W6JBR (EX WA2OOB who is a retired Hollywood Movie industry Audio Engineer with 75 IMDB credits and 30+ years as an excellent amateur operator) one of my best contest SSB trainees and Dave N6EEG, one of best SSB contest Ops with over 5 years SSB contest operating experience at the Nash-Ville test site, either directed Howard to make adjustments to the signal on the FLEX which could not be clearly tuned in and understood by the above mentioned experienced Ops. At times we actually put our hands on a external optional knob so we could adjust the FLEX so it at least, audio-wise, have some brilliance or clarity for the audio heard in our head sets.

Shoot Out Audio - Decide for Yourself

PY2NY CQ 59 11.MP3

JF2QNM CQ 59 25 1.MP3

W6TK CQ 59 03.MP3

JF2QNM CQ 59 25 2.MP3

IR2L CQ 59 15.MP3

LY7A CQ 59 15.MP3

Lunch Bunch - Food and Fellowship

Lunch bunch photos from August and December. Top, the group convenes at Fuddruckers. Middle left, KK6OOZ tries out the customized drink dispenser. Middle right, the bunch that braved a downpour to eat at a Chinese buffet! Bottom left, the bunch organizer, W0NI, imparts some wisdom. Bottom right, W0NI invites all Scope readers to attend!

Photos by Michelle W5NYV

PARC - A Year in Review

Palomar Amateur Radio Club in Action

by kk6frk@arrl.net

The Summer and Fall of 2014 has been a busy time for members of the **Palomar Amateur Radio Club (PARC)** in engaging our surrounding communities, especially youth. Our key activities have focused on Cub Scouts and Boy Scouts through events ranging from:

- ARRL Kids Day on June 21st in Poway
- **Radio Merit Badge** at the PARC Field Day on June 28th
- **Radio Merit Badge** the ARRL Southwest Convention on September 13
- Boy Scout Black Mountain District Emergency Preparedness Event on September 27, and
- 57th **Annual Boy Scout Jamboree** over the Air on October 18th at Camp Balboa, featuring the **Radio Merit Badge** and an Introduction to Radio

Photos - Brian Tagg - AG6CF at ARRL Kids Day – A 3 year old takes over Brian's rig and Cub Scout from Pack 342 gets on the air for the first time. Notice that Brian is sporting his cool PARC badge and showing off is go box to visitors in Old Poway Park.

The **PARC** Field Day was awesome. Field Day is one of the best venues to introduce the public, especially Scout age youth to the wonders of radio. **PARC** hosted a **Radio Merit Badge** for over 20 Boy Scouts, and many parents stayed the whole day to learn about radio science and it's role in science, technology, engineering, and math education.

Photo – Boy Scouts at PARC Field Day 2014 Mike Binder - NA6MB explains how the sun charges the atmosphere and how it influences radio communication, and John Rotondi – WA2OOB answers questions from Scouts about antennas

PARC and the Boy Scouts were out in full force for the **ARRL Southwest Convention**. Over 20 Scouts earned their **Radio Merit Badge** thanks to Conrad Lara – KG6JIE, Bob Shoemaker – KG6EJW, Kevin Walsh – KK6FRK, Dennis Baca – KD6TUG, Mike Binder – NA6MB, Thurston Watson – KK6NPD, Roger Hort – KK6CTI, and Charlie Restorcelli – NN3V.   A big thanks to Mike Maston – N6OPH and SANDARC for arranging the room used for the Merit Badge class, and all the vendors who were very patient and accommodating of the Scouts.

Photos - Scouts Invade at ARRL Southwest Convention 2014

Photos – Scouts at the HRO Candy Store picking out an HT and putting their name on the waiting list for a Flex SDR

Photos - Scouts take over the Radio Room at ARRL Southwest Convention

PARC also supported the **Black Mountain District Emergency Preparedness Day** on September 27th. Over 70 Scouts and their parents attended the event. The Scouts carried out a messenger service drill using radio communications between the Latter Day Saints Stake on Bernardo Heights Road, Saint Michael's Catholic Church on Pomerado Road, and Lucido Park in Rancho Bernardo. The Scouts were divided into messenger groups and jogged to operating stations to relay messages about the availability of water, baby formula, diapers and beds at designated emergency preparedness shelters. Third party traffic was handled by Mike Binder – NA6MB, Charlie Restorcelli – NN3V, and Brian Tagg – AG6CF. Erik Johnson – KK6IJN taught a course on personal and family emergency preparedness, and Terri Sorensen – KK6LBD was standing tall to share info on the Poway Neighborhood Emergency Corp (PNEC).

Photo - Scouts from Black Mountain District Emergency Preparedness Day

Jamboree over the Air 2014

PARC supported the 57th annual **Jamboree over the Air (JOTA)** on October 17th and 18th for the San Diego Imperial District at the Boy Scout Headquarters - Camp Balboa. Conrad Lara – KG6JIE --- *Mr. Lara to Boy Scouts* – carried the load to deploy four antennas to support rigs on 10, 15, 20 and 40 meters. Mr. Lara directed the supporting cast of Bob Shoemaker – KG6EJW, Kevin Walsh – KK6FRK, Mike Binder – NA6MB, Thurston Watson – KK6NPD, Brian Tagg – AG6CF, Roger Hort – KK6CTI, and Erik Johnson – KK6IJN. Special thanks goes to Craig Davis – KM6AW, the trustee of the Boy Scout Radio Room at Camp Balboa.

In addition teaching the Radio Merit Badge for Boy Scouts and providing and Introduction to Radio for Cub Scouts, **PARC** volunteers handled several waves of Scouts from troops and packs to get them on the air with other Scouting units all over the United States and other radio amateurs around the world. Radio contacts were made in California, Oregon, Washington. Wisconsin, Pennsylvania, New York, Arkansas, Oklahoma, Tennessee, Mississippi, Texas, and good DX contacts in Brazil, Slovakia, and New Zealand.

Photos - Conrad Lara – KG6JIE and Craig Davis - KM6AW work with Scouts on 20 and 40 meters at JOTA 2014

Photos –Brian Tagg – AG6CF and Erik Johnson – KK6IJN work 2 and 20 meters with Cub Scouts at JOTA 2014

2015 Board of Directors

Photo by Conrad KG6JEI
Left to right: Charlie NN3V, President, Gary W6GDK, Secretary, Richard KJ6WUY, Treasurer, Greg KI6RXX, Director 1, Jim NE6O, Director 2

(not pictured) Joe K6JPE, Vice-President

RÉPUBLIQUE FRANÇAISE
Liberté • Egalité • Fraternité

HAUT COMMISSARIAT DE LA REPUBLIQUE
EN POLYNESIE FRANCAISE
BP 115 – Papeete (Tahiti)

ANTENNE DE POLYNESIE FRANCAISE
-o-o-o-

Tél. : (689) 50 60 62 - Fax (689) 50 60 63
Dossier suivi par Madame ARITAI Léonne
Réf. : N°015/2014

LICENCE TEMPORAIRE D'EXPLOITATION
D'UNE STATION RADIOELECTRIQUE D'AMATEUR

Le Haut Commissaire de la République en Polynésie française autorise :

UTSCHIG Ellen   *Nationalité : américaine*

à établir et à utiliser dans les conditions prévues par l'arrêté 1573 OPT du 29 mai 1984

1 station(s) radioélectrique(s) d'amateur décrite(s) ci-dessous :

STATION(S) FIXE(S)		STATION(S) MOBILE(S)	
Nombre	1	Nombre	
Marque	KENWOOD	Marque	
Référence	TS 4805AT	Référence	
N° de série	83200019	N° de Série	
Emplacement		Emplacement	
Nom du navire :	ARANUI		

CLASSE 1 CEPT   : Toutes bandes radioamateurs

Le titulaire de la présente licence s'engage à respecter la réglementation d'ordre intérieur ou internationale intervenue ou à intervenir en matière de stations radioélectriques d'amateur et à informer l'Antenne de la Polynésie française du Haut Commissariat de la République de toute modification apportée dans les caractéristiques, la composition ou l'emplacement de ses stations.

En outre, il devra se conformer aux conditions particulières d'exploitations indiquées ci-après :

Conditions particulières d'exploitation : La présente autorisation est limitée au trafic radioamateur dans les bandes de fréquences autorisées par le règlement des radiocommunications applicable en région 3, en fonction de la classe affectée au titulaire.

INDICATIF ATTRIBUE : **FO/ N6UWW**

Date de validité : 29 aout 2014   Date d'expiration : 13 septembre 2014

A Papeete, le 26 août 2014
Signature de l'intéressé :

Pour le Haut commissaire
et par délégation
le chef de l'Antenne de la
Polynésie française

Dominique DIOT

Obtaining Reciprocal Licensing in French Polynesia

By Ellen Utschig N6UWW

In early September, Wild Bill, WB6BFG, and I took a freighter cruise (www.aranui.com) around the Marquesas & Tuamotus. I researched how to get reciprocal licenses so that we were legally able to operate from the various islands we'd visit (Fakarava, Nuku Hiva, Ua Poa, Hiva Oa, Fatu Hiva, Tahuata, Ua Huka, Rangiroa) and, with the freighter line's approval, on board the ship.

A quick search at the ARRL's website showed that French Polynesia, under French rules, falls under the CEPT agreement. FO is the prefix and French Polynesia, being a territory of France, has a reciprocal operating agreement with the United States. Information on the ARRL site indicated that there would be no fee for the reciprocal license and it'd be good for three months.

The contact information was easily found on the ARRL's website so I shot off an e-mail in November 2013 to Mr. Jean Chartier at the National Frequency Agency in Tahiti inquiring what would be required to obtain reciprocal licenses. That very day I received a response saying: "We can authorize you to operate your amateur radio in French Polynesia. For that, could you please fill, sign and send back to us (by post, fax or e-mail) the attached form accompanied with a copy of your amateur radio certificate or licence and of your identity card or passport." Unbelievably, once I finally got around to returning the required documents, with less than a week before we were to embark (nothing like waiting till the last second, right?!), the turn-around time was less than 24 hours.

We cruised with five of our friends, three of whom are hams (Al - WA6EFT, Tommie – KA6OAM & Ronnie – XE2/N7KVJ). Al, WA6EFT, brought along his Kenwood TS-480SAT and Wild Bill brought our power supply, coax and a Super Antenna MP-1. We were so busy having more than our share of fun both on and off the ship that we only managed to set it up twice (maybe three times) in the two weeks aboard the Aranui3. With the easy set-up for the antenna, we were on the air soon thereafter with very little effort. The antenna mounted to the starboard railing and radials woven through the safety netting. Coax & ship's power were connected, hit the power button and (presto) in no time we talked (via a phone patch while in international waters) to WB's daughter who was camping on the Oregon coast and a lot of other friends with whom we have daily schedules.

When we stopped on the island of Nuku Hiva, Wild Bill & I were able to do a little bit of reconnaissance for the TX7G DXpedition (http://tx7g.com/media/TX7G-Story.pdf) taking pictures of the site and accommodations & coincidentally making contact with the owner of the rental car business on the island.

At left, reciprocal operating document in French.

Club HF Remote Station? Let's Install One!

There are at least three reasons for the club to get involved in the HF remote movement. The first one is technical. The challenge of making a quality remote installation is fun and rewarding. The project involves backhaul establishment, HF equipment selection, remote access protocol development, command channel identification and establishment, testing and tuning, documentation, and training, among other things.

Secondly, autopatch and casual repeater usage has declined due to the increase of cellular coverage. Exploring new services that can be offered from club equipment on the Palomar Mountain property is an important responsibility. A new broadband repeater has been installed, and fresh hardware for the voice repeaters is under active investigation. Adding an HF remote station would expand the services provided by the club. This is an exciting time to get involved with renovating equipment on the site.

Third, many members are negatively affected by CC&Rs and other limitations on putting up HF antennas on their San Diego properties. We live in an urbanized area where antennas may or may not be allowed. Plenty of us live in valleys or in places that are not good for radio. Having a remote station that members can reserve and use would go a long way towards making the hobby possible for people that live in places where radio is limited.

If you would be interested in helping explore a club remote HF station on Palomar Mountain, then please join up by writing me at scope@palomararc.org.

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

HF Remote on Palomar Update

by Michelle W5NYV

We continue our investigation into a remote HF station for Palomar Amateur Radio Club use with comments from those that have responded to the call for membership in the special interest group (HF-SIG). A big thank you and welcome to Howard KY6LA, Rob WA3IHV, Mace KG6VMF, Roger AD5T, and Ken Easton!

There is strong consensus that for successful fundraising the club needs to be a 501(c)(3) organization. I'll be passing this sentiment to the incoming board. I know that several members of the incoming board are interested in seeing PARC become 501(c)(3).

Here's a summary of technical discussions so far. Dipoles are recommended for 80 and 40, a shunt feed tower for 160, and a Force 12 for 20, 15, and 10. Dennis N6KI recently put one up at his contest station in Fallbrook ("Nash'ville").

Although a Flex Radio is state of the art, and was immediately recommended by Roger AD5T, Rob WA3IHV advised that there may be too many variables with the Flex that can foul things up from a remote site. This would necessitate reboots, etc.

Rob suggested a simple, straightforward radio such as a TS 590. No linear amp but offer SSB, CW, JT65, +/- RTTY and PSK.

On the software remote control side, there are a wide variety of choices. Here's a list of just some of the remote control software that is being investigated and reviewed by active members of the HPSDR (high performance software defined radio) email list. Forum members are very interested in remote operation and it is a frequent topic of discussion.

----
http://www.remotehams.com/
Any Desk
SplashTOP
Screen Hero
Google Remote
Teamviewer
Mikogo
Parallels Access
UltraVNC
TightVNC
TinyVNC
Skype (for audio)
ipSound (discontinued in 2006, but still popular)

HPSDR (Android application for Internet Remote for OpenHPSDR written by G0ORX/N6LYT)
QtRadio (Win/Lin/MAC remote application for OpenHPSDR written by G0ORX/N6LYT)

glSDR - Android QtRadio client with full control written by volunteers for OpenHPSDR

According to a report from HPSDR member Ken N9VV,

"Flex Radio Systems is going to put Remote Operation on the top of their Developers list this year. They took a show of hands at their Dayton-2014 Banquet and *Remote Operation* was at the top of the list of desired features that their 6000 owners desired."

These are early technical discussions. We invite debate and additional discussions about the project. We anticipate having short meetings immediately before the general membership meeting to gather input, make decisions, and write a proposal. More soon!   -73s

Additional resources shared from HPSDR discussion list
http://www.dxzone.com/catalog/Contesting/Stations/ (50 entries)
http://www.dxzone.com/catalog/Manufacturers/Remote_Control/ (5)
http://www.dxzone.com/catalog/Operating_Modes/Remote_Operations/ (9)
http://www.dxzone.com/dx6349/internet-remote-base-society.html
http://www.dxzone.com/dx13063/remote-controlled-hf-operations.html
http://www.dxzone.com/dx24426/remoterig.html

Featured Program:

At 7:30pm on 7 January 2015, Palomar Amateur Radio Club will have a program. John Sonneberg will present on the crossover of commercial and amateur radio. He has a commercial radio business. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing!

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

PALOMAR AMATEUR RADIO CLUB INC.

Since 1936

W6NWG

San Diego County, Ca

Save the Date

Club Meeting	Board Meeting	Club Events
4 February 2015	**11 February 2015**	**April, May 2015**
Ron K2RP and John N6KOI will present the program. HF Remote meets at 7pm.	Palomar Amateur Radio Club board meeting at 7:00pm at W6GNI QTH.	Operating Day in April, and possible public demonstration at Carlsbad Faire in May

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Wanted: BC348 / BC224 WWII aircraft parts radio. Need crystal filter I.F. transformer, switches, knobs and some missing internal parts to restore current chassis. Must be cheap / free. WB6IQS@att.net, 760-727-3876. John. Vista, CA.

State of the Club for February

Happy Valentine's Day! I'd include some chocolates for you, but technology has not yet reached that level of transportability.

We had a great program last month about modern radios and their manufacture. To round-out the overview radio art, this month, our own K2RP (Ron) and N6KOI (John) will regale us with "The State of the Ark"

Seventeen of you attending last month's club meeting filled out a randomly distributed anonymous survey. It was simply a way to read some Club members "out in the Club audience" thoughts about Club activities, events in which they wished the Club participated, etc. The results were interesting.

There was a strong sentiment that PARC should be more visible in the San Diego County Fair, the Carlsbad City Fair, the Oceanside fair, etc. These are all worthy objectives. More on this later.

There were also interesting comments about "Elmering" and the lack of opportunities to "Elmer". As I mentioned at last month's meeting, I too think it a shame that "Elmering" is shorted these days. So I have a some questions for you. When was the last time you "Elmered" a start-up ham? When will you do so again? Will you do so?

"Elmering" has some measurable positive effects on our hobby. It brings in new blood to what, unless reversed, will soon be no more than an ARRL list of names with SK following the deceased's call sign. (In case you haven't noticed, there is a lot of the latter going around).

The other measurable effect, of importance to our Nation is that "Elmering" fosters valuable interests for people who, unless encouraged, may miss careers in science and technology. Do you remember how that 1957 Sputnik launch, and the excitement that arose from hams throughout the United States who listened to it's CW telemetry resulted in a huge influx of engineering students to colleges, and of citizens to ham radio, many of whom went on to set records in technical development? Do you remember the quiet thrill of building your first complex radio, a crystal receiver?

Those are the results of "Elmering". Look around you and you will see the aging members of that generation. Who and how many are the newcomers? And other than figuring out how to install an app on their smartphone in order to surf dubious websites, what else might attract the new generation to a technical career?

So how to "Elmer""? Remember that to you, those first steps in ham radio were scary and "mystical". You wondered how it was possible for that guy next door to be a genius, and whether you would ever become such a genius? And now, to your neighbor, you are seen as a genius because you understand all that "techie stuff". You understand wi-fi, modems, pixels, digital communications, computers, etc.

So my challenge to you. Set yourself a date by which you will have "Elmered" a person into a ham license or "Elmered" one of the many "new techs" into actually getting on the HF bands, or participating in Field Day, or some other measurable improvement in the person's comprehension of ham radio.

Speaking of Field Day. It is right around the corner! This year, on June 27th and 28th, PARC will once again celebrate Field Day with our traditional flair. We are close to confirmation of an excellent FD site! I challenge you to plan on participating in the Club's FD activities. NO. You DO NOT have to be a 60 WPM CW code operator. You don't even need an amateur radio license to operate the bands from a participating amateur FD site! All you need is a willingness to participate in the many FD preparatory activities (antenna and tower preparations, coaxial cable check-out, electric generator testing, etc.) and hopefully also a desire to be at the FD site. You can have fun, camaraderie, and even a chance to work the bands in a contest……ooopppss ...work the bands! FD is not a contest!

And having earlier mused about "Elmering", just think of the fantastic opportunity to bring a young neighbor or family member to a place where they can see and hear the magic of radio!

73 and Good DX
NN3V
Charlie

The Great Shoot-Out of 2014
Part 3

by Michelle W5NYV

Defining audio quality is fraught with peril. Just a brief listing of the descriptive words that most hams use when trying to capture the essence of voice communications gives clear warning. Signals have clarity, brightness, brilliance, flatness, or dullness. Some signals are splattered and some scintillate. Defining audio quality objectively seems like a better idea, but like most complex structures, speech is remarkably resilient to being fully characterized by scalar values.

Amateur radio encodes the idea of an objective measurement of intelligibility into RST reports. RST stands for readability, strength, and tone, and each category has an accepted number of levels indicating the quality.

Readability is a qualitative assessment of how easy or difficult it is to correctly copy the information being sent during the transmission, and relates directly to intelligibility. Readability is measured on a scale of 1 to 5.

1	Unreadable
2	Barely readable, occasional words distinguishable
3	Readable with considerable difficulty
4	Readable with practically no difficulty
5	Perfectly readable

Strength and tone have their own scales and definitions. While signal strength has an obvious relationship to intelligibility, for the purposes of this discussion we are going to assume that the audio signal under discussion was transmitted with sufficient power.

This encoding has use, if only to give contesters something to exchange with each other. The raw intelligibility of a particular voice communication tends to be uncontroversial, in that when a crowd of operators all hear the same transmission, they all generally agree on the audio being either intelligible or not. However, beyond the fundamental and objective question of whether or not the transmission is intelligible are many other questions concerning subjective quality and whether or not customary practices in amateur radio increase or decrease audio quality.

These are difficult questions to answer because one operator's preference in audio may be quite different from another's. The contrast between objective and subjective audio quality turned out to be a central issue in the Shootout. Whenever judgments about audio quality are invited, the difficult task of defining what exactly contributes to quality looms right up.

Getting from completely unintelligible to intelligible means going from an RST readability score of 1 to 3. It's easy to see that one must reduce distortion and interference in order to uncover the signal in the first place. However, once the signal can be copied, then it becomes much more interesting. Getting from readability score of 3 to 5 is a process that can be difficult to define. Compression decisions, equalization settings, and bandwidth limitations are some degrees of freedom that directly affect audio quality. Continuing to eliminate distortion and interference is of course still necessary, but one can indeed have a painfully clean and powerful signal that has been compressed or equalized in a way that reduces intelligibility, instead of enhancing it.

On the battleground between readability 3 and readability 5, both subjective and objective measurements are made. For example, "brilliance" in amateur radio audio is a very frequently used audio battleground and equipment marketing term, and came up prominently in the Shootout. But, what exactly does that term mean? Talking about audio that "sparkles" makes as much sense as colors that "shout", but anyone that has ever confronted a pair of lime green and bright orange paisley pants can certainly see the volume.

In audio research, brilliance is a technical term and is the presence of a an overtone lying between 2800 and 3200Hz. This tone is believed to be generated by structures that resonate or ring in the larynx. Obviously, if an audio signal is sampled in such a way as to eliminate or reduce the existence of such an overtone, then the sort of brilliance that audio researchers are referring to would be absent from a radio transmission, and you would not hear what an audio scientist would call "brilliance".

In amateur radio circles, brilliance is generally taken to mean that an audio signal has a certain dynamic range that has high enough time domain and frequency domain response for good approximation live speech. In other words, there has to be enough treble and enough bass, in the right proportions, and there has to

be a fast enough response in the time domain to give clearly articulated phonemes. Limiting the frequencies or smoothing the attack of each syllable or sub-syllable directly affects the perception of audio brilliance. But, those aspects don't objectively define "brilliance". The settings one person finds brilliant may sound harsh to another, and tinny to a third.

Software defined radio (SDR) doesn't have a monopoly on complicated audio settings. Almost any radio on the market has plenty of knobs to turn to change the audio response. What SDRs potentially allow for is customized audio profiles that are learned through adaptive algorithms. In this case, the radio could possibly learn exactly what equalization is necessary at that particular time, for that particular band, and that particular mode, which leads to maximized intelligibility. This requires feedback from the operator at some level, or else sophisticated software that can tell when your speech is fast and stress-free, which may indicate a high-intelligibility conversation. These sorts of functions can't be found on any amateur radio SDR. At least, not yet.

The pressures on high-quality audio are not limited to amateur radio. It's a common observation that cellular phone audio quality does not compare favorably at all to land-line telephony. There are reasons for this, first and foremost the reduced bandwidth allocated to cellular audio compared to landline telephony, and the liklihood of multiple encodings and decodings in the cellular communications chain. Unless your voice call stays within the same network, and therefore only has to be sampled and encoded once, your voice will undergo multiple encodings and decodings and recodings, with loss at each stage, and reduced audio quality at the end.

The advantage to this trend is mobile communications channels that pack in more people per Hz. For amateur radio, the future of audio quality means using modes that allow the entire bandwidth of the human voice to be transmitted, and radios that allow for advanced and personalized equalization algorithms that successfully enhance speech. The tension between the desire for better audio quality, which usually means more bandwidth, and

the good amateur practice of begin frugal with both bandwidht and power means that there is plenty of opportunity for innovations. Audio quality is only as strong as the weakest link in the chain. The decision on how to sample the voice, how it is filtered, compressed, transmitted, what sorts of things happen to the signal while it's in the channel, and how it's demodulated and decoded at the receiving end are all factors. Only the receiving end was considered in the shoot out. With the same signal being copied by both radios, some of the factors are an equal burden to both radios.

Finally, there is another very important subjective measurement, and that is fatigue. An operator may experience fatigue with one radio, and not with another, even with the settings all configured to give what the operator considered to be an ideal audio response. Fatigue may come from the integration of all the audio power weighted by frequency. Therefore, a radio that sounds louder might cause less fatigue than a softer-volume radio, due to equalization in the lower-volume radio putting more fatigue-causing frequencies in the operator's ear. Or, fatigue may come from greater cognitive effort required to decipher words that one radio requires compared to another one. Differences in spectral response with respect to speech, when comparing transmitted audio to the live audio that are brains pattern-match with, can cause significant fatigue. With practice, the fatique lessons. The brain gets used to listening to audio that is spectrally limited and equalized in funny ways. Almost everyone can relate to this when thinking back to their first few contests or field days.

Looking forward to the next shootout! :)

IEEE [amateur] Radio and Wireless Week

by Michelle W5NYV

Every year, somewhere in (almost always) the United States, the Institute of Electrical and Electronic Engineers (IEEE) holds a conference called Radio and Wireless Week. This year that conference was held 25-27 January in San Diego, CA.

"The Meeting" as regulars to the event call it, is sponsored by the MTT-S, which is a Society of the IEEE. Societies are subgroups of IEEE that reflect areas of interest. There are a myriad of Societies, ranging from amplifiers to robotics and from nitty-gritty consumer electronics manufacturing to extremely esoteric academics.

MTT-S stands for Microwave Theory and Techniques, and as the name implies, is focused on the microwave band. To make it even more complicated, Radio and Wireless Week (RWW) is not one but four "topical conferences" happening at once. Silicon Monolithic Integrated Circuits in RF Systems (SiRF), Power Amplifiers for Radio and Wireless Applications (PAWR), Wireless Sensors and Sensor Networks (WiSNet), and Biomedical Wireless Technologies, Networks, and Sensing Systems (BioWireleSS).

My interest in going to the conference was to find out more about 3D and 2D circuit printing techniques, software defined radio, and six-port structures. While those elements were compelling and challenging and made the event well worth attending, an added dimension unfolded over the several days as it became evident that a number of the speakers and presenters were amateur radio operators. Their perspectives were informed in various ways by amateur radio, and they all made efforts to communicate their membership in amateur radio.

 The first day of the conference was devoted to workshops. RFID, 5G, and Power Amplification were on offer, but I attended "3D Printing and its Impact on Wireless Systems". Based on the content and the contacts met during the workshop, I went home and 3D printed a horn antenna structure for 10GHz amateur microwave. I found the model on Thingiverse (8 to 12 GHz Horn antenna with Coax-Waveguide Transducer by kodera2t, published May 12, 2013 https://www.thingiverse.com/thing:87574).

I elected to use PLA filament, and metallize with conductive spray paint. The choice of conductive spray paint was recommended by Frank Brickle AB2KT. A hole for SMA fixtures was built into the model.
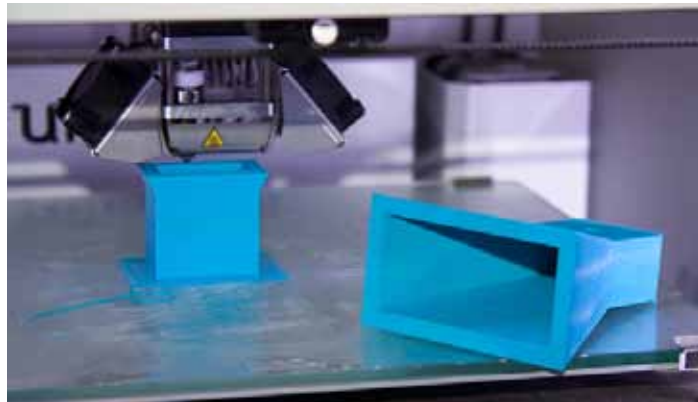
3D printed 10GHz horn structure

At the workshop, Dr. Nuno Borges Carvalho of Universidade de Aveiro, Portugal, discussed how his graduate student glued copper foil to a 3D-printed plastic model. They were now pursuing 3D printer companies to incorporate metal into their printers in order to more easily make microwave feeds.

While amateur radio didn't come up during this workshop, the application to 10GHz amateur radio was immediately evident.

Bright and early the next morning, Jeffrey Pawlan WA6KBL presented as part of the RWW Distinguished Lectures series "An Introduction to Software Defined Radio for Engineers". Jeffrey defined SDRs, gave a brief overview of their history, and categorized their evolution in easy-to-understand stages. During the live demonstration, he started WINRAD, and then used a recording of the 40m band made during a CQ World Wide contest to show the amazing agility of SDR filters and tuning. He then showed a live demonstration of distributed SDR by contacting his home machine in San Jose over the Internet. This machine continuously samples the entire 20m band and provides a digitized stream to the Internet. The laptop on the podium in San Diego was then used to demodulate and manipulate the data stream in real-time. Jeffrey showed how SDRs really shine in their ability to be configured in real-time to receive and present data streams.

One of many memorable slides was of a 16-pole analog IF crystal filter from Hiberling. Jeffrey properly framed this amazing filter design as

a real work of art. The 30 or so crystals were likely handpicked. The frequency response was presented, and it was quite lovely. Then, Jeffrey showed what a modest amount of code could do, running on a general-purpose processor. It was the exact same curve. Except, with input from the user running any one of a number of software programs, the curve could be changed, adapted, and redeployed.

Can the Hiberling filter change center frequency? Bandwidth? No. It cannot. It is frozen in place. This is not to say that lovely filters and advanced analog electronics don't have an extremely important place. In fact, there were several moments in the BioWireleSS sessions where the opposite point was driven firmly home. However, in the realm of human-centric communications, and especially in application like amateur radio, SDRs completely overwhelm the competition.

During Q&A I asked Jeffrey for his comments about FLEX Radio. He was disappointed that they had closed the source to their radio, was very impressed with the receiver, and less impressed with the transmitter. As several PARC members have noted in the days following the conference, FLEX has opened up an applications programming interface (API) for their source code, which allows people to access the radio functions without revealing the source code that implement those functions.

The next day, halfway through a long slog of math and thinking, was a presentation on "A New Multiple Antenna Port and Multiple User Port Antenna Tuner" by a man named Frederic Broyde . The host of the session stumbled over the strange letters in Frederic's biography and apologized for his unfamiliarity with the strange code. The letters were F1OYE, which was obviously a ham callsign from France! Frederic's talk was about his ideas on a tuner that would control an impedance matrix that would successfully match multiple radios to multiple antennas, in the form of a multidimensional pi network. Frederic spoke a lot about the capacitors in the pi network, so I asked him during the Q&A about the lonely inductors. He described them as being somewhat free to choose, of course "within limits". After the talk, Frederic educated the session chair in generous spirit about amateur radio and licenses and call signs. It was obvious how proud Frederic was of his call and the role it played in his personal and professional life.

I have no doubt that there were other presenters and attendees with amateur radio licenses. Whether currently active as hams or not,

amateur radio was an unexpectedly prevalent theme at an important international microwave engineering conference.

This caused me to reflect on the role amateur radio has had on my own personal and professional life. It's easy to see how amateur radio affected my choice to pursue engineering and science. What may not be quite as obvious is how it supports my decision to continue to pursue engineering and science. Amateur radio provides a place to experiment and socialize and learn in the face of substantial challenges. It's an important factor in my ability to continue to contribute to the art and science of radio.

Our access to the bands and our ability to get a license to experiment and serve the public is very important. The insatiable appetite from for-profit corporations for bandwidth continue to be a direct threat to the ability for ordinary people to access spectrum. Being able to access spectrum is necessary in order to learn advanced electronics, develop the skills to protect and serve the public during disasters, and to share the skills during ordinary enjoyable events such as parades, races, and other large gatherings. It's easy to see that organizations like IEEE would be much poorer and have diminished effect without a strong amateur radio community. This is why it's so important to be a good representative of the amateur radio service. Let your representatives know today what your license means to you!

Interested in attending in 2016? RWW will be in Austin TX in late January.

An amateur radio conference

Main tower in the snow. No damage observed.

Tower Trailer under a blanket of snow. Frozen spiderweb.

Oddly shaped snow structures on all the buildings from wind.

How deep was it? Snow covered chairs on walk to repeater site.

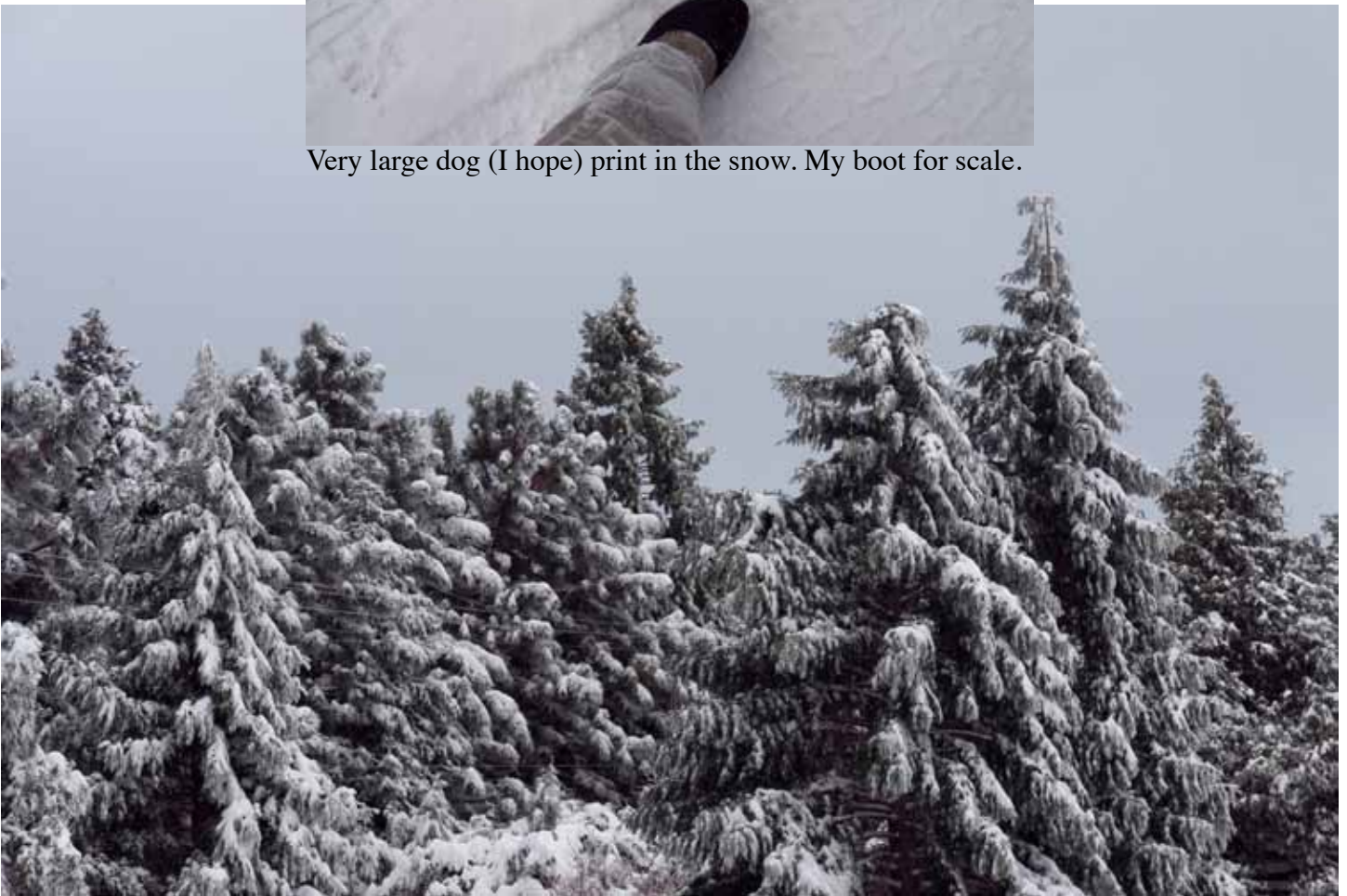Looking south from the site.

KK6OOZ snow angel.

Snow covered cars in driveways along the walk

Very large dog (I hope) print in the snow. My boot for scale.

The snow was beautiful.

True southern California living involves lots of optimism. And adaptability. Just in case, this guy has his canoe on hand.

Winterize! If you didn't heed the advice already, then by this weekend, it was too late.

Repeater site was visited on New Year's Weekend, 2015 in order to inspect for damage from an 18" snowfall. W5NYV and KK6OOZ hiked down from Birch Hill and found the site in excellent shape. Photos by W5NYV.

2015 Arizona Section Convention

Yuma Hamfest
Yuma, Arizona
Feb. 20 & 21, 2015

Yuma County Fairgrounds
2520 East 32nd Street, Yuma, Arizona

www.yumahamfest.org

Check the Website for Additional Information

Gates Open for Camping Thursday, 2 pm	Event Hours	Hamfest Dinner &
Vendor Setup Friday, 7 am - Noon	Friday, Noon - 5 pm Saturday, 8 am - 5 pm	Grand Prize Drawing Saturday Night 6:00 - 8:00 pm

Vendors & Exhibitors	**Tailgating (Swap Meet)**
Consignment Sales	**Full Seminar Schedule**
License Testing	**DXCC Card Checking**
Hourly Door Prizes	**Incredible Grand Prizes**
On-site RV Camping	**Emergency Preparedness**
Hamfest Dinner	**Admission Prize**
ARRL Speaker	**Hospitality Area**
Transmitter Hunt	**Near Space Balloon Launch**
$5.00 Admission	**Antenna Clinic**

Hamfest Talk-In Frequency: 146.840 (–) PL 88.5 Hz

Email Contact: *info@yumahamfest.org*

We are proud to have the Amateur Radio Council of Arizona (ARCA) as a sponsor of our event.

The Yuma Hamfest is an American Radio Relay League (ARRL) sanctioned event.

Presented by the Yuma Amateur Radio Hamfest Organization

PALM SPRINGS
HAMFEST

SAT. MARCH 14, 2015 • 9 AM to 4:30 PM
PALM SPRINGS PAVILION • 401 S. PAVILION WAY
NEXT TO PALM SPRINGS STADIUM • PALMSPRINGSHAMFEST.COM

GORDON WEST
10:30 a.m. • Keynote

America's leading ham radio educator, Gordon West, WB6NOA, will give our keynote address. Gordon is the author of numerous books and audio lessons on ham radio licensing and is well known for his sparkling, humorous and informative presentations.

ANDRE HANSEN
11:30 a.m. • Broadband Hamnet

This presentation will provide an overview of the Broadband Hamnet project, featured in the July 2013 issue of QST. Andre will highlight the technology concepts, network designs and implementation, of this fast-growing emergency communications technology.

DENNIS KIDDER
12:30 p.m. • Maker Faire

Dennis explains Maker Faire as: "The Maker Faire Experience is Bringing Ham Radio to a new community. Have you heard of the Maker movement? It is becoming a Renaissance of hobbyist electronics.

BOB BREHM
1:30 p.m. • Curing RFI & Working more DX

Bob (AK6R) is Chief Engineer at www.Palomar-Engineers.com. He'll be speaking on Curing RFI and keeping your neighbor's happy!

To I-10 Freeway Parking at Palm Springs Mall

Palm Springs Library

Baseball Stadium

SUNRISE WAY

S. PAVILION WAY

E. BARISTO ROAD

Palm Springs Hamfest

(Limited Parking)

S. FARRELL DRIVE

E. RAMON ROAD

Map not to scale
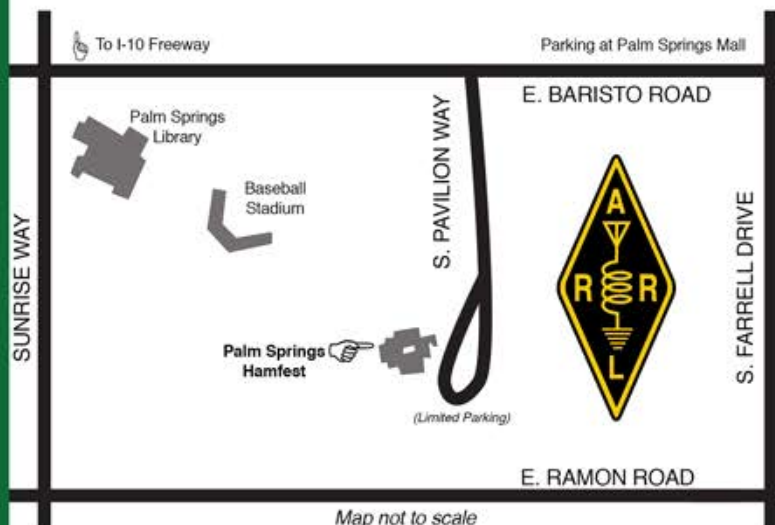
VE TESTING
Technician • General • Extra
8 to 10:00 a.m.
ARRL VE Team

NEW! All license classes will be available for testing. The test fee is $15. Please bring photo I.D. and, if you are upgrading, a copy of your current license to attatch to your application.

RAFFLE PRIZES
Thousands worth of prizes
Tickets: $1 ea./25 for $20.

FOOD & BEVERAGE
9 a.m. - Morning Snacks & Coffee.

Noon - Hamburgers, hot dogs, chips, salads, sodas and more.

VENDOR EXPO
Hamfest is the best place to "gear up." Dozens of vendors and organizations will be selling specially-priced mechandise and giving demos.

TAILGATERS/CAMPING
The fee for a Tailgater is $25 and can include camping. Camping Friday and Saturday nights is $25 per night.

CONSIGNMENT TABLE
Sell your unused gear at our consignment table (less 20% sales commission).

TALK-IN NET • WD6RAT
2 Meters
146.940 MHz -107.2
7 a.m. to 1 p.m.

Club HF Remote Station? Let's Install One!

There are at least three reasons for the club to get involved in the HF remote movement. The first one is technical. The challenge of making a quality remote installation is fun and rewarding. The project involves backhaul establishment, HF equipment selection, remote access protocol development, command channel identification and establishment, testing and tuning, documentation, and training, among other things.

Secondly, autopatch and casual repeater usage has declined due to the increase of cellular coverage. Exploring new services that can be offered from club equipment on the Palomar Mountain property is an important responsibility. A new broadband repeater has been installed, and fresh hardware for the voice repeaters is under active investigation. Adding an HF remote station would expand the services provided by the club. This is an exciting time to get involved with renovating equipment on the site.

Third, many members are negatively affected by CC&Rs and other limitations on putting up HF antennas on their San Diego properties. We live in an urbanized area where antennas may or may not be allowed. Plenty of us live in valleys or in places that are not good for radio. Having a remote station that members can reserve and use would go a long way towards making the hobby possible for people that live in places where radio is limited.

If you would be interested in helping explore a club remote HF station on Palomar Mountain, then please join up by writing me at scope@palomararc.org.

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

HF Remote on Palomar Update

by Michelle W5NYV

We continue our investigation into a remote HF station for Palomar Amateur Radio Club use with comments from those that have responded to the call for membership in the special interest group (HF-SIG). A big thank you and welcome to Howard KY6LA, Rob WA3IHV, Mace KG6VMF, Roger AD5T, Ken Easton, and Lou KW6Q!

The Ham Radio Lunch Bunch meets Fridays for lunch and socializing at any one of a number of restaurants on a rotating schedule.

The Lunch Bunch signup is

http://w0ni.com

Reminders are sent out on Wednesdays.

All are welcome for food and fun!

Some of the restaurants on the schedule are Fuddruckers, UTC Food Court, Spices Thai, Savory Buffet, Denny's, Callahan's Pub and Grill, and Phil's BBQ.

Terrain Profiles Automated

by Howard KY6LA

Stu K6TU has automated the process of generating terrain profiles for use with N6BV's HF Terrain Analysis (HFTA) program.

To support HFTA's modeling, a user must first obtain a terrain profile which describes the height of terrain around the antenna location. This process is cumbersome and time consuming as the source of the data must be located, downloaded, then processed with MicroDEM.

Terrain Profile Requests are available to any user with a registered account on K6TU.NET at no charge and no subscription to Stu's propagation prediction service is necessary.

Stu's site maintains copies of both the USGS National Elevation Dataset (for the United States) and the NASA Shuttle Radar Topography Mission dataset enabling fast turnaround of requests.

FYI – Stu K6TU also is the Author of the Supercheck Partial Files and the K6TU iPad Control for the Flex 6000 series.

Lunch Bunch at FuddRuckers on January 30th, 2015. Photo by Michelle W5NYV.

Featured Program:

At 7:30pm on 4 February 2015, Palomar Amateur Radio Club will have a program. Ron K2RP and John N6KOI will present a program. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing, and for the HF Remote Special Interest Group meetup.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

At the March 4th meeting Howard White KY6LA will present Modern Radios SDR-101. The talk will begin with a history of radio and the six major architectures used in radios. Modern radios (software defined radios) will be explained to show how they work and how they differ from legacy radios that most hams currently use. The benefits of modern radios will be demonstrated with practical examples of how modern radios perform substantially better than legacy radios. Finally, time and internet permitting, we will have a real-world demonstration of remote HF operation using a modern radio located in La Jolla.

PALOMAR AMATEUR RADIO CLUB INC.

Since 1936

W6NWG

San Diego County, Ca

Save the Date

Club Meeting	Board Meeting	Club Events
4 March 2015	**11 March 2015**	**April 2015**
Howard KY6LA presents on Modern vs. Legacy Radios, with special emphasis on SDR.	Palomar Amateur Radio Club board meeting at 7:00pm at W6GNI QTH.	Support Boy Scout Radio Merit Badge at Scout Fair! Write scope@ palomararc.org for info

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Wanted: BC348 / BC224 WWII aircraft parts radio. Need crystal filter I.F. transformer, switches, knobs and some missing internal parts to restore current chassis. Must be cheap / free. WB6IQS@att.net, 760-727-3876. John. Vista, CA.

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What a difference a month makes! Here is the repeater site on a sunny late February Day. All the snow has melted.

Photos by Paul KB5MU.

Hams / MAKERS / OPEN SOURCE — March 2015 Scope
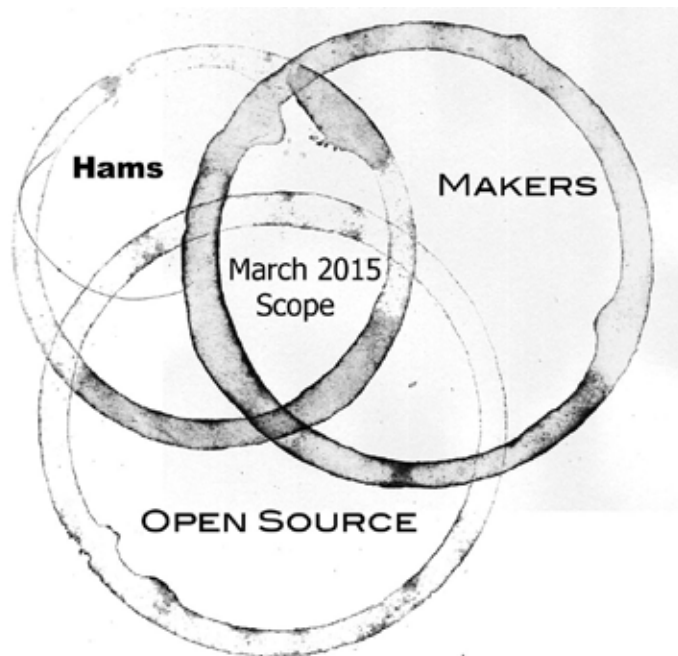
This issue of the Scope focuses on the intersection between three communities, the amateur radio service, the maker movement, and the open source community.

Each of these communities is composed of large numbers of extremely diverse people engaging in a multitude of projects. These three communities, over the past few years, have increasingly interacted with one another to produce innovative and high-quality hardware and software.

Amateur Radio

The amateur radio and amateur-satellite services are for qualified persons of any age who are interested in radio technique solely with a personal aim and without pecuniary interest. These services present an opportunity for self-training, intercommunication, and technical investigations.[1]

The amateur service, established as early as 1909 in the United States, is regulated by the International Telecommunication Union (ITU) through the International Telecommunication Regulations. National governments execute the regulations and issue individual station licenses. Each license is identified with a call sign.

The amateur service in the United States, as regulated by the Federal Communications Commission (FCC), is intended to fulfill a number of specific purposes.[2]

a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

(b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c) Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communication and technical phases of the art.

(d) Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts.

(e) Continuation and extension of the amateur's unique ability to enhance international goodwill.

The Critique:
Amateur radio is stuck in the past. It lacks technological and social diversity, is hostile to innovation, and has failed (so far) to adjust to a world where the capability to communicate reliably with specified and unspecified people at close and distant locations is something literally anyone can do over the internet. Amateur radio needs a new killer app.

The Maker Movement
The maker movement is a culture consumed with extending the "do it yourself" (DIY) culture by incorporating contemporary technology. Makers enjoy engineering-oriented things such as electronics, robotics, 3-D printing, and the use of CNC tools. Metalworking, woodworking, and traditional arts and crafts are also heavily represented. There is a strong emphasis on developing and sharing reliable techniques, using and learning practical skills, and applying them to projects in a way that can serve as a reference to others.

The Critique:
Emphasizing the process and products of making over maintaining and caretaking costs the movement dearly in terms of relevance and sustainability. It's one thing to make yet another toy Arduino project, it's quite another to contribute to civilization and culture. If the maker movement will ever amount to anything, then it will need to find a more meaningful purpose than yet-another-quadcopter.

1   http://wireless.fcc.gov/services/index.htm?job=service_home&id=amateur
2   http://www.arrl.org/part-97-amateur-radio

The Open Source Community

Most often encountered in the software realm, open source communities write computer software with the source code made available. Usually this is done with a license in which the copyright holder provides the rights to study, change and distribute the software to anyone and for any purpose.

Open hardware communities publish circuits in the same way, with the schematic being provided for study, modification, and distribution.

Open source is a commitment that doesn't necessarily preclude making money from the hardware or software, but quite often the software or hardware is donated to the public domain without any compensation.

Almost always, the work product is the focus of some type of open source license. There is, however, a second component of the open source philosophy, and that is the process by which the work was created in the first place.

There are at least four different ways to approach a project. The work product, which is the thing produced by the project, can be published as an open source product, or these documents can be kept private or closed source, with only a black box or executable code produced. Regardless of which method is chosen for the product itself, the work process can be done openly, where people can observe or participate in making something, or the process can be closed, where only a limited list of people have access to the design, build, and test process. At right is a 2x2 grid that summarizes these possibilities and gives a description of each.

The Critique:
The first thing one notices about the open source philosophy is that it is almost entirely dedicated to criticizing the closed source mind set. As a way of thinking, the open source mind set is fundamentally reactionary. Plus, open source projects often bog down due to too many voices interrupting the process. There is value to closing the process, or closing the source, for a variety of reasons. Indiscriminate open source can be counterproductive.

The Interface Improvement

The three communities strengthen each other's weaknesses. Amateur radio brings meaning and purpose to the open source mind set and provides a compelling framework for makers. Makers improve their craft by opening themselves up to critique through openness and documentation and producing works that have useful application in the amateur service. Amateur radio is improved by the challenge of incorporating contemporary technology, such as software-defined radio and 3D printing. Challenging closed-source innovation in the amateur radio service has enormous potential to improve and engage amateur operators in ways that mitigate the risk of amateur gear becoming stagnant and dominated solely by corporate interests.

-Michelle W5NYV

	Open Source	Closed Source
Open Process	Our process and our work product are open source. Anyone can see what we do and how we produce it. We share with all, and welcome improvements to both the product and the process.	We open up the process of creating the work product, but once we're done, the source code and hardware are closed. You have to sign a license to not reveal our innovations in order to see the source. ?
Closed Process	We want to share our work product with the world, but we're uncomfortable or unable or unwilling to show you how we make the end product. Maybe we don't want to reveal proprietary things, or maybe we just don't want you to be able to see our mistakes.	We need to be able to keep the details of our work product, and the details of how we make the work product, a secret, because we don't want others to be able to duplicate or improve upon our designs.

Adventures in the Open Source Trade

by Frank Brickle, AB2KT/VE7

I'm writing here as the co-author (with Bob McGwier, N4HY) of the DSP software engine at the heart of quite a few Software Defined Radios. That software we called DttSP. It is the core SDR component for PowerSDR used with the Flex Radio Systems SDR-1000, 1500, 3000, and 5000 models. It also animates directly and indirectly a significant number of other SDR projects including HPSDR.

From the beginning, DttSP was an Open Source project, issued under the General Public License (GPL), at first Version 2, later Version 3. It is written entirely in C and was meant to be as portable as possible: it runs on Linux, BSD, OS X and Windows. For a number of years it was hosted at the CGRAN archive at CMU. It now lives on github. The source code is Free both as in Speech and as in Beer.

Where it started was with the development of the original set of 3 SDR-1000 boards by Gerald Youngblood, K5SDR. Gerald's accompanying software suite for the boards was written in Visual Basic running on Windows XP. I was the third purchaser of the original board set and saw no reason that the boards shouldn't be usable with Linux. There were some inherent design problems with Gerald's software, problems which would be difficult to address within the limitations of Visual Basic.

Thus the creation of a new SDR engine for the boards would require a completely new design and implementation. Correspondingly, a new wrapper and user interface would be needed to house the redesigned SDR core. Part of the idea was to completely decouple the DSP and UI components, which would yield all sorts of anticipated and as-yet-unforeseen application possibilities.

There were also some software design issues that needed to be solved once and for all, such as finding a provably correct concurrent design that would allow for fast T/R switching on hardware that could assume only half-duplex access to the digital I/O hardware, or would provide safe asynchronous parameter updating.

This is what we -- the DttSP developers -- succeeded in doing. Along the way we provided a host of other value-added features, such as highly effective speech compression, a viable CW keyer, multiple simultaneous receivers, transmit predistortion, multiband parametric EQ, and more.

We did this work as volunteers, on the understanding that we were providing a service to the entire amateur radio community, building an infrastructure on which to build even more interesting things. It was very important to create a robust, easily accessible platform for future amateur SDR work, in particular in such a way that other developers and programmers could concentrate on their own applications and not have to concern themselves with core functioning.

We did this work in close cooperation with Flex Radio Systems, who understood fully the implications of adopting GPL software at the heart of their PowerSDR application. Specifically, this meant that all of the PowerSDR software would need to be made available in source form to anybody who received a working binary of the program. No exceptions. This was the common understanding of the acceptance of the GPL, an understanding which has been reinforced and reiterated more than once in court.

It is our belief that, unfortunately, Flex Radio Systems went back on their part of the bargain. A number of important enhancements to the code were made at Flex which they have kept to themselves. We should be clear on this point: they are quite entitled to keep their code to themselves. However, in so doing, they lose their right to distribute our code. The GPL is, after all, merely a license. We still own our code. They have violated the license and are violating our copyright. This point has been shown time and time again in court. They should not be distributing a PowerSDR which contains any code or derivative of DttSP.

At this point in time it is unclear what our next step will be. The architecture of DttSP is somewhat obsolete at this point for many reasons. We have also been informed that DttSP code is being used in more than one commercial product without acknowledgement. Perhaps the whole episode in the end serves as little more than a warning to people who want to contribute freely.

Below, a sunny late February day at repeater site. Paint crew might be needed this summer!

Yuma Hamfest Report

By Ellen N6UWW

After waking up way too early Saturday morning to leave Oceanside well before dawn, we arrived at the Yuma Fairgrounds as the starting bell of the 2015 Yuma Hamfest sounded. We raced in to find where Andre K6AH was giving his Broadband Hamnet presentation. The $5 admission to the Yuma Hamfest was well worth it as when we entered the Theater Building to find a Who's Who of friends & acquaintances we don't get a chance to see nearly often enough. In addition to the various seminars held throughout the day, there was plenty of stuff to occupy one's time. While some headed off to the nearby swapmeet, others stayed in the thick of things at the Hamfest and enjoyed a full day of spur of the minute antenna projects, t-hunting, vendor booths, tailgating, etc. Sources tell me there was even an impromptu ukulele concert complete with appetizers! Here's hoping those of you who attended all had a great time.

*photos by
Paul KB5MU*

Lunch Bunch
at Phil's BBQ

Club HF Remote Station? Let's Install One!

There are at least three reasons for the club to get involved in the HF remote movement. The first one is technical. The challenge of making a quality remote installation is fun and rewarding. The project involves backhaul establishment, HF equipment selection, remote access protocol development, command channel identification and establishment, testing and tuning, documentation, and training, among other things.

Secondly, autopatch and casual repeater usage has declined due to the increase of cellular coverage. Exploring new services that can be offered from club equipment on the Palomar Mountain property is an important responsibility. A new broadband repeater has been installed, and fresh hardware for the voice repeaters is under active investigation. Adding an HF remote station would expand the services provided by the club. This is an exciting time to get involved with renovating equipment on the site.

Third, many members are negatively affected by CC&Rs and other limitations on putting up HF antennas on their San Diego properties. We live in an urbanized area where antennas may or may not be allowed. Plenty of us live in valleys or in places that are not good for radio. Having a remote station that members can reserve and use would go a long way towards making the hobby possible for people that live in places where radio is limited.

If you would be interested in helping explore a club remote HF station on Palomar Mountain, then please join up by writing me at scope@palomararc.org.

Mailing list archive located at http://palomararc.org/pipermail/hfremote/

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

HF Remote on Palomar Update

by Michelle W5NYV

We continue our investigation into a remote HF station for Palomar Amateur Radio Club use with comments from those that have responded to the call for membership in the special interest group (HF-SIG). A big thank you and welcome to Howard KY6LA, Rob WA3IHV, Mace KG6VMF, Paul KB5MU, Roger AD5T, Ken Easton, Lou KW6Q, and Steve KB6VME.

Mace, Howard, Michelle, Paul, Rob and several others had a productive working Lunch Bunch meeting on 6 February 2015.

Items discussed included design philosophy, feature set, quality of accessibility, and identification of the gating items (bandwidth off the mountain featured primarily). Action items were recorded and further discussions held at the March club meeting and at upcoming lunch bunch and evening meetings. Consensus on a simple, easy-to-access, easy-to-reboot design was strong.

Steve contributed valuable questions via email concerning how to handle access in terms of authentication, as well as how to handle ongoing maintenance costs.

A prioritized list of frequencies was generated. This way, in case the system needs to be built in phases, the most desired bands are provided first.

A Visual Guide to PARC Repeaters

Echolink

447.000
107.2

146.730
107.2

147.075
107.2

52.680
107.2

147.130
107.2

PARC
Voice
Repeaters

PARC
Digital
Repeaters

145.050
packet node
linked to Metro 9600 Net

146.700
packet duplex repeater
Duplex

- operational
- non-operational

Circle Diameters Scaled to
Show Relative Wavelengths
Between the PARC Repeaters

Nonoperational => Operational

The 6m repeater has been nonoperational for 3 years as of February 2015. John W6JBR, Bill N6PIG, and Michelle W5NYV have picked up the project and made a lot of progress since beginning work on 1 February 2015. The team is approaching the repairs as an open source and open process project. The tracking document, which is a chronological record of the work done on the repeater, is located here:

https://docs.google.com/document/d/1vrlMv0jMd83iTxgk8H1ZgbULF-comYmVPwpy3Uqz2-c/edit?usp=sharing

A final report will be written and published once the repeater is re-installed at the repeater site on Palomar Mountain.

Is there a piece of hardware or software that you would like to work on to benefit the club? The Scope is interested in your proposals! Send them in to scope@palomararc.org

PARC
ATV
System

915 MHz WBFM in
5.8 MHz audio subcarrier

1241.25 MHz VSB out
NTSC standard

2441.5 MHz WBFM in
6.0 MHz audio subcarrier

146.415
79.7
intercom

operational

non-operational

Circle Diameters Scaled to
Show Relative Wavelengths
Between Equipment

San Diego Microwave Group and Microwave Update 2015

The February 2015 meeting of the San Diego Microwave Group (SDMG) was well-attended by Palomar Amateur Radio Club members. The group meets the third Monday of the month at the home of Kerry N6IZW. All amateurs interested in the microwave bands are welcome to join.
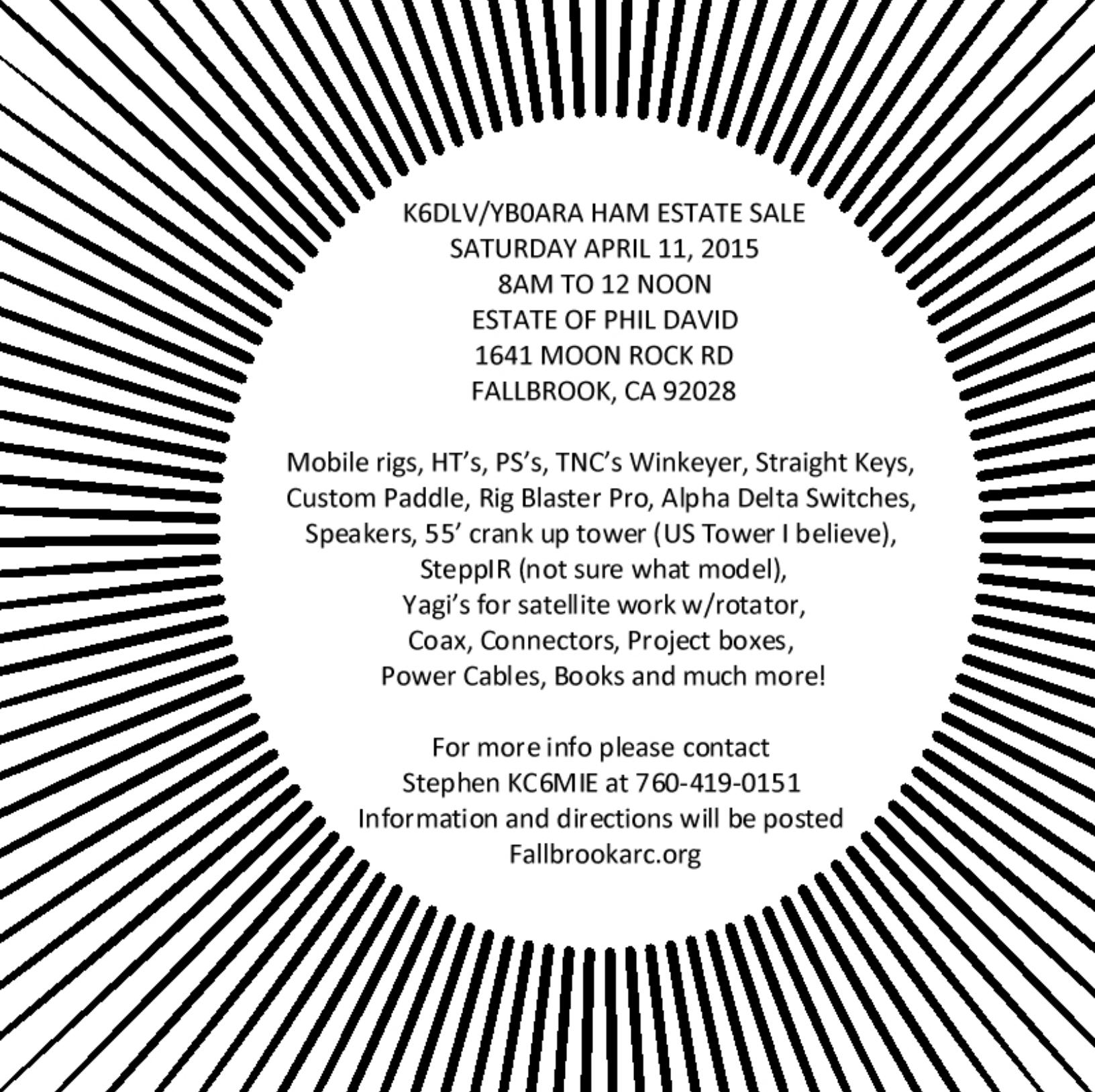
Members gather, show and tell, give reports, and have refreshments. The positive spirit, technical support, and good humor make this a highly enjoyable amateur microwave group. The amateur microwave community frequently deals with open and closed source issues due to the nature of the surplus market, which is where a lot of microwave enthusiasts get their parts and gear. Microwave gear documentation is often reverse-engineered, since the original documentation is either proprietary or just so obscure that it may as well have been closed. Besides reverse-engineered documentation, tribal lore is often used in the microwave community. For example, in the SDMG QUALCOMM sourced boards have been used to enable local hams to get on the air. Support often comes from former employees of QUALCOMM or those that have successfully used the boards in their projects.

SDMG is directly supporting this year's Microwave Update. Held 15-18 October 2015 here in sunny San Diego, Microwave Update is a conference devoted to amateur microwave activity. Tours, talks, socializing, and plenty of equipment to browse have been highlights in the past. SDMG is providing the antenna test range at the event. Participants bring their microwave gear to get output power and minimum discernible signal levels measured.

Visit the Microwave Update FaceBook page for more information about the event!
https://www.facebook.com/MicrowaveUpdate

SDMG Meeting Photos by Paul KB5MU

K6DLV/YB0ARA HAM ESTATE SALE
SATURDAY APRIL 11, 2015
8AM TO 12 NOON
ESTATE OF PHIL DAVID
1641 MOON ROCK RD
FALLBROOK, CA 92028

Mobile rigs, HT's, PS's, TNC's Winkeyer, Straight Keys,
Custom Paddle, Rig Blaster Pro, Alpha Delta Switches,
Speakers, 55' crank up tower (US Tower I believe),
SteppIR (not sure what model),
Yagi's for satellite work w/rotator,
Coax, Connectors, Project boxes,
Power Cables, Books and much more!

For more info please contact
Stephen KC6MIE at 760-419-0151
Information and directions will be posted
Fallbrookarc.org

Tear the back page out of the Scope and take
it with you! If you find a friend that might be
interested in the estate sale or our next meeting,
pass this page along to them.

SCOPE PERIODICALS
P.O. Box 73
Vista, CA 92085-0073

Return service requested

Featured Program:

At 7:30pm on 4 March 2015, Palomar Amateur Radio Club will have a program. At the March meeting Howard White KY6LA will present Modern Radios SDR-101. Modern radios (software defined radios) will be explained to show how they work work and how they differ from legacy radios that most hams currently use. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing, and for the HF Remote Special Interest Group meetup.

> Sign up for the PARC Email Lists:
>
> http://www.palomararc.org/mailman/listinfo

President's Corner

As I write this note, I am pleased to announce that the Poway City Council has directed all Poway Home Owners Associations (HOAs) to implement the FCC and PRB-1 antenna regulations we all hold so dear. It wasn't just the enactment of the long awaited tower ordinance in Poway. The Council has "seen the light".

Over the past several months we've had the pleasure of very fine club programs. Last month's SDR-101 by KY6LA (Howard) covered a lot of ground regarding the development of radio architectures since the dawn of radio, and all who attended should have gained considerable knowledge about the guts of "knobbless radios". Thank you Howard. On March 8th, PARC held a workparty up at the repeater site. Well attended. We frequently overlook the fact that repeater sites are the "infrastructure of ham radio", and seldom give it much thought. Those who went to the work party had a great tour of the many buildings and equipment that keep our venerable PARC repeaters on the air. If you have not done so, I think you should join one of our "infrastructure maintenance parties" and see the guts of our systems. And the drive up to Palomar Mountain will enthrall you with the fantastic visibility of San Diego County. I am pleased to look forward to the April program covering the capabilities of Yaesu's C4FM Fusion system. Soon five of our repeaters will be upgraded to that technology, will be able to repeat digital and analog signals, and will seamlessly translate one mode into the other in real time. I hope to see many of you at the April General Meeting. And before I forget, Happy April Fool's day (in case you took the opening sentence too seriously)

73 de NN3V

Save the Date

Club Meeting
1 April 2015

Mr. Chris Wilson from YEASU will present about System Fusion

Board Meeting
8 April 2015

Palomar Amateur Radio Club board meeting at 7:00pm at W6GNI QTH.

Club Events
April 2015

Support Boy Scout Radio Merit Badge at Scout Fair! Write scope@ palomararc.org for info

Advertisements are free for members
Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Spectrum Analyzers, two HP141T working mainframes. HP8555s (10 MHz - 22 GHz) parts units, HP 8554s (good 1.2 GHz) and HP8553 (good 110 MHz) RF plugs ins. With HP8552A & B I.F. modules. Lots of spare parts. Make offers. WB6IQS@amsat.org. John, Vista.

The Ham Radio Lunch Bunch meets Fridays for lunch and socializing at any one of a number of restaurants on a rotating schedule.
The Lunch Bunch signup is http://w0ni.com

Reminders are sent out on Wednesdays.
All are welcome for food and fun!

Some of the restaurants on the schedule are Fuddruckers, UTC Food Court, Spices Thai, Savory Buffet, Denny's, Callahan's Pub and Grill, and Phil's BBQ.

Please support our advertisers. Their support of the club is vital.

{special} THANKS to our sponsors

Nonoperational => Operational

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A final report will be written and published once the repeater is re-installed at the repeater site on Palomar Mountain.

Is there a piece of hardware or software that you would like to work on to benefit the club? The Scope is interested in your proposals!
Send them in to scope@palomararc.org

Field Day T-Shirt Alert

The ARRL web site (arrl.org/shop) will offer limited edition 2015 Field Day antenna t-shirts with conductive ink resonant on a range of bands, from size small (6 meter band) to XXXL (80 meters). While supplies last. ARRL will begin on-line sales of these unique walk-around antennas on 4/1/15.

System Fusion - Photography

FT1D USB CAMERA SETTINGS FOR THIS PHOTO WERE SIZE: 160 BY 120, AND QUALITY SET TO LOW (2KB)

FT1D USB CAMERA SETTINGS FOR THIS PHOTO WERE SIZE: 320 BY 240, AND QUALITY: HIGH (20KB)

Above are two photos taken with the FT1D handheld microphone on 4 March. One is at lowest file size, lowest quality, and the other is at highest file size, highest quality. Quality seems to be level of JPG compression, as both photos had a resolution of 72 pixels per inch. They were received on a FTM400, and forwarded back to the FT1D. I'm holding up the microphone and trying to point it towards me. There's no screen on the FT1D, so you have to just point and shoot and hope all those years of taking camera phone photos helps guide your aim :+) Setup was extremely easy and everything worked out of the box. -Michelle W5NYV
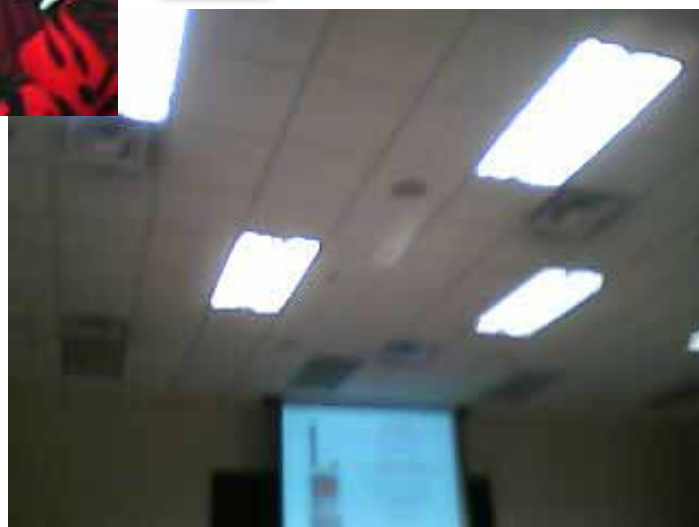
AIMING THE MICROPHONE CAMERA COULD POSSIBLY TAKE SOME PRACTICE. HERE IS A SHOT THAT DOESN'T APPEAR TO INCLUDE EXACTLY WHAT WAS INTENDED!

FULL SUN OUTDOOR SHOTS APPEAR A LOT MORE SHARP THAN THE LOWER LIGHTING INDOOR SHOTS.

EARS General Meeting

When	Thu, April 9, 7pm – 9pm
Where	900 Canterbury Pl, Suite 300 (third floor) Escondido, CA 92025 (map)
Description	EARS Monthly General Meeting.

more details»   copy to my calendar»

ALERT! ALL HANDS ON DECK! EARS AUCTION IS COMING UP IN APRIL. NOTICE THE NEW LOCATION IN THE INFO ABOVE.

March Membership Meeting - FT1D Photos

HERE IS THE SORT OF INDOOR PHOTOGRAPHY YOU CAN EXPECT TO ACHIEVE WITH THE MH-85A11U YAESU CAMERA MICROPHONE FOR FT1DR/FTM-400DR. THESE PHOTOS WERE TAKEN AT SIZE: 320 BY 240, AND QUALITY: HIGH THE MICROPHONE CAMERA RETAILS (AT PRESS TIME) FOR $134.95. THERE IS AN EXTENSION CABLE AVAILABLE FOR $50.

Figure 3-1   C4FM modulation procedure

Figure 3-2   C4FM demodulation procedure

(2) Encoding

The binary data series of the serial input is entered into the modulation system after being converted into dibits starting from the leading bit of the signal format and then mapped onto the various symbols of the C4FM. The corresponding relationship between the dibit, symbol and frequency deviation is shown in **Table 3-1**.

Table 3-1   C4FM Mapping

Dibit	Symbol	Frequency Deviations
00	+1	+900 Hz
01	+3	+2700 Hz
10	-1	-900 Hz
11	-3	-2700 Hz

C4FM is the modulation scheme used in System Fusion. It stands for Constant Envelope 4-Level Frequency Modulation.

Above is a section of the System Fusion Digital Specification document from Yaesu. System Fusion uses C4FM.

Modulation, the process of making a carrier mean something, and demodulation, the process of extracting meaning from a signal, are expressed in block diagram form. A binary string of data, whether voice, text, or photo, is taken two bits at a time. These sets of bits are referred to as dibits in this document. Each dibet can be one of four values (00, 01, 10, and 11). Each of these values is called a symbol and is assigned a name (+1, +3, -1 and -3). Each symbol is associated with a specific frequency deviation.

In FSK, which stands for Frequency Shift Keying, the carrier changes frequency based on the symbol. In C4FM, there are four different frequency deviations. The deviation is added or subtracted from the center frenquency.

In order to demodulate the signal, matched filters are used. There are four filters. Each filter is tuned to one of the four frequency deviations. When energy is detected by the filter, then for that time slot, a particular symbol is recorded as being received. The symbol corresponds to a particular dibit, and a binary stream is therefore reconstructed. The impulse response of the filter used in C4FM is expressed below. -W5NYV

$$|H(f)| = \int_0^1 \cos\left[(T/4\alpha)(2\pi|f| - \pi(1-\alpha)/T)\right]$$

$$0 \le |f| < (1-\alpha)/2T$$
$$(1-\alpha)/2T \le |f| < (1+\alpha)/2T$$
$$(1+\alpha)/2T \le |f|$$

ARRL Announcement

From the ARRL:

"The Amateur Radio Parity Act of 2015 -- H.R.1301 -- has been introduced in the US House of Representatives. The measure would direct the FCC to extend its rules relating to reasonable accommodation of Amateur Service communications to private land use restrictions. US Rep Adam Kinzinger (R-IL) introduced the bill on March 4 with 12 original co-sponsors from both sides of the aisle -- seven Republicans and five Democrats."

It behooves every ham, whether an ARRL member or not, to make their voice heard in Congress (House as well as Senate) about how important getting this bill passed is for the amateur radio service.

Having fought the battle for antennas in Poway, I don't need to tell you that this is an opportunity to nullify some of the special interests that oppose ham radio.

Should this measure be enacted, thousands of hams nationwide will be able to re-enter the hobby which they have been denied by "Ms. Clipboard".

The ARRL webpage at http://www.arrl.org/hr-1301 has extensive coverage of this, and includes draft letters recommended to be sent to Senators and Congressional representatives, including links to your individual Senator or Representative (determined by your Zip code).

I urge you to get involved in making your voice heard, for the benefit of all our fraternal amateur radio operators.

73 de NN3V

Micro Girl wants YOU to attend MUD 2015!

NORTH SENTINAL ISLAND DX CLUB

ORGANIZATIONAL MEETING 2 APRIL 2015 CARMEL VALLEY LIBRARY 7PM

RSVP TO SCOPE@PALOMARARC.ORG
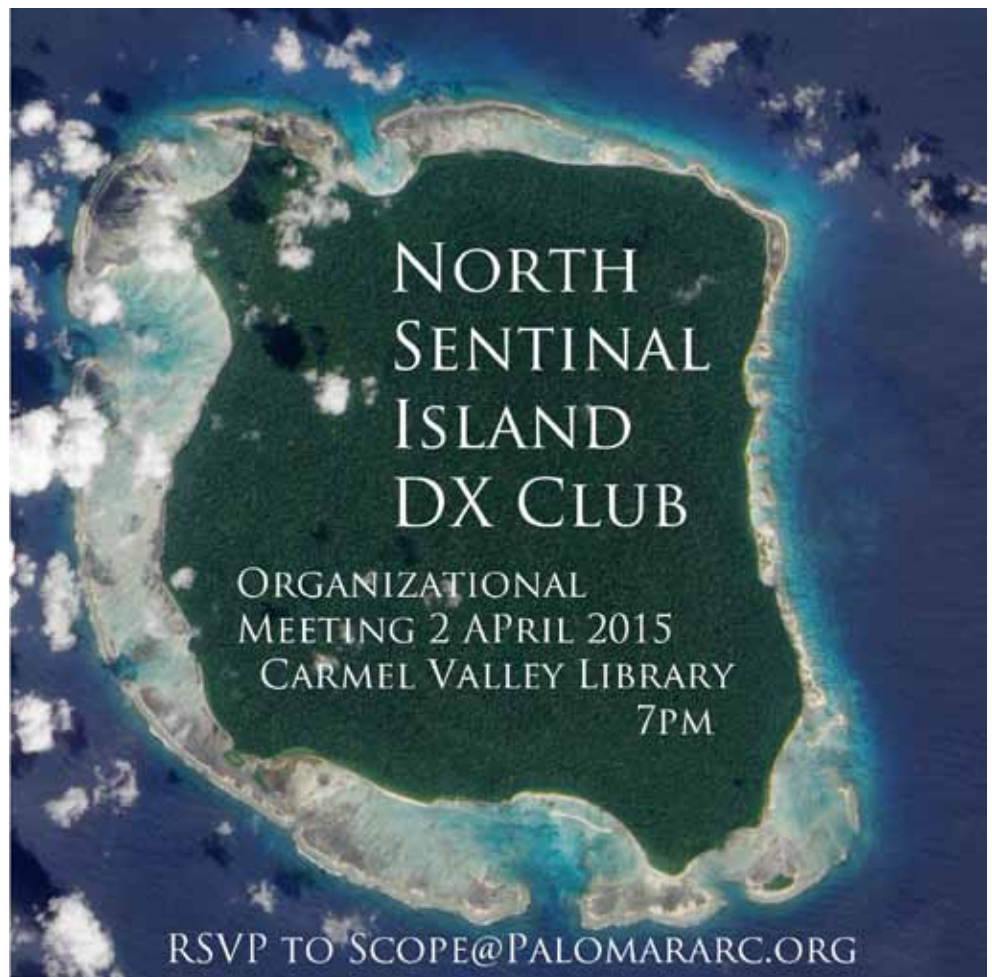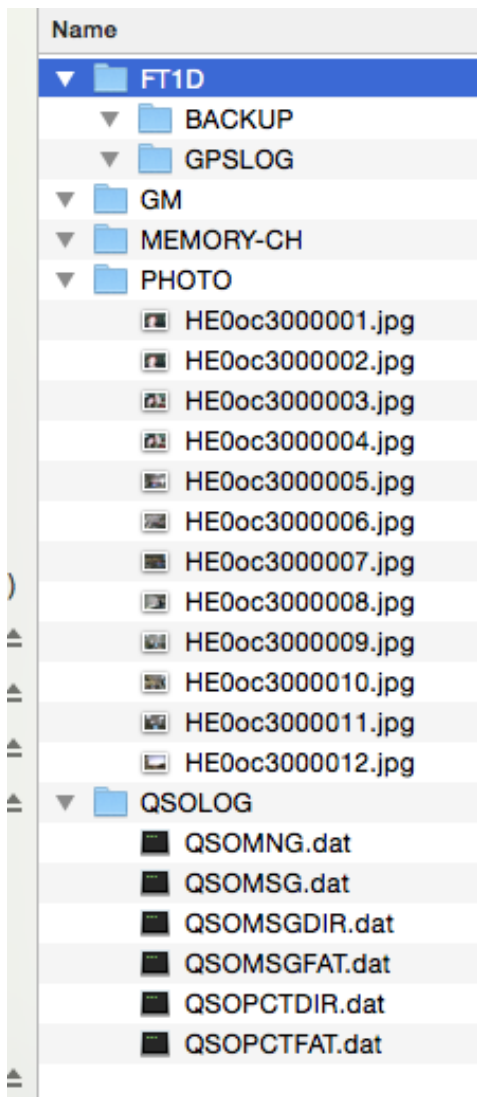
Above: The directory structure on the SD card from an FT1D.

PHOTO contains photos taken by the microphone camera in jpg format.

QSOLOG contains data files from picture and text messaging. We're going to look more closely at QSOPCTDIR.dat

GM is for Group Monitor, a System Fusion function for alerting when people on a list are in range.

MEMORY-CH is stored memory channels.

GPSLOG stores GPS logging data, if enabled, and...

BACKUP is for backups.

Below are two files related to the text messaging function. First, QSOMSGDIR.dat seems to record metadata of a text message. E0oc3 is the radio ID of my handheld, and F03af is my mobile rig. The GPS coordinates appear to be my driveway, which is where the text message was sent. QSOMSG.dat contains the actual content of the text message.


```
0E0oc3W5NYV
F03afW5NYV


N032573000W117123800
```



```
Re:us in Odessa nice!
```
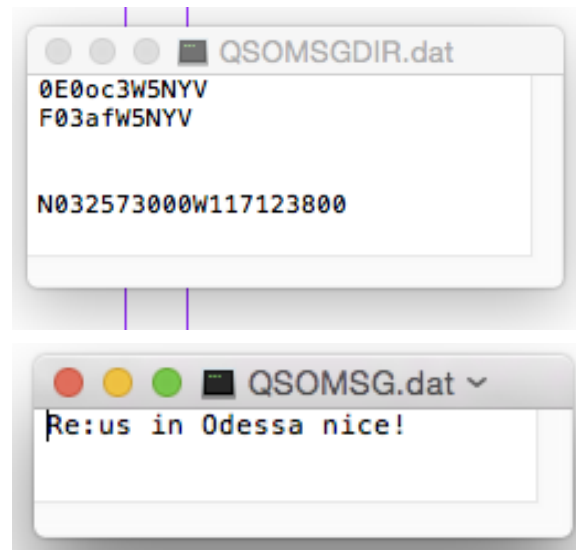
Some of the files are a bit more cryptic. Below are the final three files with their contents as read by a text editor on a desktop computer.


```
@@Ä@@Ä@@Ä@@Ä@@Ä@@Ä
```



```
@
```

Under the


```
E0oc3W5NYV
E0oc3W5NYV
F03afW5NYV
E0oc3W5NYV
E0oc3W5NYV
F03afW5NYV
E0oc3W5NYV
E0oc3W5NYV
E0oc3W5NYV
E0oc3W5NYV
E0oc3W5NYV
E0oc3W5NYV
E0oc3W5NYV
E0oc3W5NYV
F03afW5NYV
```

Above are the conten
be seen as part of the
mobile rig, and E0oc3

Next seems to be a d
the mobile rig was ins
after the date codes a

Between the timestam
formatting, or some o

Immediately after the
driveway at N032573
at N033082645W117
areN000E000000000.
successfully transmitt

Immediately before s
what these indicate, i
for example). Howeve
photo filenames. So,

The final column som
a photograph, you ha
That way, you can se
photos of you finally

There was discussion
microphone camera.
microphone camera)
representative said th
could be sent from th
microphone camera.

```
                     QSOPCTDIR.dat

WWW2015/03/04 15:57åHE0oc3000001.jpgN032573032W117123817a    ALL
YYW2015/03/04 15:57åHE0oc3000001.jpgN032573032W117123817p    ALL
  W2015/03/04 15:57åHE0oc3000002.jpgN032573000W117123800
  2015/03/04 16:05L¬HE0oc3000003.jpgN032573032W117123817a    ALL
  2015/03/04 16:05L¬HE0oc3000003.jpgN032573032W117123817p    ALL
  2015/03/04 16:05L¬HE0oc3000004.jpgN032573000W117123800
  2015/03/04 19:09)ñHE0oc3000005.jpgN033082645W117159349
  2015/03/04 19:09⁻HE0oc3000006.jpgN033082658W117159343
  2015/03/04 19:09−2HE0oc3000007.jpgN033082611W117159346
  2015/03/04 19:09&ΩHE0oc3000008.jpgN033082573W117159336
  2015/03/04 19:09++HE0oc3000009.jpgN033082561W117159299
  2015/03/04 19:20'[HE0oc3000010.jpgN033082535W117159371
!!!2015/03/04 19:21jHE0oc3000011.jpgN033082549W117159355`   ALL
YYU2015/03/09 14:55−rHE0oc3000012.jpgN0 00E000000000|
```

nts of the QSOPCTDIR.dat file. You can see it's somewhat human-readable. My callsign is W5NYV, which can
e left-most column. The numbers immediately before my call sign are the radio ID. F03af is my FTM-400
B is the radio ID of my FT1D handheld.

ate code. You can see a lot of activity on March 4th at around 2:05pm and again at 3:57 pm, the day that
stalled in my vehicle. This is when I tested the photography functions with the microphone camera. Right
are photo file names (see corresponding file names in directory structure snapshot at left).

mp and the filename are additional characters. It's not clear yet what they indicate. They could be
other sort of character that does not translate when these files are opened in a text editor.

e filename are GPS coordinates. The first set of photographs were taken on my handheld, in my
032W117123817. The second set were taken on my handheld, at the PARC meeting, located
159349. The last line has a radio ID that belongs to the mobile rig in the radio. Coordinates
. I believe this is a reception (on the handheld) of a photograph taken with the mobile rig and then
ted to the handheld.

ome of the date codes are additional letters. You can see WWW, YYW, W, YYU, and !!!. I'm not sure yet
if anything. On many Yaesus, there are codes for when APRS messages have been received (the asterisk,
r, these letters may be in the same category as the characters that appear between the timestamp and the
if you find out, track it down, or figure it out, write me and let me know at scope@palomararc.org!

ometimes contains the word ALL. This corresponds to who the photograph was transmitted to. When you take
ave the option of transmitting it to "ALL" System Fusion radios in range, or a custom Group Monitor list.
t up lists of people that might want photos of your Field Day setup to the "Field Day" Group Monitor list, or
leaving the club meeting to your "Friends and Family" Group Monitor list.

in one of the System Fusion forums that there is metadata added to the photos taken by the Yaesu
This discussion was sparked by an operator that put his own JPGs on the SD card (not taken with the
and then attempted to transmit the photo. This attempt failed. In discussions with Yaesu tech support, the
hat there was metadata associated with the photograph, and only photos with the microphone camera
e radio. This metadata was assumed to be something that identified the photo as coming from the
This would seem to be an attempt to force operators to use only the Yaesu microphone camera with the

e 12

A Brief Review of FT1DR Programming Options

Chirp was relatively easy for me to use. I have used it before on other radios, so I had a clue. I have not worked with saving as a csv yet, but this is the meathod for cross platform programming.

For the FT1D, programming frequencies reqired filling out four (4) fields for standard shifts. Offsets entered automaticly. Splits like Crest (+945) and EVENT (+2.655) did need to be entered.

Fields entered:
RX frequency
Name
Tone type - no tone, tone, tone decode, dcs
Tone frequency
Offset/split if split
Offset frequency if non standard
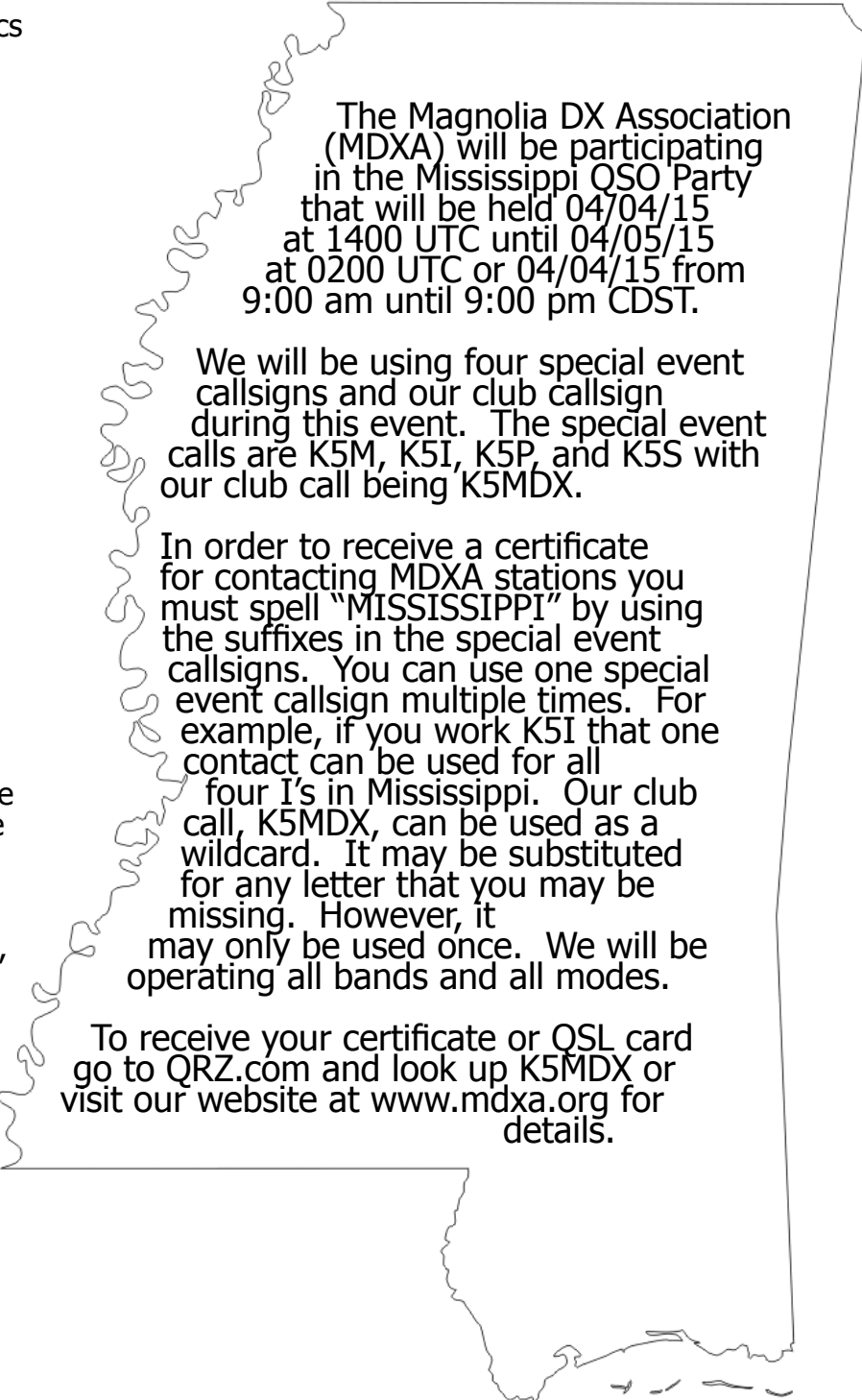
Time taken: about an hour and a half of piddling around, no hurry. Some time checking out CSV saving.

I have also worked with RT systems programming. I like their product and use it on other radios using the same loads.

Dennis KD6TUJ

Update from Newton

Bowing to public pressure, the ARRL Board of Directors is considering a name change of the annual Field Day event. If approved, the name change would be effective with the 2016 Field Day. Those opposed to the current Field Day name cite several reasons for the need to update the name. First, many groups operate inside a building, not in a field, so the name does not fit actual 21st Century practice. Park Day might be a better description. Second, for decades, debate has raged inside the ARRL as to whether Field Day refers principally to the electric or magnetic field generated by good-humored participants.

The Magnolia DX Association (MDXA) will be participating in the Mississippi QSO Party that will be held 04/04/15 at 1400 UTC until 04/05/15 at 0200 UTC or 04/04/15 from 9:00 am until 9:00 pm CDST.

We will be using four special event callsigns and our club callsign during this event. The special event calls are K5M, K5I, K5P, and K5S with our club call being K5MDX.

In order to receive a certificate for contacting MDXA stations you must spell "MISSISSIPPI" by using the suffixes in the special event callsigns. You can use one special event callsign multiple times. For example, if you work K5I that one contact can be used for all four I's in Mississippi. Our club call, K5MDX, can be used as a wildcard. It may be substituted for any letter that you may be missing. However, it may only be used once. We will be operating all bands and all modes.

To receive your certificate or QSL card go to QRZ.com and look up K5MDX or visit our website at www.mdxa.org for details.

Income/Expense by Payee - Last month

2/1/2015 through 2/28/2015

PARC Income/ Expenses Monthly
Month of February

INCOME	
SCOPE Advertisement	$288.00
Donations	$00.00
Dues (May include Future Years)	$645.00
TOTAL INCOME	**$933.00**

EXPENSES	
Utilities	$298.63
SCOPE Printing/ Mailing	$132.37
Repeater Site Maintenance	$339.66
TOTAL EXPENSES	$770.66

2/2015

- Income
- Expense
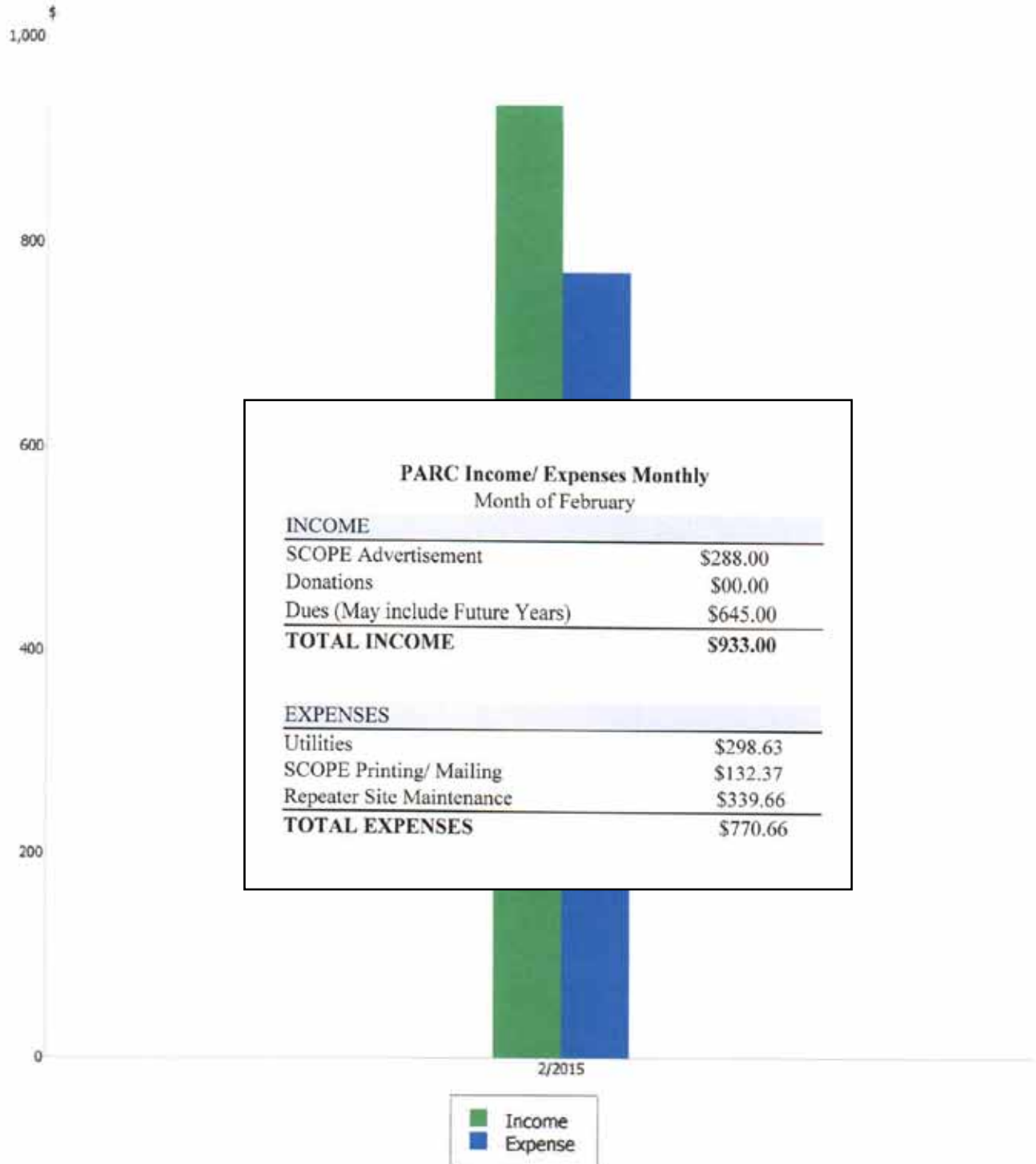
radio. If this metadata could be identified and duplicated, then other cameras can be attached to the radio.

Looking at metadata of the photos taken with the microphone camera in Adobe Lightroom, nothing unusual was seen on a first pass. Opening up the photos in Photoshop and looking at the raw data didn't reveal anything remarkable there, either.

However, it occurred to the Scope Editorial Science Staff that simply placing photos in the PHOTO directory wouldn't necessarily work since the photos were also logged in the QSOPCTDIR.dat file. There might not be any extra metadata in the photo after all.

So, an experiment was made where a new photo, not taken with the microphone camera, was substituted in for a photo

spectra measurement and photography setup. Photos and measurement images by Paul KB5MU

that was taken with the microphone camera, and already existed on the SD card and therefore already appeared in the QSOPCTDIR.dat log. By using the same filename, the photo would be "findable" by the firmware on the radio, if the firmware is using the listing in QSOPCTDIR.dat to transmit the most recently taken photo.

A 320 by 240 pixel test image was created in Photoshop, saved as a JPG, saved to the SD card as the latest image (replacing an existing image), and then image transmission was attempted. The image was successfully received on the mobile rig, thus proving that there is no

metadata in the image preventing other cameras from being used.

It was assumed that the "smarts" to update and manage the QSOPCTDIR.dat file are in the radio, and not in the camera microphone. Therefore, if we can build an interface that mimics the one in the camera microphone, we should be able to take photos or images and send them out without having to use the camera microphone.

The next thing looked at was spectra from the FT1D, so we could see what's emanating from the radio. With assistance from Paul KB5MU in photographing the measurements from our spectrum analyzer, the four images on the facing page were obtained.

The FT1D was held 5 feet away from the Tektoronix 492 and was set to lowest power. These images show the transmissions in the frequency domain. Frequency is the horizontal axis, and power in dBm is the vertical axis. For this set of measurements, the settings were 2kHz per division (horizontal) and 10dBm per division (vertical).

First, an FM carrier with no voice was measured. Then, an FM transmission of DTMF tone 4. Next, an FM voice transmission with max hold turned on was made over the course of about a minute and an half. Finally, a photograph was sent using data mode and the spectra measured.

by Michelle W5NYV

FM carrier with no voice on FT1D
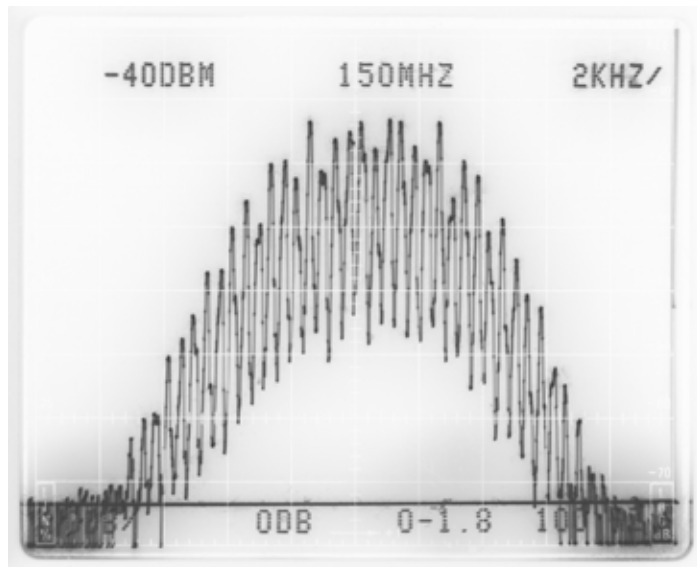
FM transmission of DTMF tone 4 on FT1D
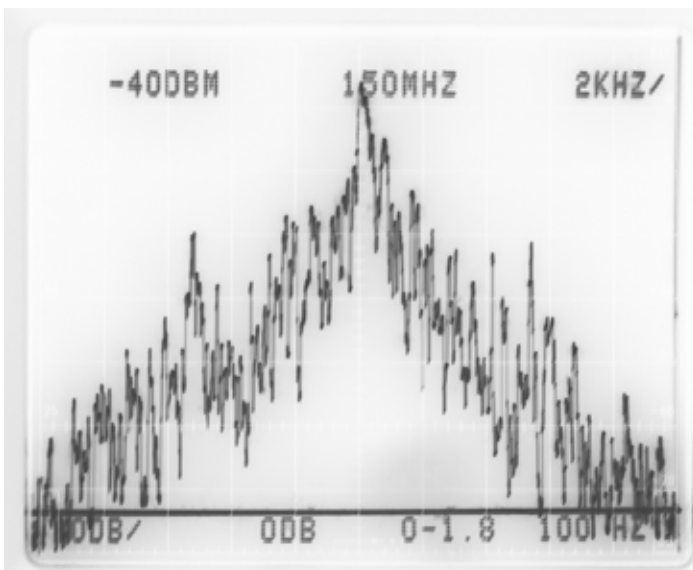
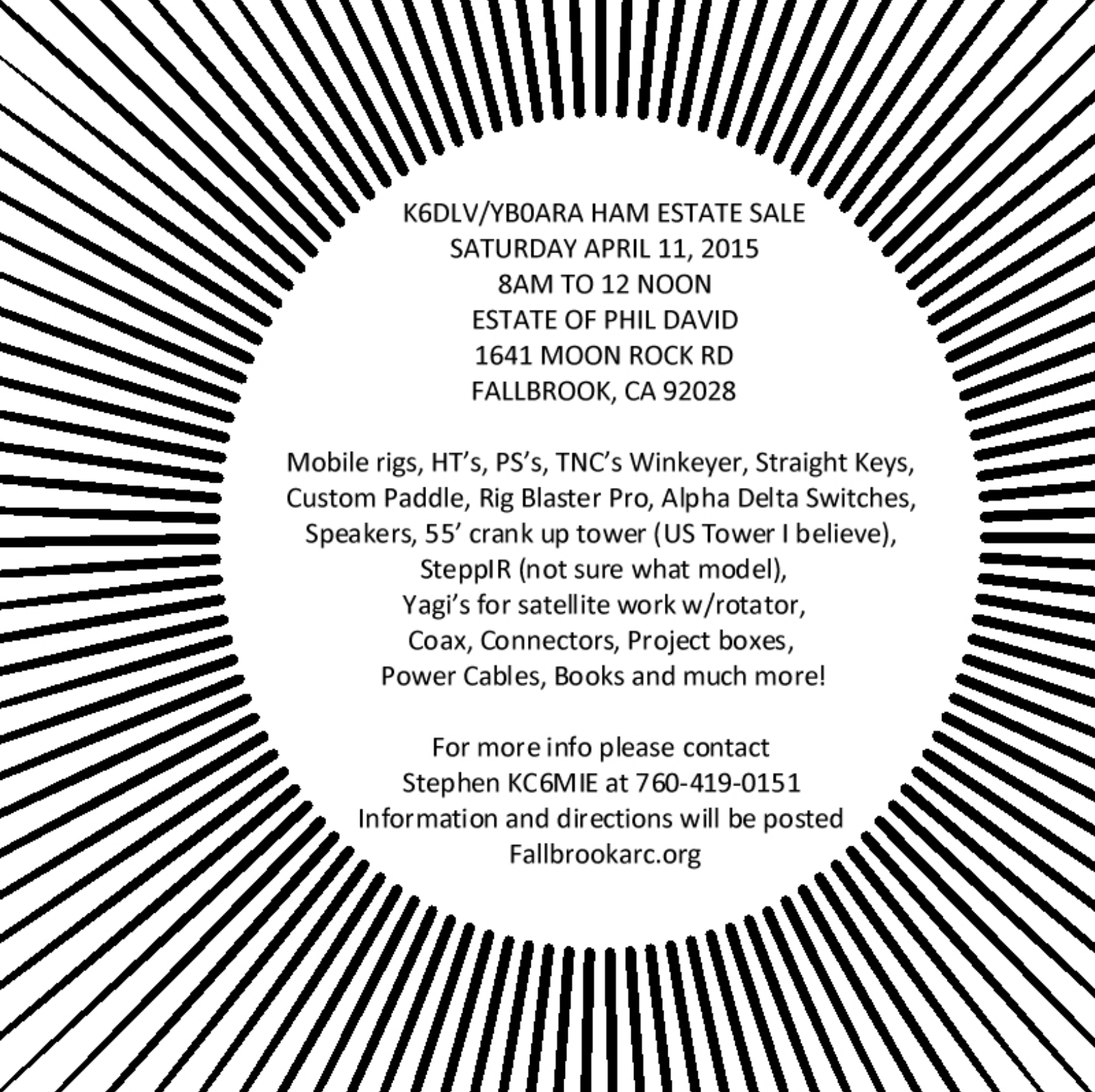FM voice transmission on FT1D
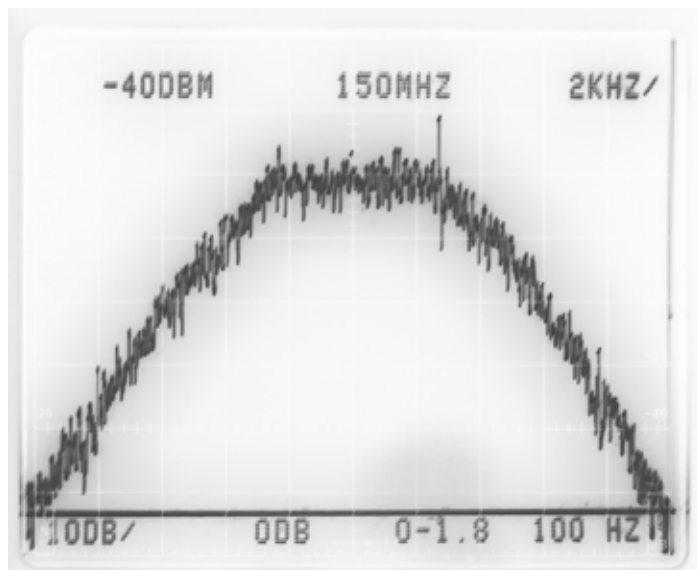
Microphone camera transmission using data mode

PARC Radio Drawing
FT1DR Radio
Cost: $3.00 per ticket.
Do not need to be
present at drawing.

This radio will give the
user a capability to use
digital communications
through the new C4FM
repeaters planned for
installation by PARC.
The April program on
Yaesu Fusion will cover
many of the possible
uses of this radio.
Don't miss a chance
at getting a new radio
at an incredibly low price!

K6DLV/YB0ARA HAM ESTATE SALE
SATURDAY APRIL 11, 2015
8AM TO 12 NOON
ESTATE OF PHIL DAVID
1641 MOON ROCK RD
FALLBROOK, CA 92028

Mobile rigs, HT's, PS's, TNC's Winkeyer, Straight Keys,
Custom Paddle, Rig Blaster Pro, Alpha Delta Switches,
Speakers, 55' crank up tower (US Tower I believe),
SteppIR (not sure what model),
Yagi's for satellite work w/rotator,
Coax, Connectors, Project boxes,
Power Cables, Books and much more!

For more info please contact
Stephen KC6MIE at 760-419-0151
Information and directions will be posted
Fallbrookarc.org

Tear the back page out of the Scope and take it with you! If you find a friend that might be interested in the estate sale or our next meeting, pass this page along to them.

SCOPE   PERIODICALS

P.O. Box 73
Vista, CA 92085-0073

Return service requested

Featured Program:

At 7:30pm on 1 April 2015, Palomar Amateur Radio Club will have a program. Mr. Chris Wilson from
YEASU will present about System Fusion. We look forward to seeing you at the Carlsbad Safety Center,
2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing, and for the HF Remote Special Interest Group
meetup.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

PALOMAR AMATEUR RADIO CLUB INC.
Since 1936
W6NWG
San Diego County, Ca

Save the Date

Nonoperational => Operational

The Ham Radio Lunch Bunch meets Fridays for lunch and socializing at any one of a number of restaurants on a rotating schedule.

The Lunch Bunch signup is

http://w0ni.com

Reminders are sent out on Wednesdays.

All are welcome for food and fun!

Some of the restaurants on the schedule are Fuddruckers, UTC Food Court, Spices Thai, Savory Buffet, Denny's, Callahan's Pub and Grill, and Phil's BBQ.

The 6m repeater has been nonoperational for 3 years as of February 2015. John W6JBR, Bill N6PIG, and Michelle W5NYV have picked up the project and made a lot of progress since beginning work on 1 February 2015. The team is approaching the repairs as an open source and open process project. The tracking document, which is a chronological record of the work done on the repeater, is located here:

https://docs.google.com/document/d/1vrlMv0jMd83iTxgk8H1ZgbULF-comYmVPwpy3Uqz2-c/edit?usp=sharing

A final report will be written and published once the repeater is re-installed at the repeater site on Palomar Mountain.

Is there a piece of hardware or software that you would like to work on to benefit the club? The Scope is interested in your proposals!
Send them in to
scope@palomararc.org

Please support our advertisers. Their support of the club is vital.

{special} **THANKS** to our sponsors

AMSAT is excited to announce that we have accepted an opportunity to participate in a potential rideshare as a hosted payload on a geostationary satellite planned for launch in 2017. An amateur radio payload, operating in the Amateur Satellite Service, will fly on a spacecraft which Millennium Space Systems (MSS) of El Segundo, CA is contracted to design, launch, and operate for the US government based on their Aquila M8 Series Satellite Structure.

A meeting to discuss this potential rideshare took place on April 13 at Millennium Space Systems that included Dr. Bob McGwier, N4HY; Franklin Antonio, N6NKF, co-founder of Qualcomm; Jerry Buxton, N0JY, AMSAT Vice President of Engineering and member of the board for AMSAT-NA; Dr. Tom Clark, K3IO, Director and President Emeritus of AMSAT-NA; Phil Karn, KA9Q; and Michelle Thompson, W5NYV.

Hosting the meeting for MSS were Stan Dubyn as founder and chairman of MSS, Vince Deno as president of MSS, Jeff Ward, K8KA, of MSS as VP for Product Development, formerly with SSTL and University of Surrey Space Center, and Ryan Lawrence of MSS as Project Manager on the spacecraft mission. Attending by telephone were Dr. Jonathan Black, Associate Research Director of Hume Center for Aerospace Systems and Associate Professor of Aerospace and Ocean Engineering and Dr. Michael Parker, KT7D, founder of RINCON Research Corp.

Following the meeting, Dr. Bob McGwier, N4HY, Director of Research at the Hume Center for National Security and Technology of Virginia Tech, and former director and former VP Engineering of AMSAT, described this as an opportunity to go forward with "AMSAT-Eagle" which, in the 2006-2008 timeframe, evolved into a microwave payload to be flown to geostationary orbit as a hosted payload. It would have provided digital communications to small terminals on the ground and a linear bent pipe transponder had it flown. This failed to go forward in part due to lack of an affordable flight opportunity.

McGwier outlined the next steps toward developing this mission:

1. To organize an effort at Virginia Tech to make a firm proposal to MSS and its US government sponsor, and organize an effort to raise sufficient funds to

(L-R) Sonya Rowe, KK4NLO; Jerry Buxton, N0JY; Bob McGwier, N4HY; Franklin Antonio, N6NKF; Tom Clark, K3IO; Michelle Thompson, W5NYV; and Phil Karn, KA9Q standing next to the Aquila M8 Bus flight article.

pay for development of the mission.

2. Enable Dr. Jonathan Black to lead the construction project at Virginia Tech in the Space@VT Center. Sonya Rowe, KK4NLO, Project Manager at the Hume Center will be the project manager.

3. Work for development of a low-cost microwave ground station for amateur radio still needs to be determined.

4. Dr. Michael Parker, KT7D, will solicit the cooperation of the Rincon Research Corp. for development of the software radio technology for this payload.

The AMSAT Board of Directors has accepted the invitation to participate in this potential rideshare payload opportunity. AMSAT expects to be involved in the development of the ground station and the payload RF development, and will serve as the amateur radio (hosted) payload operator once the satellite has been launched.

McGwier summarized, "The launch is currently scheduled for 2017 and the payload must be delivered for testing and integration by Spring of 2016. It is an ambitious schedule and all involved will have to gain and maintain a serious level of commitment to that which they agree to undertake." AMSAT President, Barry Baines, WD4ASW, said, "The AMSAT leadership is excited to fly a Phase-IV geostationary amateur satellite payload. This is an evolving development as we

collaborate with the VT Hume Center with a project that provides technical challenges to create a new amateur radio capability in space that will provide a variety of benefits not only for amateurs but also for emergency communications and STEM educational outreach."

The transponder is expected to support a wide range of voice, digital, and experimental advanced communications technologies. A decision is expected soon specifying the microwave uplink and downlink bands.

Additional information on the Aquila M8 Series Satellite can be viewed on-line:

http://www.millennium-space.com/

http://www.millennium-space.com/ platforms#aquila

You're invited to find more information about AMSAT on our web at:

http://www.amsat.org

President's Corner

Many good opportunities are coming up for PARC members to have fun on the ham bands. **On 2 May, the Club is sponsoring an operating day at Fry's in San Marcos.** A great chance to come out and enjoy the HF bands, especially if you live in an antenna restricted location. Speaking of antenna restrictions, below we again are publishing the ARRL call to communicate with your Congress elected representatives urging them to support H.R. 1301, the proposed legislation that would require Home Owners Associations (HOAs) to abide by the FCC regulations for Amateur Radio. Have you communicated with our Congressional delegations in Washington, D.C.? Needless to say, Field Day is around the corner. Have you marked your calendar on June 26th - 28th to come and enjoy the fun and challenge of Field Day? As always, we will start the Field day set up on at noon Friday, May 26th., and operate continuously Saturday -Sunday, with tear-down of the equipment on Sunday

There is another opportunity for volunteering to help PARC remain up to date. We've benefited by the many years of service Al (W6GNI) has given PARC as the membership chairman. Keeping track of the status and records for some 260 club members is an act of kindness to all of us. To help keep the records in order, we are looking for a club member who would be willing to serve as an Assistant to Al. The duties are fairly straightforward. All the club's membership records are maintained in a spreadsheet program that is completely accurate thanks to Al. If you would consider volunteering for this effort, please see Al.

It is unfortunate that I must tell you KG6JEI (Conrad) has resigned from the Club's Technical Chair position for personal reasons. His service and willingness to support every operation of the Club will be missed.

It is fortunate that KF6WTN (Mark Raptis) has volunteered to assume the Club's Technical Chair duties. Several years ago Mark performed many technical support efforts for the Club. Welcome back Mark.

-Charlie NN3V

ARRL Announcement

From the ARRL:

"The Amateur Radio Parity Act of 2015 -- H.R.1301 -- has been introduced in the US House of Representatives. The measure would direct the FCC to extend its rules relating to reasonable accommodation of Amateur Service communications to private land use restrictions. US Rep Adam Kinzinger (R-IL) introduced the bill on March 4 with 12 original co-sponsors from both sides of the aisle -- seven Republicans and five Democrats."

It behooves every ham, whether an ARRL member or not, to make their vices heard in Congress (House as well as Senate) about how important getting this bill passed is for the amateur radio service.

Having fought the battle for antennas in Poway, I don't need to tell you that this is an opportunity to nullify some of the special interests that oppose ham radio.

Should this measure be enacted, thousands of hams nationwide will be able to re-enter the hobby which they have been denies by "Ms. Clipboard".

The ARRL webpage at http://www.arrl.org/hr-1301 extensive coverage of this, and includes draft letters recommended to be sent to Senators and Congressional representatives, including links to you individual Senator or Representative (determined by your Zip code).

I urge you to get involved in making your voice heard, for the benefit of all our fraternal amateur radio operators.

SDIMA Demonstration Success

by Dennis KD6TUJ

Palomar Amateur Radio Club was invited to participate in a community emergency preparedness fair held at 1444 Lake Drive in Cardiff. This location is the Cardiff Ward of The Church of Jesus Christ of Latter-Day Saints. Many other organizations were present. Most of the event was held in the courtyard (patio for us southern Californians). Helping to enlighten the guests were Richard KJ6WUY, Ron W6TXK , Gary W6GDK, and Dennis KD6TUJ. Richard and Dennis brought down the "canopy display" and Richard's setup for HF including his "portable" antenna. Setup was OK, as we had to bring the equipment through the front door to the side portal to the courtyard. The Mayor of Encinitas, Kristin Gaspar, came to welcome guests and interact with the displays. We did not know this was to occur. She came to our display first as we were the first she saw from her point at the "front" of the crowd. She asked who was our PR spokesperson. Suddenly three hands pointed to Dennis. Guess Dennis is the spokesman! Why is amateur radio the communications choice? Our systems are not on fancy computers and links that can be affected by earthquakes and loss of GPS signal. Palomar ARC also has about 2 weeks of battery supply to maintain the repeaters on the air during loss of power situations. Lots of people came to ask questions, including scouts and their leaders. The weather was good, mild temperatures, sunshine, and no rain. We have already been asked to come back next year.

California QSO Party

This Certificate of Achievement Is Awarded To

AF6WF K6KAL WB6NBU N6CY K6GO NA6MB W2PWS K4RB N6KI

NX6T

Class: M/S-H Rank: #1-San Diego #7-CA San Diego Contest Club
San Diego County

During the 2014 California QSO Party

1,816	Contacts	
57	Multipliers	
259,122	Total Points	

John Miller
John, K6MM, CQP Webmaster

NCCC

Chris Tate
Chris, N6WM, CQP Chairman

Spokesman Dennis KD6TUJ!

NORTH SENTINEL ISLAND DX CLUB

DESIGN AND BUILD ZOLTAR
WED AFTERNOONS IN MAY
AT W5NYV QTH
3PM-5PM

RSVP TO SCOPE@PALOMARARC.ORG
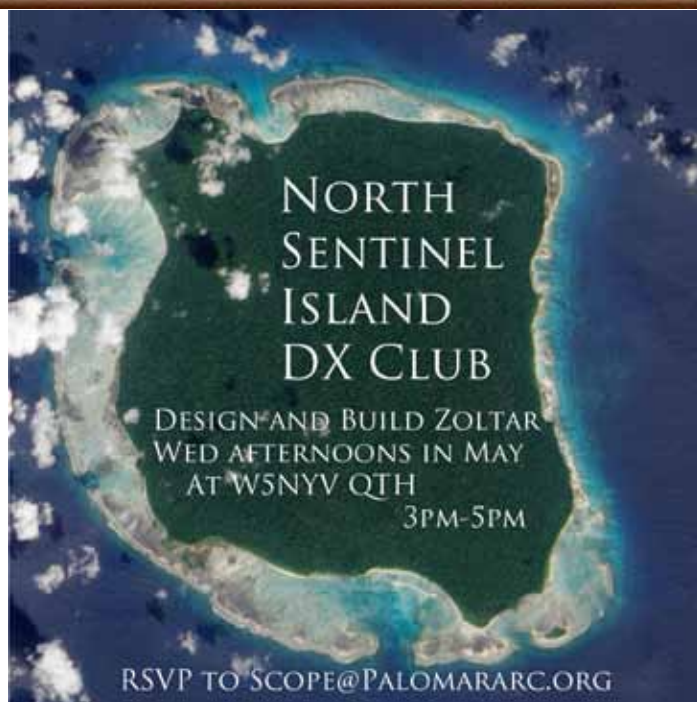
Repeater Site Work Party Report

by John W6JBR

On Saturday 4/24/15, an ad hoc repeater work party headed by John WB6IQS, accompanied by Rich, NI6H, and I, headed up to the PARC Palomar Mountain repeater site. Our primary objective was to ascertain the status of the 146.700 MHz duplex digital repeater, and make repairs as necessary. Users of this repeater, including Ron, KG6HSQ, Rich, and I, had recently determined that it had ceased to allow throughput, so connections could not be made to known good WinLink nodes such KG6HSQ-10 and XE2BNC-13.

Upon arrival at the site, John made basic checks of the repeater's power supplies, which tested good. He then proceeded to check the operation of the receiver and transmitter individually. He also checked the receiver input using Rich's portable packet station. The repeater receiver appeared to have an issue with sensitivity, and the transmitter could not be keyed locally. Due to the inclement weather, and possible need for parts not on hand, it was determined that the best course of action would be to remove the repeater from the hill and take it back to John's home lab, where he could affect repairs. The transmit antenna for this repeater was checked for SWR, directly, and via the cavities, and was found to be working as expected.

The repeater was removed, and secured in John's truck bed with ropes, covered by a blue tarp from the main storage container on site.

While working on the repeater, we had aired out the battery room. We then proceeded to check the batteries for electrolyte level. Approximately 7 cells were topped off with distilled water. The charger voltage measured 54.5 VDC on my DVM.

A brief site survey was then made. John checked the tower guy wires. We looked for any possible tree branches or debris that might threaten the guys. I took several pictures of the main tower and antennas (below). Visibility and detail were hampered by the thick fog and ongoing drizzle.

The site was then secured, and we departed.

Respectfully submitted,

John Rotondi
W6JBR
w6jbr@arrl.net

Club HF Remote Station? Let's Install One!

John WB6IQS checks the repeater power supply.

Your PARC Tower!

There are at least three reasons for the club to get involved in the HF remote movement. The first one is technical. The challenge of making a quality remote installation is fun and rewarding. The project involves backhaul establishment, HF equipment selection, remote access protocol development, command channel identification and establishment, testing and tuning, documentation, and training, among other things.

Secondly, autopatch and casual repeater usage has declined due to the increase of cellular coverage. Exploring new services that can be offered from club equipment on the Palomar Mountain property is an important responsibility. A new broadband repeater has been installed, and fresh hardware for the voice repeaters is under active investigation. Adding an HF remote station would expand the services provided by the club. This is an exciting time to get involved with renovating equipment on the site.

Third, many members are negatively affected by CC&Rs and other limitations on putting up HF antennas on their San Diego properties. We live in an urbanized area where antennas may or may not be allowed. Plenty of us live in valleys or in places that are not good for radio. Having a remote station that members can reserve and use would go a long way towards making the hobby possible for people that live in places where radio is limited.

If you would be interested in helping explore a club remote HF station on Palomar Mountain, then please join up by writing me at scope@palomararc.org and I'll add you to the mailing list!

Mailing list archive located at http://palomararc.org/pipermail/hfremote/

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

Current state: We think PARC needs to be 501c3 in order to get the required equipment.

May Program: Evolution of Early Radio Detectors

Dr. Eric Wenaas will be our program presenter at the May meeting. This presentation will cover the evolution of early radio detectors from the time of Heinrich Hertz in 1887 to the dawn of the broadcast era in the early 1920s. The talk will be accompanied by actual examples of each detector type, such as the Marconi Magnetic Detector shown below. It will also be accompanied by several demonstrations to illustrate the operation of certain devices such as the coherer.

Eric P. Wenaas has had a lifelong passion for antique radios beginning with his first Radiola and crystal set given to him as a young man growing up in Chicago by family friends. He experimented with radio devices and repaired radios and televisions as a hobby while in high school, and went on to study electrical engineering at Purdue University. At SUNY in Buffalo, NY, he earned a PhD, and then spent many years in the Defense industry

In 2002, he set out to research the early days of wireless and document interesting historical vignettes based on original documents of the era. He has written numerous articles for the *Antique Wireless Association (AWA) Review*, the *AWA Journal* and the *Antique Radio Classified*, and published a critically acclaimed book in 2007, *Radiola: The Golden Age of RCA - 1919-1929*, covering the early history of RCA—including the formative years of the Marconi Telegraph Company of America.

Club Finanical Update

Income/Expense by Payee - MTD

4/1/2015 through 4/28/2015

Income/Expense by Payee - MTD
4/1/2015 through 4/28/2015

Payee	4/1/2015-4/28/2015
INCOME	
Donations	25.00
DUES	75.00
TOTAL INCOME	**100.00**
EXPENSES	
AT&T	30.21
Cottage Printery	132.24
SDG&E	55.15
YAESU CD	23.78
TOTAL EXPENSES	**241.38**
OVERALL TOTAL	**-141.38**
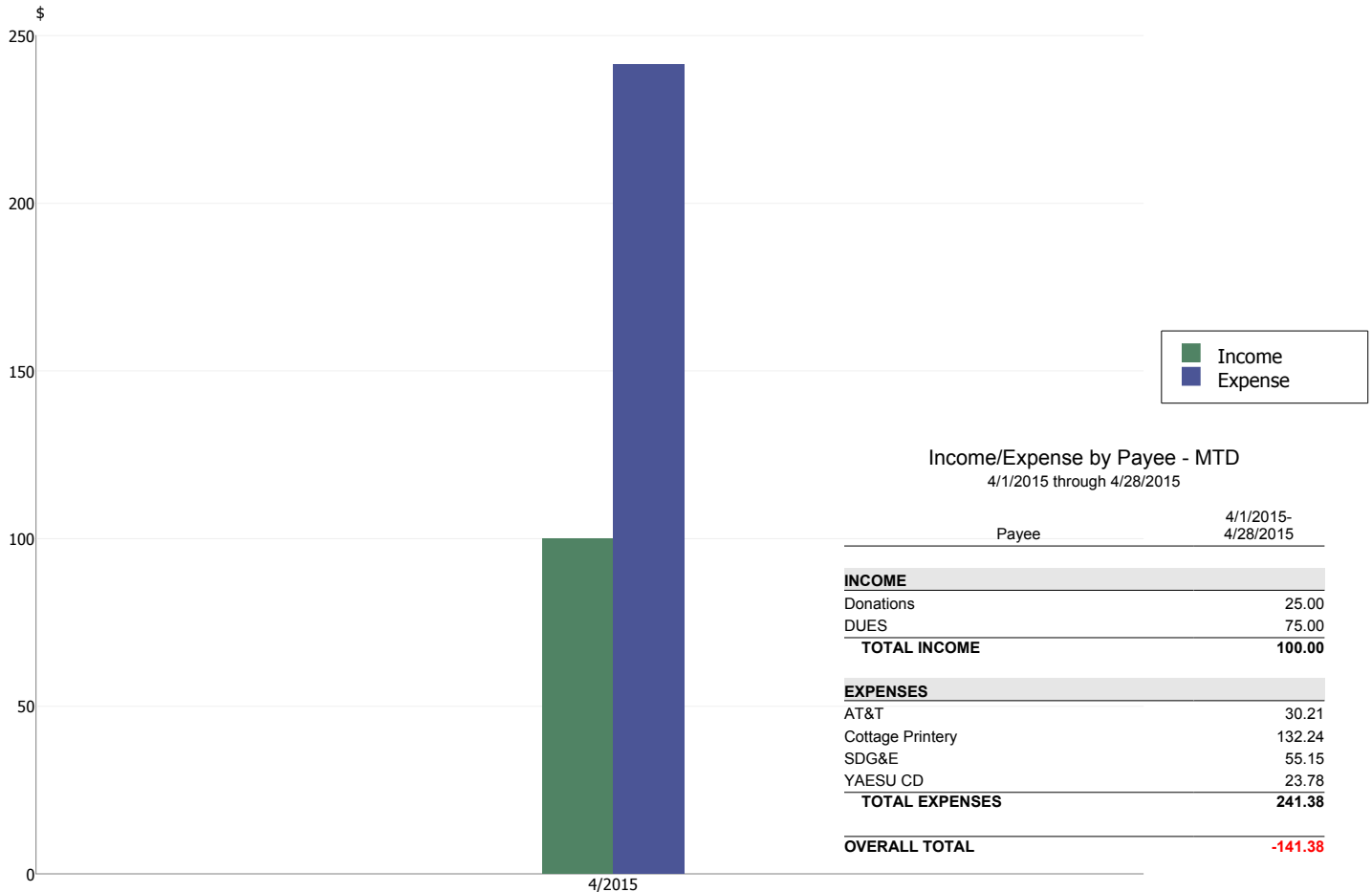
Preliminary Data, 146.700 Repeater Repairs

Receiver Bench Testing:
I swept the receiver and noticed that it was about 8 KHz high in frequency. The I.F. (11.7000 MHz) was correct and the channel element had drifted off frequency. Checking the receiver connections and I.F. alignment all seemed nominal so I re-adjusted the trimmer capacitor on the channel element and the receiver picked up about 10 dB in sensitivity (at 146.100 MHz). The discriminator audio output was now symmetrical for FM modulated tones. I will re-do the receiver alignment later but even at the 146.108 MHz receive frequency it was a little numb at -100 dBm sensitivity to break squelch. Now it is -110 dBm at 146.100 MHz and that is more like normal.

TX Issues: The transmitter keying is still not working. Working on why the P.T.T. (push to talk) signal is not being keyed by the TNC. It may be Motorola module problem because even with the locally keyed P.T.T. there is still no TX RF output.

John Kuivinen, WB6IQS
Vista, CA.

Art McBride KC6UQH Silent Key

It is with sadness that I pass along the news that Art McBride KC6UQH passed away today, April 16th at 9:10 AM. Art became a silent key at his home in Vista after a long fight with brain cancer. He contributed much to our amateur radio community and I will always remember his broad smile as he explained his microwave station at PARC field days. Art was a wonderful human being with an infectious zest for whatever he pursued. He will be missed by us all.

73 de Tom - W0NI

Art was a gentle soul. He was extremely knowledgeable and was gifted with the ability to explain stuff so that even I could understand it. Rest In Peace, my friend.

73 de N6UWW (ps - say hi to my Dad when your wings touch his)

The way he spent a lot of his time: talking with others!

Art was a great elmer and always had a great attitude whenever you interacted with him. He represented the best of ham radio. Highly intelligent but accessible. I will never forget the field day where he demonstrated satellite communication to my teenage boys. Both had their tickets but were clueless about satellite. Art patiently explained to them how it all worked and did a great demonstration. And who can forget "Art the Auctioneer". Years of "What do we have here? Weelllllll!!!, it's a box of broken Midland 11 meter radios.....who wants to say 10-4 good buddy? You won't have to feel bad either cause no one will hear you or respond....cause they're.....broken"

Back in the late 90s, we had a commuter net in the morning and the evening and I would frequently talk to Art. His laugh was infectious and his comments were great.

"Off to the button factory"

"Is it possible that the DMV actually certified the vehicle that just cut me off as safe for the roadway??"

He had a sing song way of announcing his call sign and used to joke that UQH stood for "UnQualified Ham" which could not be further from the truth.

I am sure others will relay all the stories of his contributions to PARC but I just remember he was fiercely committed to the club and a friend to all. One last 73 Art – You made us all better.

Michael KF6HCL

Dirk Reschly The EARS board was meeting when we learned about this. Very sad news. He helped our club with our auction and added an educational component. He will be missed by all who knew him.
April 16 at 11:51pm · Like · 👍 2

Alf Pettersen RIP Art, you will be missed but not forgotten.
April 17 at 2:52am · Like · 👍 1

Ron Rosson Rip Art,, you will be missed by all that had the pleasure of knowing you.
April 17 at 3:35am · Like · 👍 2

Donald Johnson Art Will be missed by everyone
April 17 at 6:36am · Like · 👍 2

Tom Martin RIP Art. You will be missed by all. Love to watch you at the clubs Autions.....73 my friend
April 17 at 6:40am · Like · 👍 3

Richard Scardino Art you will always be remembered and missed. Thanks for providing my start in this hobby some 20 years ago. Now you get to work a new grid square.
April 17 at 7:03am · Like · 👍 1

Robert Wynne Johnson The satellite station on field day will not be the same without Art.
April 17 at 9:31am · Like · 👍 1

Jo Ashley 73 Art! Hope you are with your son! You will be missed here!
April 17 at 9:38am · Like · 👍 1

Art KC6UQH - PARC Contributor

by Paul KB5MU

To understand all the contributions that Art McBride has made in his years with the Palomar Amateur Radio Club, I searched through the Scope archives for his callsign, KC6UQH. Here are some of the things I found, in memory of Art.

In July 1991, Art shows up in the New Members listing. "New member Art-KC6UQH is interested in antennas, DX, and Satellite Communications." As soon as the August issue, Art is listed in the Field Day report as helping with "building, testing and refurbishing antennas." By the September issue, in the Picnic report, Art has already started dreaming up new ideas for the club. "Art is Chief Engineer for Ocean Satellite Systems in S.D. and showed some interest in a DFing station located on Palomar Mountain." By November he is setting up equipment at club meetings for members to check their mobile equipment, and attending the club's Executive Meeting. At the November meeting, the club's Nominating Committee tapped Art to be the club's next Vice President, serving with President Harry WA6YOO (now W6YOO). New member to Vice President in half a year!

Art served as Vice President for three years, 1992-1994. As Vice President he was responsible for arranging the speaker at club meetings, and he is seen in every issue of the Scope announcing the speaker for the next meeting. He also actively managed Show and Tell for most of the meetings, and often had items of his own to show. In 1993 he even organized the club Picnic.

During that time he became increasingly active with maintaining the club's repeaters. He shows up doing significant work at nearly every work party, of which there were many in those years, starting in October 1991. In November 1992 he was listed as the repeater technician in charge of the 147.075 MHz repeater. In August 1993 he was installed the fancy new autopatch controller at the repeater site. By September 1994 he was also the technician in charge of the 147.130 MHz repeater. In January 2003 Art was officially designated the club's ATV guru. In July 2003 Art established and began to operate the club's test equipment pool for loan to members. Art was active in maintaining the repeaters through 2014.

Art's technical contributions weren't limited to PARC. In March 1993 we read about him

tracking down a stuck transmitter on the EARS repeater, and then in July 1994 he's helping with cavities for the San Diego 220 Club's repeater. Later that year, he was working on filters and pre-amps for that repeater.

He served as net control on the Ham Help Net and later on the License Theory Net as well, and continued to check in and answer questions, and occasionally ask them.

Many will remember Art as the auctioneer for the annual club auction in October. He first shows up in the Scope helping with the auction in 1993, then as auctioneer in 1996, and most recently as auctioneer in 2014. He also served as auctioneer for EARS for many years.

A new era for the club dawned in December 1994 when Art took over as club President, after Harry WA6YOO resigned. Art was to serve as President for several years. Art immediately started writing a monthly column for the Scope, which he called "President's Wavelength". It would usually include thanks and praise for members who had accomplished something for the club, starting with outgoing President WA6YOO:

"Under Harry's tenure we have seen our Club's membership almost double in size. In 1992 we hald our meetings in the cafeteria of Lincoln Midle School in Vista. We out grew the Vista site and we moved to the Carlsbad Safety Center in 1993. We placed First in Field Day in our category (5A) in 1992 and 1993. We added five new repeaters to our site on Palomar Mountain including an ATV repeater. Our autopatch system is in its second generation and now serves four repeaters. We have a new repeater building that is full and another building ready to fill. We have a cooperative agreement with Challenger Junior High to introduces Amateur Radio to students. We are designated a Full Service Club by the ARRL. We offer license classes. We also conduct VEC testing the second Saturday of each month. We hold 11 different special interest nets on our repeaters. We publish a 12 page news letter each month."

He's also offer personal insights into amateur radio. In February 1995, "I am enjoying ATV. It allows full communication (sight and sound) between Amateurs. Body language especially facial expressions fill in the gaps that are left up to interpretation when using other modes of communication." In May of 1995, the club began transmitting its meetings on ATV.

Now and then, he'd offer some advice from his

own unique perspective. In February 1995, "All of us are human and some of us built most all of the equipment that our Club is operating. Our repeaters have one of the best operating records of all the Amateur repeaters in San Diego County, while a private local system that used all new equipment has had several failures this past year. Those of us that built the equipment always hear about the "problems", and most "problems" are traced to outside interference. Please be considerate when venting your frustrations to a Member who built the system you are complaining about. They most likely have spent several hundred hours making and maintaining the equipment you use. They are understandably more sensitive to complaints and solving technical problems is best done in an nonemotional atmosphere. I for one can assure you that I, as a equipment builder, have a defense for my creations lurking in my subconscious at all times. Push the right buttons and it will come forth quicker than lightning, in the most technical terms I can muster."

Very often, the President's Wavelength would include a call to action. In June 1995, "Field Day is almost here. We still need everyone's help in making this Field Day a success." This message could appear in every June issue from now on.

In December 1995, "Just as a ship has a compass to maintain a steady course, I have found my compass to guide our Club in the Five Purposes of the Amateur Radio Service as stated in Part 97.1 of the FCC Rules and Regulations. (A) Our repeaters are dedicated to Emergency service groups during an emergency and we hold several nets for several Emergency Service Groups. (B) Improving the state of the Radio Art requires innovation and Innovation requires risk taking and experimentation. I have tried to promote both. (C) We learn by doing. Those who claim there is only one way to do something, forget that we as Amateurs must learn from our mistakes and experimentation. (D) In the short time I have been an Amateur, I have seen growth in the skills of myself and many others, making for a larger pool of operators, technicians, and electronic experts in the Amateur Radio field. (E) Continuation and extension of the amateur's unique ability to enhance international goodwill. I prefer to apply this to all areas Locally and Nationally as well as International. Our Club has done well 1n this regard, and I am pleased that we have some of the most friendly repeaters in the County.

"The founders of Our Club had the wisdom to choose Five Stars for our Logo to represent the Five Purposes of the Amateur Radio Service. I am sure this was their way of reminding new Captains like me, that a Compass has been provided for."

Art didn't stop writing for the Scope after his term as President was over. In March 2002 he introduced a long article about recent happenings this way. "In the Forties of the previous Century a theory to explain why things happen was called "Theory of the Universal Principal of Perversity" The classic proof of this theory was given to the probability that buttered bread, when dropped, would land on the floor with the buttered side up approached zero, and even less when peanut butter and jelly have been added. Other observations include wires and cables that always seen to intertwine themselves in to a hopeless tangled mess, the stalled engine that will not restart because the gear selector is still in drive, or the service call to find the equipment is either not plugged in or misadjusted."

The sad duty of reporting the passing of club members fell to Art several times over the years. In 2002 he wrote about N6OLE, "Ivan also had an infinite amount of patience in teaching others. He would try to explain a thought in several different ways using analogies to help others to understand a technical concept. He was always helpful and shared his knowledge, never withheld any information he had on a technical subject. Ivan definitely learned by doing and he shared what he learned with everyone that was interested.

"His analytical mind retained almost everything he learned and his knowledge extended far beyond electronics. A great man, who will be missed by all those who seek knowledge, and remembered for his willingness to share his knowledge with all who would take the time to ask him."

Check out the Scope archives on the club's web site for much more of the wit and wisdom of Art McBride, KC6UQH (SK).

Return service requested

Featured Program:

At 7:30pm on 6 May 2015, Palomar Amateur Radio Club will have a program. Dr. Eric Wenaas presents
about the evolution of early radio detectors. See page 10 for details. We look forward to seeing you at the
Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

Field Day is fast approaching! Planning efforts for this year's Palomar Amateur Radio Club Field Day Effort are underway. Field Day this year will fall on June 26th, 27th, and 2th 2015. See website for location.

The Field Day net occurs Wednesdays at 8PM. We are currently looking at a 4A setup this year. This will free up 10M for GOTA so they have a place to operate and will also free up some of the congestion at the site on the airways (hopefully).

Our Field Day Chef this year will be Gina along with her impressive Psycho Kitchen. Cuisine still to be determined.

We have sourced many of the needed supplies. We still need help with setup and tear down. Setup will begin on Friday at 11am on site. Field Day is a group effort and cannot be accomplished with out all the generous help from PARC club members and other volunteers. Many hands make light work!

Field Day is not a contest, but will sure be fun. When you have fun doing something you love, you generally end up doing well. That is this year's goal. To have FUN and do well. Come out and visit with your fellow club members and hams alike, get on the air and operate, eat good food, enjoy eyeball QSO, demonstrate amateur radio to the public, and most of all have fun. Thank you for all you do and I look forward to hearing you on the Net and more importantly, seeing you at Field Day.

73,
Greg Gibbs KI6RXX
Cell: 760-583-9668

Save the Date

	Board Meeting	Club Events
3 June 2015	**10 June 2015**	**27-28 June 2015**

Field Day Program! Plus, Trade Tech High shows off their robotics project.

Palomar Amateur Radio Club board meeting at 7:00pm at W6GNI QTH.

Field Day! New site!

June 7th work party!

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Spectrum Analyzer, HP141T working mainframe with HP8553 (working 110 MHz) RF plug in with HP 8552 I.F. module. Several HP8555s (10 MHz - 22 GHz) parts units and extra HP8552A & B I.F. modules. Make offers. WB6IQS@att.net. John, Vista.

Wanted: E. F. Johnson electronic T-R switch, working or not. Matt, 619-865-8497, ae6hf@arrl.net. Matt AE6HF

Goodie Table Update!
For next few month's meeting I would like the Scope to stress that the Goodie Table will be exceptionally well stocked. I will have all manner of variable capacitors, resistors, power resistors, power and RF cables, coaxial fittings, relays, digital and analog ICs. I am hoping to get fair value for the club for these items but JoAnne McBride is more interested in them being used for future projects rather than just being dumped as electronic trash going to the recycle. Also, a large assortment of test meters and component parts will be on the "Goodie" table at the June & July meetings. Bird type RF Wattmeter w/ VHF/UHF slugs, variable capacitors, cables, power resistors / fixed capacitors, etc. Bring bags / boxes to take home the treasures. Contact WB6IQS@att.net for any specific requests. John Kuivinen, WB6IQS

May 2015 Club Meeting Filmstrip

Please support our advertisers. Their support of the club is vital.

{special} **THANKS** to our sponsors

13   14   15   16

13   14   15   16

Integrating Yaesu System Fusion Photos into the World

Paul KB5MU and Michelle W5NYV

Some of the Yaesu C4FM "System Fusion" transceivers (FTM-400D mobile, FT-1DR and FT-2DR handhelds, but not the C4FM-enabled FT-991 HF/VHF rig or the brand-new (Dayton 2015) FTM-100DR) support a camera microphone accessory (MH-85A11U) that can take relatively poor-quality, low-resolution photographs. These photographs are stored locally on a microSD card, as are photos received over the air. Later, any photograph stored on the microSD card can be transmitted to ALL or to a specified Group ID. The FTM-400D has a color graphic display which can display the photos. The FT-2DR can display the photos in monochrome. The FT-1DR can't display the photos at all, so if you transmit a picture taken with the camera mic or forward a received photo you're doing it without seeing the photo first. The FTM-100DR can't display the photos either, but it can still receive and forward them, even though it doesn't support the camera mic.

Photos are integrated to some extent with Yaesu's WIRES-X internet linking system. Photos can be stored on the server, and can be part of so-called News items. These capabilities have not been evaluated. WIRES-X server software for C4FM repeaters has yet to be released. WIRES-X support for user stations requires the HRI-200 interface box (about $125) and a Windows computer. We recently bought an HRI-200 for evaluation. The HRI-200 software limits photos to 40 kilobytes, according to the user manual. Pictures taken by the MH-85A11U seem to be a maximum of about 20 kilobytes.

The goal of this investigation is to bring this photo capability into the wide world of the internet and open systems, somehow, to whatever extent seems feasible. Here are some possible use cases to consider.

* Photo Channel Logger. A receiver would be dedicated to monitoring a particular channel frequented by C4FM users and store every picture it hears. These pictures might be made available in real time on the web, or on other amateur radio data systems. The pictures could be enhanced with EXIF metadata generated by the logger, which could easily include, for example, the date and time of reception. With a little more work, the pictures could be associated with signal strength information, or even signal bearing from the receiver site. A logger could be placed at an EOC and set to automatically display all photos sent to a list of Group IDs, so that information gathered in the field would be immediately available to served agencies.

* Automatic Photo Sender. A system that has automated access to some kind of image data would be able to automatically transmit the image on a particular channel. For example, it would be easy to hook into weather forecasting systems and transmit a radar image periodically, or only when weather alerts are active, or according to any other set of rules. A system placed temporarily at a key location in an event could be set up to take a photograph of the area and transmit it periodically, or when some other sensor is tripped, or even when computer image analysis says that the photo contains something interesting.

* Interactive Photo Sender. A system controlled by text messaging (whether over C4FM, or AX.25 packet, or cellular SMS, or any other system) or via the web (whether over amateur radio or not) could be set up to allow a remote user to trigger the transmission of a specific image. The image might be one that already exists, or it might be captured by a camera on demand, or it might be computer generated on demand. The "News" feature of the WIRES-X software is a simple

Why A Packet Repeater?

by Paul KB5MU

Why do we have a full duplex repeater on 146.700 MHz dedicated to packet radio? Like a regular FM voice repeater, the packet repeater gives every little station in range the coverage that comes with a good antenna and a spectacular mountaintop location. A handheld on one end of the county can communicate with a mobile in a crummy location on the other side of the county. That's good magic.

Packet radio, though, can get the same range with just a digipeater on the mountaintop. A digipeater is much simpler than a full duplex repeater. It's just an ordinary transceiver connected to a little controller called a TNC ("Terminal Node Controller"). The TNC listens for packets that want to go through the digipeater. Once it has fully received such a packet, it listens for the radio channel to go idle and then retransmits it. This mode of operation is called "store and forward", because the TNC stores the message briefly before forwarding it on to the next station. The TNC in a digipeater is only listening (to store incoming packets) or transmitting (to forward them on) at any given time. It never needs to transmit and receive at the same time.

There is one obvious disadvantage to the store-and-forward mode. Every packet has to be sent twice, once by the original station and then again by the digipeater. This not only adds a little bit of delay to every communication, it also takes up twice the capacity on the channel. That is, there's only room for half as much data. That's a big deal, because standard 1200-baud packet radio is already pretty slow. It can be pretty speedy compared to users typing back and forth on keyboards, but for most practical applications giving up half the throughput is painful.

Unfortunately, it's actually much worse than that.

It all comes down to how packet stations share the channel. Packet stations listen before they transmit, except for some APRS trackers that get by without a receiver. If there's a signal present already, the station waits until the signal is gone. If it didn't do that, there would be two station transmitting at once -- a "collision". Very likely, they would interfere with each other and neither packet would be received. Remember, the packet has to be received perfectly with no errors in order to be used at all. After the channel sounds clear, the station waits an additional random interval, called a backoff. Provided the channel is still clear, the station then finally transmits its packet.

This all works pretty well, provided that every station can hear every other station. But in a typical metropolitan area network, that is not the case. Each station has its own area of coverage, depending on its antenna, the local terrain, the local noise and interference levels, and so on. The coverage might be different on receive and transmit. A low power station will have a smaller coverage area on transmit than on receive, while the opposite would be true for a high power station. You can think of these coverage areas as circles of various sizes, but a real-world coverage map looks more like the shape of a bug splattered on a windshield. The network consists of a crazy patchwork quilt of all these unique coverage areas. Each station can hear some subset of the other stations. If Alice can hear Bob and Carol, there's no guarantee that Bob and Carol can hear each other.

Consider the case of a mountaintop digipeater. It has an excellent location, high up on a mountain, and a good antenna. Its coverage area might blanket the county. For simplicity, let's just assume that the digipeater can hear everyone else just fine, and everyone can hear the digipeater. That'll never be exactly true, but close enough. No problem, right? When the

version of this sort of application.

* Photo User Terminal. A system could be set up to send and receive photos locally, providing a superset of the capabilities built into the Yaesu transceivers. A variant would use the camera and screen of a connected smartphone.

There are two obvious main approaches to this sort of integration: use the C4FM capabilities of Yaesu transceivers, or go directly to the on-the-air signals with whatever radio hardware is convenient. Unfortunately, the Yaesu radios treat the photo capability as part of their closed system. The available interfaces are the proprietary jack that the camera microphone plugs into, the 10-pin mini-DIN radio interface connector used by the HRI-200 (on the FTM-400D), and the microSD card slot with its file formats and conventions. The pin assignments for the 10-pin mini-DIN are documented, but the other two interfaces are completely undocumented by Yaesu.

There is a serial RS-232 interface on the 10-pin mini-DIN. The radio menu lets you choose the baud rate (4800 to 57600) and one of four modes: Off(camera), GPS Out, Packet, and Waypoint. Setting the mode to Off disables the port (and is documented as disabling the camera mic as well, but this is clearly a misprint.) In GPS Out mode, the port transmits NMEA sentences GGA and RMC, containing position fixes from the radio's GPS receiver. In Packet mode, the manual says that the port "Outputs the AX.25 packet communication data received using the in-built modem function." In Waypoint mode, it "Outputs the position information of other station beacons obtained from the APRS packets received as WAYPOINT data." None of these documented functions lets you send and receive data using C4FM, which is a shame. Yaesu could and should expose data communications features on this interface, but so far has not.

The HRI-200 and WIRES-X software also connect to that 10-pin mini-DIN port, and are able to do things that are not otherwise possible. The software controls the radio's frequency, for example, and transmits and receives C4FM digital data to implement the WIRES-X protocol operations. To enable all this, the radio has to be put into a special mode by pressing two buttons while turning it on. In this mode, none of the regular user features of the radio work. The radio becomes a dedicated slave to the software. This mode might be useful for other applications, but it is completely undocumented. Some reverse engineering work on a working HRI-200 system would help here.

We have already spent some time trying to reverse engineer the camera microphone jack. It is encouragingly labeled "Data" on the transceiver, but even the pin assignments on this connector seem to be unpublished. We've written up our results in some detail and are waiting to hear from ARRL about whether they want to publish it. We found what appears to be a USB interface, or something very much like a USB interface, on several of the pins. That's consistent with the Yaesu menu text, where the camera microphone is called "USB Camera". If this interface is indeed standard USB, or close enough, it should be possible to interface it with other hardware. It may be possible to partially confirm this with a logic analyzer. Gathering more details on how this interface works will depend on getting access to a non-invasive USB analyzer. The least expensive such instrument I was able to find costs $1200. Even if we knew everything about this interface, the most we could hope to do is emulate the camera microphone to store pictures to the radio's SD card.

We have also spent considerable time reverse engineering the microSD card interface. If Yaesu had chosen to comply with DCF, the standard

that all digital cameras follow when they put the pictures into a directory named DCIM, and if Yaesu had paid more attention to compatibility with different kinds of SD cards, it would have been possible to use an Eye-Fi wireless-enabled SD card to at least get images out of the radio. However, they chose to invent their own directory structure, and managed to be incompatible with both of the Eye-Fi cards I was able to test. With some specialized hardware, it would be possible to emulate an SD card or eavesdrop on the radio's communication with an actual SD card, and thus to extract all the photos taken by the camera mic or received over the air. That would enable the Photo Channel Logger application described above, but none of the others.

Yaesu may be planning a firmware update to enable data communication and other features that seem possible with the existing hardware, but as far as I can tell they have made no such promises. We can only wait and hope.

In the mean time, it might be possible to bypass the Yaesu radios completely and make our own C4FM stations, at least for data. Doing C4FM voice would require the proprietary AMBE voice codec. Yaesu publishes a document titled "Amateur Radio Digital Standards" (Revision 1.01 April 18, 2013). This dense 38-page document appears to specify the technical details of the transmitted signal, perhaps in sufficient detail that a third-party implementation would be possible, with access to Yaesu radios for reference. GNUradio already has code to receive C4FM modulation as used by the P25 system, as part of the DSD (Digital Speech Decoder) package. This may not be directly compatible, but should give a starting point for demodulating the symbols. The rest of the processing would have to be created from scratch using the Yaesu document as a guide, but the more complex parts of it should be buildable from available building blocks. Nonetheless, it would be a non-

trivial amount of highly technical work.

The question, then, is whether the work to create an independent implementation of Yaesu's version of C4FM is justified by the photo capability. Yaesu has two products, a mobile and a handheld, that could be useful as photo terminals. Many amateurs may be buying these products to use with the System Fusion repeaters that are being deployed by many clubs, including ours. Is it worth the trouble of a big development project to make these radios a little more useful?

Ms. Ohm! Where in the world are we?

I don't know, Mr. Tor! But I think we should find out!
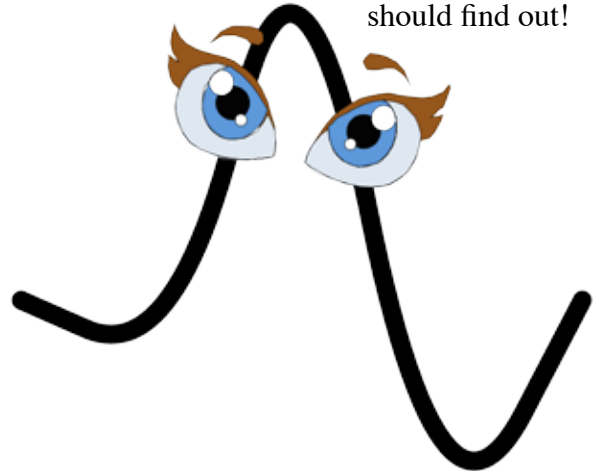
Successful Amateur Radio Demonstration

Amateur radio was demonstrated to Scouts from San Diego County at the Scout Fair held at Qualcomm Stadium. Members from PARC bought down KD6TUJ's trailer to help demonstrate. Conrad KG6JEI, one of the most public faces of amateur radio for these events, made a presentation to the Scouts that helped capture their interest and helped them desire to earn the radio merit badge.

Scouts at Qualcomm Stadium Scout Fair, in front of PARC's radio trailer. Photo from Dennis KD6TUJ.

"Hello,
I just wanted to let you know how much I enjoyed the class yesterday at the scout fair. Thank you very much for for your time teaching about radio. I would like to complete the merit badge when you do the follow up at Camp Balboa next month. Hopefully it will not conflict with the week-end of the 16th and 17th of May. That Saturday I have a mandatory high school orientation, and on Sunday an annual Karate tourna-ment. Can you please email me when the date of the follow up is confirmed.

Much appreciated, Ben G."

(a letter from one of the Scouts at the Scout Fair)

Club HF Remote Station? Let's Install One!

There are at least three reasons for the club to get involved in the HF remote movement. The first one is technical. The challenge of making a quality remote installation is fun and rewarding. The project involves backhaul establishment, HF equipment selection, remote access protocol development, command channel identification and establishment, testing and tuning, documentation, and training, among other things.

Secondly, autopatch and casual repeater usage has declined due to the increase of cellular coverage. Exploring new services that can be offered from club equipment on the Palomar Mountain property is an important responsibility. A new broadband repeater has been installed, and fresh hardware for the voice repeaters is under active investigation. Adding an HF remote station would expand the services provided by the club. This is an exciting time to get involved with renovating equipment on the site.

Third, many members are negatively affected by CC&Rs and other limitations on putting up HF antennas on their San Diego properties. We live in an urbanized area where antennas may or may not be allowed. Plenty of us live in valleys or in places that are not good for radio. Having a remote station that members can reserve and use would go a long way towards making the hobby possible for people that live in places where radio is limited.

If you would be interested in helping explore a club remote HF station on Palomar Mountain, then please join up by writing me at scope@palomararc.org and I'll add you to the mailing list!

Mailing list archive located at http://palomararc.org/pipermail/hfremote/

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

Current state: We think PARC needs to be 501c3 in order to get the required equipment, and we might need to use a base station in addition to Valley Center Wireless (ISP) to get audio up to the mountain.

PARC Repeater Site Work Party
May 23, 2015-146.700 Packet Repeater

John WB6IQS and Rich NI6H

The day started at 6 am, with NI6H pre-testing the intermittent functionality reported for the last few weeks. Two (2) 20 k packet files were successfully passed thru the XE2BNC-13 and KG6HSQ-13, radio internet, gateways; hmmm, we might have to call off, the work party.   I queued up a 105 KB file to XE2BNC-13 and after 18 minutes it choked, it killed the repeater, repeated connects were not successful, NI6H contacted our friend N6KZB in Tijuana, who manages XE2BNC and he tried several times and confirmed it was dead. NI6H arrived at the WB6IQS bench about 8:30 AM and demonstrated the intermittent functionality, sometimes it just stops hearing or passing tones and stops repeating; John is not sure but has his truck loaded for bear and wants to head up the mountain to check things out. We take a moment to call Ron KG6HSQ to see if he has been monitoring and he has. He too scratches his head as to a definite cause but will keep an eye on the traffic while we test again at the site.   We arrived on the repeater site about 11:30 AM, we were in the clouds with light drizzling.

John opened the repeater, checked the power supply and the VSWR on the transmit antenna. After the cavities its' best VSWR was 1.3:1 at 145.70 and was about 1.5:1 at 146.1 to 146.7. Not too bad, should not be a problem! Because the receive antenna is shared with our main repeaters, we did not test/disturb the receive side. John inspected the connectors in the repeater and the T connector at the cans to the antenna. He did not like how the center connector appeared, spread out too much so he replaced the T connector. Also the brass PL259 on the antenna feed was very dark and corroded so it was cleaned with sand paper and reinstalled. Another suspicious right angle BNC connector was replaced.   John pulled and inspected the hang time card and moved the jumpers to increase the repeater's hang time because he thought it might help.

At this point, Rich set up his portable Winlink station and put on a dummy load, while John set up his service monitor and started inspecting various aspects of repeater operation: TX frequencies, TNC tones, TNC tone distortion, TNC keying the transmitter, TX deviation, power output and all looked in order.   We passed two 20 kb files and four 87 kb files thru the two internet gateways mentioned above, to my cell phone and all went well. We consulted by phone with KG6HSQ, who concurred the packets looked good.   We searched for the 146.700 repeater documentation in the files onsite and John removed several files so he can build a working spare MFJ 1270 or Tucson Taper TNC repeater controller back at his QTH. John treated the repeater cards connections with Blue Stuff (contact clearer). We then secured the site and headed back down the hill.
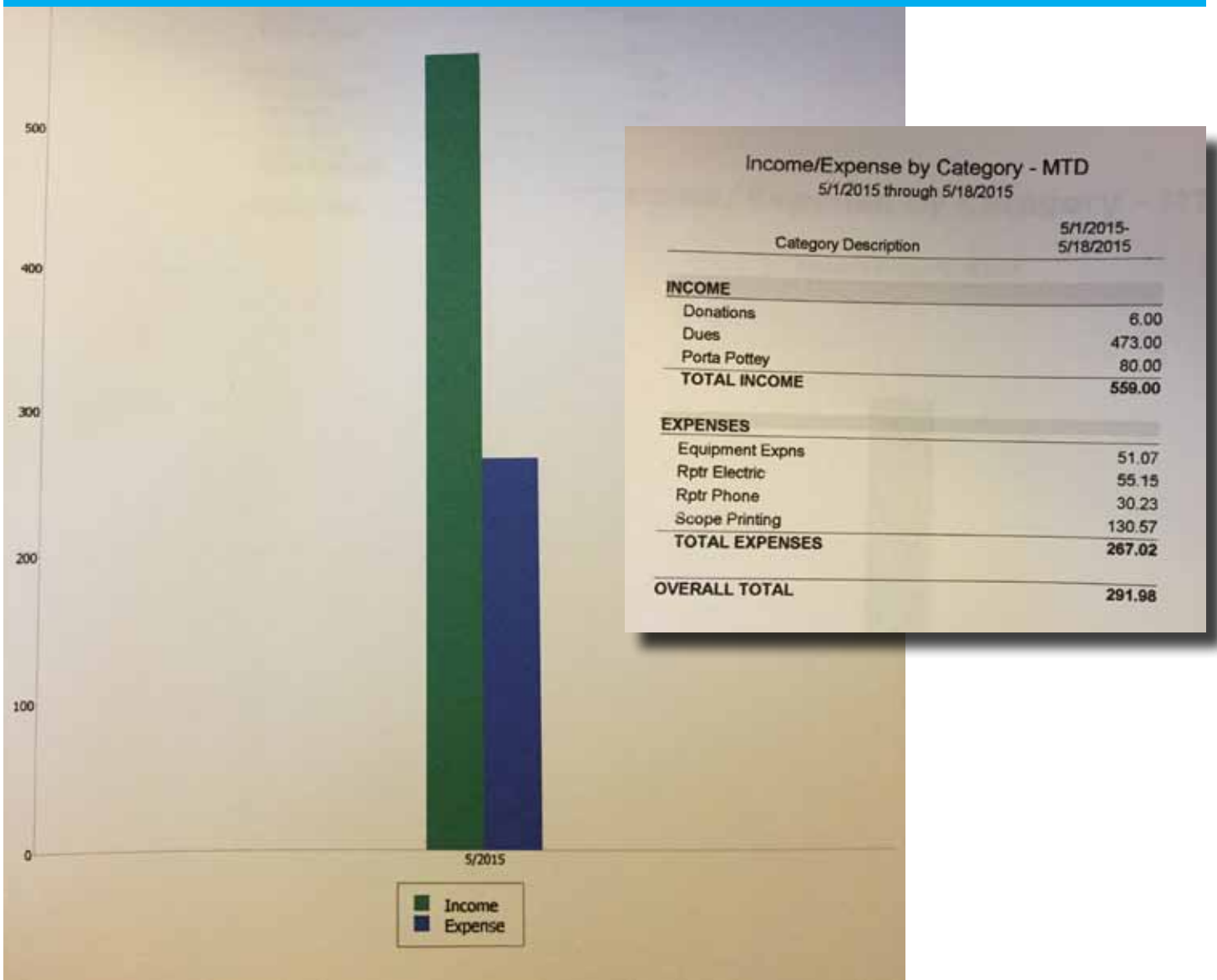
We can't be sure how much we did to improve the efficacy of the repeater but we will be testing for the next few days/weeks. It's an intermittent problem, so we did what we could. When we left it was working very well, having successfully passed about 500 kilobytes of data files, without incident.

Rich NI6H
John WB6IQS

WB6IQS adjusts 146.700 repeater hang time

146.700 T antenna/can connector

Club Finanical Update

Income/Expense by Category - MTD
5/1/2015 through 5/18/2015

Category Description	5/1/2015-5/18/2015
INCOME	
Donations	6.00
Dues	473.00
Porta Pottey	80.00
TOTAL INCOME	**559.00**
EXPENSES	
Equipment Expns	51.07
Rptr Electric	55.15
Rptr Phone	30.23
Scope Printing	130.57
TOTAL EXPENSES	**267.02**
OVERALL TOTAL	**291.98**

Friday, May1, was a beautiful Southern California day, a great day to be outside in the sunshine. However, many of us were outdoors for the saddest of reasons. It was time to pay respects and say "73" to our good friend, Art McBride, KC6UQH.

I'm sure that Art would have been pleased and touched by the attendance of many ham friends of long standing. Several spoke of his knowledge, skill, and willingness to share that knowledge and those skills with so many of us. The many eulogies given by people who knew Art from different aspects of his life all centered on his creative problem solving skills and great knowledge of electronic theory and practice.

Some of the hams who attended were Don, WB6FWE; Tom, W0NI; Tom, KG6RCW; John, WB6IQS; Jim, NE6O; Tom, KI6IET; Ted, KD6AKT, and Ron, K2RP. I'm sure there were others; my apologies to any I missed.

Art's leadership, enthusiasm and skills were instrumental in the success of PARC for many years. To say that he will be sorely missed understates the reality.

Ron K2RP

March 2015 Club Meeting Photos

Rare DX! W5NYV in front of the lens. Photos by KB5MU.

June Presidential Address

Greetings all. This is the long awaited Field Day month! Your club will carry out FD operations from a new location. As you may be aware, we lost our longstanding FD location because the site finally is being developed with very large construction. See the FD note on the cover of this Scope for full details about FD.

I am happy to be back in town after a fantastic Dayton Hamvention. Was pleased to see several PARC members at the Hamvention, and was delighted to even see KD6AKT having a grand time browsing through all the goodies. Lots of interesting things to see this year.

As always, there were a myriad of vendors. The "usual suspects" (ICOKENYAE, Flex, and K3) were there, along with a host of new and interesting players. Yes, some surprises, at least for me. ICOM highlighted the ICOM 7851 HF/VHF/UHF transceiver. Mighty fine looking radio. Probably works pretty well too. Nice built-in output for a full PAN display with point and click capability. I am not schooled in ICOM, so maybe this is common. At a price of $15.5 K it must be astounding!

Yaesu was in full C4FM/Fusion marketing, with a very fine display and presentation at one of the forums. The real surprises to me were the various newcomers to the SDR world. For example, ELDA, an Italian company, was highlighting and selling their QRP Full SDR Transceiver. An HF transceiver that even has "knobs", since the unit DOES NOT need a computer to operate It is standalone capable of CW/SSB in the "old way" if you happen to be communicating when the big one hits. But operated with a laptop, you achieve full SDR performance similar to FLEX. You only get 5

Watts output, but the radio is powered through the USB port that communicates all usual digital commands to the laptop, and has built into the radio itself all the software: Digital processing, logging, display, etc. All it uses on the laptop is the laptop's sound card for digital signal generation, and the laptop is the source for commanding the radio when not commanded with knobs. And for a price of $1200.00, it even gives you 4 slice receivers compared to the 2 slices you get with a FLEX 6300. Most intriguing!

So, there is a lot to look forward to in order to have fun in ham radio.

See you at FD.
73 de NN3V

Club Members ONLY!
PARC has a tube bank that includes many 6 & 12 volt receiving tubes (and some transmitting types) for use by club members to repair their own personal equipment. Not for commercial use or resale. If we have your requests, we will pre-check the tubes and deliver them to you at the next club meeting.

Contact John WB6IQS WB6IQS@att.net

Hamvention Report

by Howard KY6LA

Weather was the usual muggy and rainy Dayton crap weather. glad I no longer live near the center of the continent

Dayton. usual FILTHY disgusting arena with overflowing toilets. As an American I am shamed that Foreign visitors have to see Ham Radio's Mecca as such a worse than 3rd world place.

FLEA MARKET
Flea market was clearly down about 25% less vendors this year and virtually everything for sale was garbage that you would not normally pull out from your own trash. Even the usual hat embroidery places were down to one vendor. I suspect old age plus a lousy weather forecast was a contributing factor.

FORUMS
I attended 2 Forums = Ham Law. which was terrible this year without Fred Hopengarten. and SDR - which was excellent with a number of new ideas and concepts being shown.

JAPANESE
The Japanese had their usual Legacy HF radios which clearly are no longer selling very well. Kenwood and Yaesu HF Both areas were totally dead.   Icom - who are better showmen. had some interest in the Overpriced IC-7851 - but it still lacked a modern display capability. they were misrepresenting the 7851 as an SDR. which it obviously is not as it is legacy Superhetrodyne technology with a DSP. Circa 1980 design. albeit they have tried to address the phase noise issues they had with the 7800.

It was pretty obvious that the Japanese have almost given up on selling HF equipment in the face of superior US Offerings from Elecraft and Flex Radio. The Japanese seem to moved heavily into the VHF/UHF and various incompatible digital modes. Talking to HRO. they admitted that they hardly ever sell a Japanese HF radio anymore but the VHF/UHF Radios sell well.

CHINA
However the star of the VHF/UHF were the Baofeng Chinese Radios selling for $24.95. Hard to justify $400 for a Japanese radio that does the same thing. Needless to say the Baofeng were selling like hot cakes.

STEPPIR
SteppIR introduced a portable Antenna analyzer for $389 which is visibly superior to the MFJ269@$399. Several of us bought the SteppIR analyzers. Rob WA3IHV and Ben N6MUF bought the CrankIR portable vertical Antennas for DXpeditions.

ELECRAFT
Elecraft introduced the K3S which is the old K3 with a new synthesizer board to fix the poor RMDR issues that had the K3 down on the Sherwood List. Like the Japanese, Elecraft tried to misrepresent the K3S as an SDR but clearly it is a Legacy Superhetrodyne Radio with a DSP audio stage. Circa 1980 design. With the new synthesizer board the K3S still ranks second to the Flex 6700/6500 on the Sherwood list.   The sales table at Elecraft had 3 sales stations and were lined up 3-5 deep waiting to place orders. Clearly Elecraft still make winning products.

FLEX RADIO
Flex Radio introduced their $999 Maestro Portable Front Panel - Contest Optimized Knobs and Display for their 6000 series. Clearly it was the star of Dayton 2015. Flex is making a major push into the contest world. more on that later. Maestro's were selling spectacularly. both over the sales counter and online. in fact the order flow online was so heavy that the on line sales site clearly slowed down under the load. Flex had several stations set up that each include a Maestro Front Panel - One demonstrated close integration with N1MM+ Contest Software, One Demonstrated the Application Programming Interface where users are now connecting all sorts of interesting and cool things to the Flex 6000 series. WITHOUT WIRES. Since all the Flex 6000 series have 95 dB antenna isolation, Flex introduced a SO2R box to enable full duplex in all the 6000 radios. The major benefit is that now a Single Radio can now be used to SO2R contest at about 1/2 the cost and much less complexity of the comparable two K3S that would be needed to accomplish the same result.

Rob WA3IHV and I put in orders for the Maestro.

ITALY
Italy was very strongly represented. Begali Morse Code Keys are definitely still the #1 CW Key. Expert Amps had their 1.3K-FA Amp on display. only 16lbs and 1500 Watts. Only $4,695 Show Special.Backordered by shows end to at least January 2016.
I was particularly impressed with the $1099 Elad SDR-DUO. (I saw it also at Friedrichshafen 2014) with is a complete Second Generation SDR 5 W Transceiver in a very portable box with Knobs. it runs stand alone or with a computer. More impressive was when hooked up to a Expert 1.3K-FA it drove 1000W with only 5 W drive.

Charlie NN3V bought one.

FLEX BANQUET
We normally avoid events in Downtown Dayton. too yucky and dangerous
. But this year the draw was Ranko 4O3A and Craig K9CT - two renowned world class contesters who were the guest speakers. Top Contesters are like Formula One Drivers. They push the technological envelop to achieve better and better results. We all benefit from the technological improvements that trickle down from their competitive experience.

Gerald Youngblood, President of Flex, told us of his design process for the Maestro in which he visited with and listened to top contesters to try to understand what they needed to be able to perform better. With the help of Craig K9CT they design the Maestro box . with only the absolutely needed knobs and controls and put it in a small enough package that it could fit at the most ergonomically optimum angle for contesting for minimum operator fatigue He then went onto explain the rapid development process where they literally backed the molds in an oven to produce working models for the show in 4 weeks.

Ranko 4O3A's company is well known for making devices such as the Station Genius to integrate any and every possible peripheral device into a contest station. Most important all the new devices are 21st Century Ethernet Speed Connected rather than 20th century slow serial ports. He went over the joint development of the Flex SO2R box to give it the features of the Station Genius as well as enable the Flex 6000 operate as a Full Duplex SO2R station. Ranko's contest station set the new European Record for the 2014 CQWWDX CW contest. His plan is to use the Flex 6000 with the SO2R in the 2015 CQWWDX contest and hopes that the improvements will enable him to shatter the world record. He then surprised us all by revealing that Flex was working with him on the design a Full Legal Amplifier (using 2 - 1400W transistors) - This will be the first totally Ethernet Connected Amplifier. Flex gave NO PRICES or DETAIL or Delivery Dates. but likely the main stumbling block will be the usual bureaucratic regulatory approval delays associated with Amps .rather than engineering or production.

Craig, K9CT, started his talk by stating that "Elecraft should be worried that he was over at the Flex Dinner" He explained the concepts and designs behind K9CT contest station and how the new Flex Contest Suite would not only cut his costs of a SO2R station in 1/2 but more

important greatly simplify station configuration, design and contest work flow. K9CT is committed to using the Flex Contest Station Suite in the Fall Contests.

FINALLY
Ken NN9P and I got a totally unexpected award at the Flex Radio Banquet at the Dayton Hamvention as the 2014 Top Flex Radio Elmer.

In case you are wondering, I am not paid by Flex nor do I own any of their stock. All my life I have worked at the Bleeding Edge of Technology and I really enjoy working with others who also invent new things. Flex has put fun back into Ham Radio for me by pushing me to consider new things all the time.

I appear to be able to poke through the side of these boxes!

Oh no!
I think I am trapped!
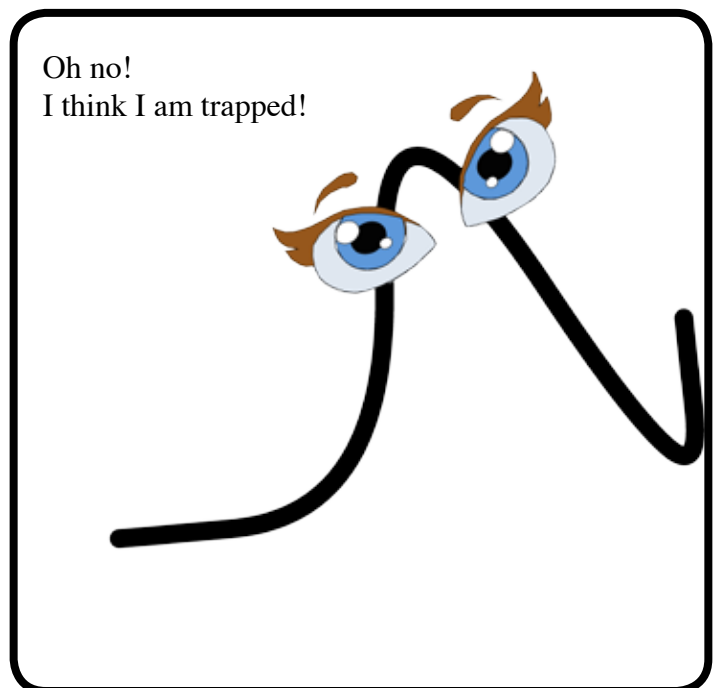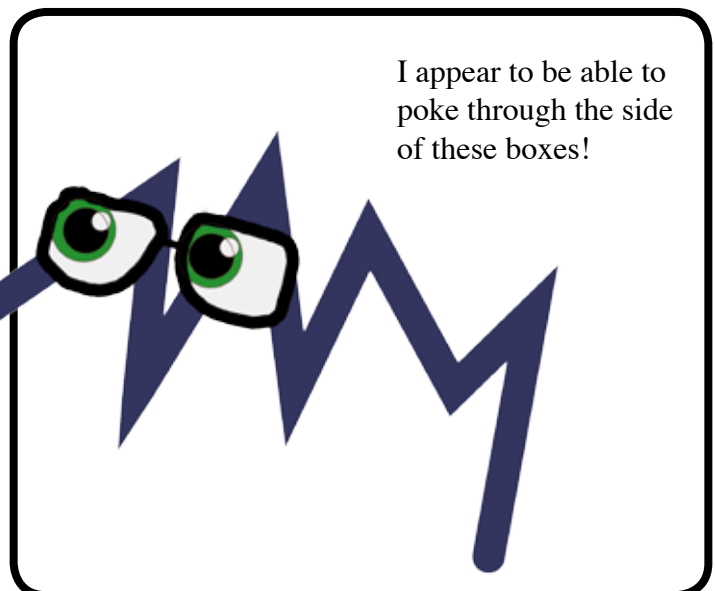
digipeater is transmitting, everybody hears it and waits. When the digipeater stops transmitting (and starts listening), any user station can transmit to it and be heard. But what happens if two users have a packet to send?

That's what the random backoff is for. Without the backoff, both stations would jump on the channel at the exact same instant, and interfere with each other every single time. With the backoff, the station that randomly chooses a shorter backoff starts to transmit first. The other station is supposed to hear that transmission and wait its turn. But if those two stations are low-level stations that need to use the digipeater to cover the county, chances are pretty good that they can't hear each other. The second station won't know that the first station has taken over the channel, and will happily start transmitting on top of it. The digipeater will hear both stations, which means it can't copy either one, unless one is very much stronger than the other (thanks to the FM capture effect). This is called "the hidden terminal problem", since the two low-level stations are hidden from each other.

I won't try to reproduce the math here, but this situation has been analyzed rather thoroughly. It turns out that the hidden terminal problem can really hurt the channel capacity. If nobody listens at all, and just transmits randomly whenever they have data, the best throughput you can expect is about 18% of the ideal channel data rate. Listening before you transmit is supposed to help. A network with listening but suffering from hidden terminal effects can be even worse than not listening at all!

There are various ways to address this problem. If the transmissions were much shorter than the backoff times, for instance, chances of a collision would be pretty small. We can't really use that technique, though, because our data rate is so slow. It can take several seconds to send a long packet, so backoffs would have to be many tens of seconds to have much effect on the collision rate. We don't want to wait that long, so just increasing the backoff times isn't a practical solution. It's also possible to add complexity to the packet protocol in ways that reduce the problem. For instance, stations might be required to transmit a short burst to request the channel, and then wait for a go-ahead from the receiving station before sending the payload. That technique is used by WiFi wireless networking with good results. However, we're pretty much stuck with the existing AX.25 protocol for short-term compatibility, so that's out too.

The best solution is to make sure everybody can hear everybody else, and the way to do that on a metropolitan area scale is to install a full duplex repeater in place of the digipeater on the mountaintop. A full duplex repeater transmits exactly what it hears, with essentially no delay. Because everybody can hear the mountaintop repeater, and it can hear everybody, effectively everybody can hear everybody else through the repeater. There are no hidden terminals. Stations who can't hear the repeater will know right away, and choose another network, so our assumption that everybody can hear the repeater is self-fulfilling.

Notice that the full duplex repeater doesn't participate in the network as a station. Packets are not received and stored by the repeater. The repeater retransmits the tones in real time, without worrying about what they mean. There's no extra delay or extra complexity. Each station can hear every other station (through the repeater) and the standard channel sharing mechanism works well. The user stations don't have to do much special. They do have to program their radios for split frequency operation, just as on a voice repeater, but since this is automatic on most modern radios, that's easy and familiar.

There is one TNC timing parameter that might need to be adjusted for the full duplex repeater. It's called TXDELAY and it controls the delay between enabling the transmitter's push-to-talk and beginning to send the packet's actual data. This delay has to be long enough to let the transmitter turn fully on, plus long enough for the other receiver's squelch to open and demodulator to synchronize with the transmission. When operating through a full duplex repeater, this also has to allow for any delay in bringing up the repeater. Typically, default TXDELAY values are so generous that it works fine on the repeater without adjustment.

There are costs at the mountaintop, of course. Because it's a full duplex repeater, it needs cavity filters to isolate the transmitter from the receiver. Because it's transmitting whenever anybody wants to transmit, it has to be build robustly to take 100% duty cycle transmitting indefinitely. To guarantee availability in times of emergency, it needs substantial battery backup and maybe a fallback generator too. It needs a coordinated frequency pair. Just like a voice repeater.

And just like a voice repeater, it needs maintenance. Ours had to be repaired just recently (see page 10). Much more next month.

PALOMAR AMATEUR RADIO CLUB
FIELD DAY 2015

JUNE 26th – 28th

see palomararc.org for location

2015 ARRL FIELD DAY
HAM RADIO)))

W6NWG
WHISKEY SIX NOTHING WORKS GOOD

FD PICNIC
DINNER
PSYCHO
Kitchen
Saturday 6pm

FD SCHEDULE
(Tentative)
June 26th
-11AM Setup at site

June 27th
-7AM Breakfast
-8AM Crank up towers
-9AM Final Setup Test
-11AM CQ Field Day...
-1230PM Lunch
-6PM Dinner
-8PM NTS Message NET

June 28th
-7AM Final Breakfast
-10:59:59 Final Contact
-11:30 Tear-down

OPERATING 5 STATIONS

~20/80 M CW   ~20/80 M SSB

~15/40/10 M CW   ~15/40 M SSB

~GOTA and VHF 6 M

Category:
4A

Amateur Radio Emergency Data Network Demonstration:

AREDN™
AMATEUR RADIO EMERGENCY DATA NETWORK

Pictures of Past Field Day Fun on CLUB WEBSITE
WWW.PALOMARARC.ORG

DO NOT HAVE TO
• BE A PARC CLUB MEMBER
(Club Membership is encouraged)
• BE LICENSED or KNOW CODE

ALL ARE WELCOME INCLUDING GENERAL PUBLIC!
COME OPERATE, LEARN MORE ABOUT HAM RADIO!
VISIT SAN DIEGO COUNTYS GREATEST AMATEUR RADIO CLUB!
COME JOIN THE FUN!

Work Party at Repeater Site 7 June 2015

The next scheduled work party is for June 7, the Sunday after the meeting.
Needed are helpers to help clean off the flaking paint on the freezer building. After it is cleaned up, we will prime the freezer building. Plans are to follow up on the next trip with a moderate green paint keep blending in better for our neighbors.

There are also two trees that have been felled, one by choice, one by a superiors act. These will need to be cut and removed at some point in the near future. Should a club member wish then for personal use, I believe they are welcome to them. If not we will cut them and ask a small price for the service/goods to be given to the club.
The group will gather at Mother's Kitchen at 10:00 AM and proceed to the site from there. Those that wish may come earlier and enjoy the delight of the Kitchen before the party. Mother's is at the top of south grade and to the left.

This is a great time to provide the club with support and join together. Also a chance for new members to learn some about Palomar's equipment.
More hands make for easier work.

Dennis
KD6TUJ

Featured Program:

At 7:30pm on 3 June 2015, Palomar Amateur Radio Club will have a program about our upcoming Field Day. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

PALOMAR AMATEUR RADIO CLUB INC.

Since 1936

W6NWG

San Diego County, Ca

JULY 2015

Save the Date

Club Meeting
1 July 2015

Come hear about the rewards and challenges of 2m spectrum management!

Board Meeting
8 July 2015

Palomar Amateur Radio Club board meeting at 7:00pm at W6GNI QTH.

Club Events
3-4 October 2015

San Diego's first full two-day Maker Faire at Balboa Park. Amateur radio will be a big part!

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Wanted: E. F. Johnson electronic T-R switch, working or not. Matt, 619-865-8497, ae6hf@arrl.net. Matt AE6HF

Goodie Table Update For July!

WB6IQS will bring three 2-meter beam antennas (9 to 11 elements each) and several UHF antennas. There also will be bulk RG-58/U cable (no connectors), resistors / capacitors and antenna tuner parts.Contact WB6IQS@att.net for any specific requests. John Kuivinen, WB6IQS

Amateur Radio will be a big part of the San Diego Maker Faire. This will be an amazing event full of all sorts of DIY techie goodness! It's the world's biggest show and tell.

If you are interested in volunteering for the Maker Faire through PARC, or volunteering directly, then contact: Michelle at w5nyv@yahoo.com

Please support our advertisers. Their support of the club is vital.

{special} **THANKS** to our sponsors

Check out more photos starting page 7

Presidential Address

As I write these comments, we just completed a FANTASTIC FD. But in order to meet our Scope deadline, I can't yet comment on the details of how things went, since it just happened. But I do know there were many Club members who made this a great success, and a chance to have fun. The club members can be thankful for the arduous job performed principally by KD6TUJ (Dennis), and KI6RXX (Gregg) in bird dogging the possibility of finding a FD site. That is never easy. Likewise, a thanks to the various band captains for taking the time to organize the band operation. More on FD results next month.

On the club's infrastructure work and maintenance, we've had several good work parties carrying out tasks on the mountain. Particular thanks to WB6IQS (John) and NI6H (Rich) for the detailed work they've performed on restoring the PARC packet repeater. If you are a Packet devotee, check the repeater on 146.700 MHz.

This month's program will be a presentation by the Two Meter Spectrum Management Association (TASMA). This is the ham radio volunteer association that coordinates use of our VHF/UHF frequencies, with an eye towards minimizing interference, particularly those that arise when repeaters may have overlapping coverage. In those cases, TASMA will endeavor to allocate different "channels" in the spectrum in order to eliminate the interference. If you wish to learn how this works, you may find it interesting to start by looking at the immense list of coordinated repeaters for California that is shown at http://www.tasma.org/repeaters/.

Again, thanks to all who participated in the PARC Field Day, and made it such a wonderful event. Lots of fun! Hope to see you at next year's FD which will take place June 24 - 26, 2016.

-Charlie NN3V

Ham Radio
Shouting at Random People

By Howard Groveman W6HDG

I always envy other hams that have kids who also became a ham. I have three sons who were more into active stuff like swimming, wakeboarding and motocrossing. In fact, one of my kids sent a dagger through my heart by once saying, "What is the point of ham radio? You just shout at random people!"

Our hobby is sometimes hard to get across to others.

Have you ever had a dinner party and for one reason or another got the opportunity to show off the ham shack to the uninitiated? I don't know about you, but I rarely have a good experience doing this. Maybe I'm just a poor ham ambassador, but my friends develop a courteous but blank stare and inevitably start asking questions like, "So what exactly do you say to them?"

My wife loves ham radio only because it makes me happy. I don't think she understands how I can enjoy spending hours on the air.

But rather than this turning into a Rodney Dangerfield joke (no respect), I have to defend our hobby.

First off, there are in fact many "ridiculous" hobbies, at least on the surface. I don't ridicule my friends who are into golfing, fishing, bird watching, or coin/stamp collecting. I don't ask golfers, "So what do you do after hitting the little ball in the hole?" Golfers will also claim that theirs is a physical sport. But how can it be a sport when you burn less than 100 calories in 18 holes if you use a cart? Heck, I can burn more than that cranking up a tower or feverishly sending CW in the WPX Contest. I think stamp or coin collectors get away with their activities because there is the possibility of financial gain – and that is always an easy one to get across to others. They don't get asked, "so you put them in a little book and then what do you do?"

[The editor would like to interject here that that's exactly what she asks stamp collectors. She would like to share that they don't appreciate this question very much, but the results are quite entertaining.]

The fact that we get passionate about radios, antennas, ragchewing, elmering, contesting and rare DX is in fact hard to explain. Others may not get it, but the knowledge, skills, and challenges of our hobby create a special thrill that is hard to put into words. All I know is that we deeply love our hobby. Fortunately we have the ham fraternity to understand our magnificent obsession.

Club Finanical Update

Income/Expense by Category - MTD

6/1/2015 through 6/18/2015
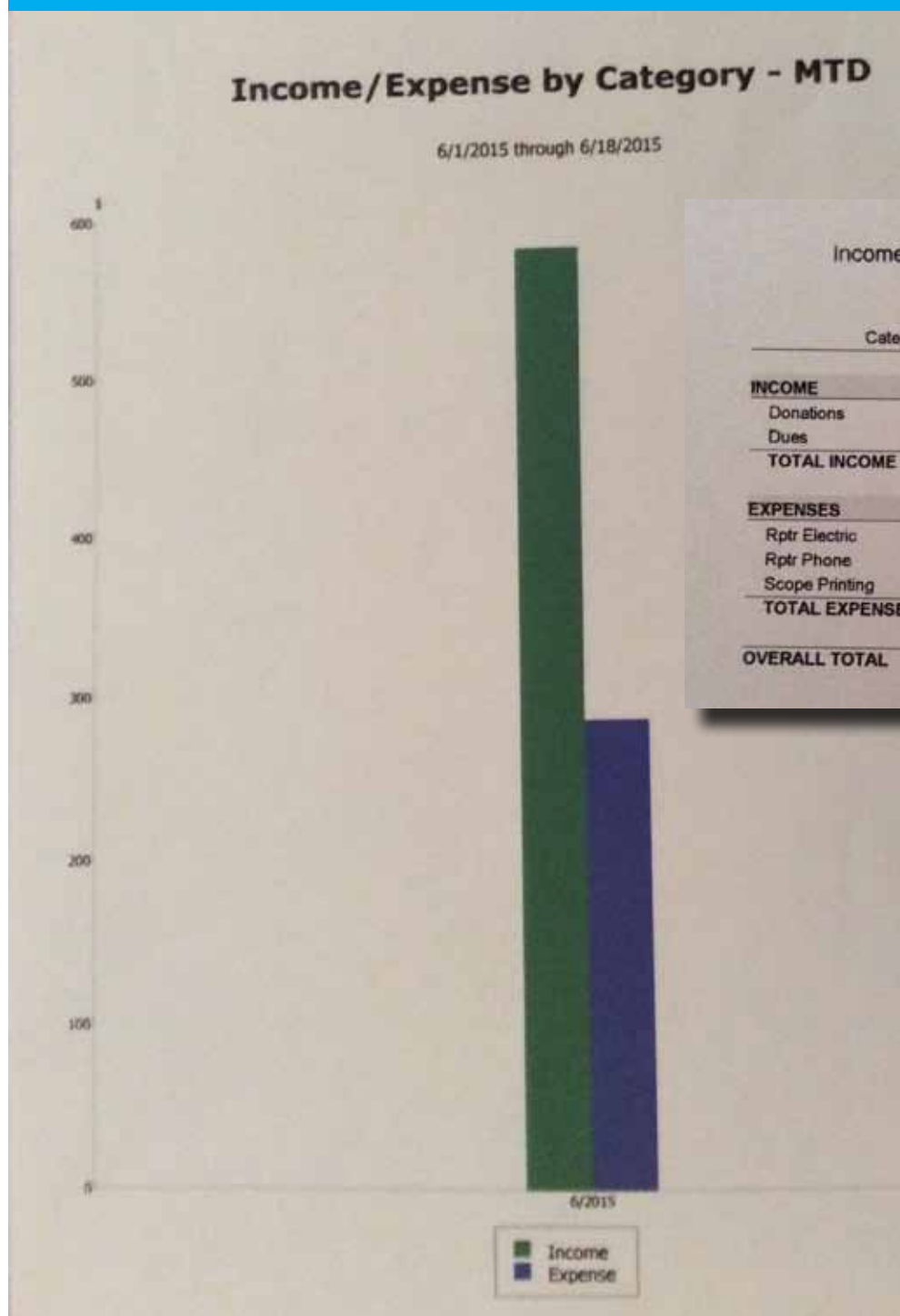
Income/Expense by Category - MTD
6/1/2015 through 6/18/2015

Category Description	6/1/2015-6/18/2015
INCOME	
Donations	300.00
Dues	278.50
TOTAL INCOME	**578.50**
EXPENSES	
Rptr Electric	70.72
Rptr Phone	31.90
Scope Printing	179.82
TOTAL EXPENSES	**282.44**
OVERALL TOTAL	**296.06**

Club Members ONLY!
PARC has a tube bank that includes many 6 & 12 volt receiving tubes (and some transmitting types) for use by club members to repair their own personal equipment. Not for commercial use or resale. If we have your requests, we will pre-check the tubes and deliver them to you at the next club meeting.

Contact John WB6IQS WB6IQS@att.net

Congratulations to the Team!

Congrats for spectacular finish in JIDX CW 2014 Contest to NX6T Ops N0DY, NB7V, W6JBR, N6KI!

We had top score in the WORLD outside of Japan and only 5 JA stations who have the advantage of working stns in their own country besides worldwide stns. This was best score we have ever done in JIDX CW!   See more at http://jidx.org/jidx2014cw-all.html

Plaque will be mailed shortly.
Dennis N6KI

If you think the choice of silver or black from the recent Yaesu FT1DR was the height of fashion, then you should check out these radios from... Creative Communications Technology Co., Ltd. Not exactly a familiar name to most hams!

you can choose from almost every color of the rainbow. Sadly, orange and purple are missing.

Peruse the whole line at http://kdxcn.en.alibaba.com

MRHS Offers Radiotelegraph Exams!

The Maritime Radio Historical Society is now authorized to administer the examination for the commercial radiotelegraph license. Yes, the FCC still issues this ticket! When you take your exam with us you can visit to the KSM transmit and receive sites - and when you pass you can immediately exercise the privileges of your license by sitting the circuit at KSM. We'll even endorse your license with our special stamp certifying that you're a qualified commercial radiotelegraph operator.

We also offer exams for:

General Radiotelephone Operator License (GROL)
GMDSS Operator (full and restricted) Licenses
GMDSS Maintainer License
GMDSS Operator/Maintainer License
Ship Radar Endorsement
Marine Radio Operator Permit

We've set up a special Web page with all the information including dates, times, locations, costs and contact information.

If you don't already know about the Maritime Radio Historical Society, then you are in for a treat! Visit their home page at:

http://www.radiomarine.org

Go to this link for more information about these license exams:

http://members.aceweb.com/royh/

Where exactly is Point Reyes? It's near the Bay Area. it's a 71,000-acre park with a visitor center, hiking trails, expansive beaches and panoramic water views. Looking for a summer vacation? Here's the home page:

http://www.nps.gov/pore/index.htm

May Meeting Photos from David Doan

Club HF Remote Station? Let's Install One!

There are at least three reasons for the club to get involved in the HF remote movement. The first one is technical. The challenge of making a quality remote installation is fun and rewarding. The project involves backhaul establishment, HF equipment selection, remote access protocol development, command channel identification and establishment, testing and tuning, documentation, and training, among other things.

Secondly, autopatch and casual repeater usage has declined due to the increase of cellular coverage. Exploring new services that can be offered from club equipment on the Palomar Mountain property is an important responsibility. A new broadband repeater has been installed, and fresh hardware for the voice repeaters is under active investigation. Adding an HF remote station would expand the services provided by the club. This is an exciting time to get involved with renovating equipment on the site.

Third, many members are negatively affected by CC&Rs and other limitations on putting up HF antennas on their San Diego properties. We live in an urbanized area where antennas may or may not be allowed. Plenty of us live in valleys or in places that are not good for radio. Having a remote station that members can reserve and use would go a long way towards making the hobby possible for people that live in places where radio is limited.

If you would be interested in helping explore a club remote HF station on Palomar Mountain, then please join up by writing me at scope@palomararc.org and I'll add you to the mailing list!

Mailing list archive located at http://palomararc.org/pipermail/hfremote/

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

Current state: We think PARC needs to be 501c3 in order to get the required equipment, and we might need to use a base station in addition to Valley Center Wireless (ISP) to get audio up to the mountain. See page 11 for why 501c3 is important to capital-intensive projects like this one.

Why Should PARC Apply for 501(C)(3) Status?

by Robert Reichman

Today's Tax Code as enforced by the United States Internal Revenue Service is excessively complex and ever changing. Included in this code is the provision for a 501(c) organization that is a non-profit organization, which is tax-exempt. Many of the San Diego ham clubs have filed for and obtained 501(c)(3) status. Included in these ranks are: San Diego ARES, Coronado Emergency Radio Operators (CERO), San Diego Six Shooters, and Escondido Amateur Radio Society (EARS). Aside from the benefits of "tax-free" status for the club, they may receive charitable donations in the form of money, equipment, vehicles, or other property. These donations may used by the club or sold to benefit the club. The benefit to the donor is a tax deductible credit to their annual income tax filing for the fair market value of their donation documented by a letter from the club treasurer.

At first glance the process seems onerous, but when systematically approached is quite straightforward and can be filed by a layperson without need for either legal or accountant consultation. This is a piece of cake for anyone who can pass an FCC exam.

The first step is to file Articles of Incorporation with the State Attorney General using the formal name of the Corporation and the purpose of the non-profit (i.e. public benefit, education, scientific purposes, etc.). Next the Board of Directors, Officers, and Bylaws are adopted into the Corporation structure. An EIN is obtained from the IRS, a Form CT-1 filed with the California Attorney General, Form SI-100 filed with the California Secretary of State, and finally the Form 1023 application for exempt status under Internal Revenue Code (IRC) Section 501(c)(3). Once Federal Tax exemption is obtained file for State exemption. The process is a stepwise function with data from each step applied to subsequent applications. The time frame for the entire process is nominally 3-6 months at a cost of less than $1000. The largest portion of the cost is to file the Form 1023 which costs $850, much of which may be refunded by IRS dependent upon the charitable income to the corporation for their first year.

Overall, it's good for the club conferring Tax Exempt Status and receiving donations, good for the donors allowing them to receive tax credits for their donations and mobilizing unused radio equipment which can be put to use by either the club or resold by the club, and good for San Diego allowing expansion of clubs with a public benefit to our entire community.

What Would 501(C)(3) Status Immediately Affect?

by Michelle W5NYV

Being able to accept donations would mean that capital-intensive projects would be more likely to proceed past the design stage. For example, installing an HF remote station for club use requires equipment that is relatively expensive. Being a 501(C)(3) would make seeking the donation of expensive gear a bit easier.

For every action there is an opposite and equal reaction. As several have pointed out along the way, becoming a 501(C)(3) does incur an additional accounting burden on the organization. This is something that we as a club would have to take care of every year. However, it's the opinion of the active members of the hfremote team that it's worth it in order to get the ideal set of equipment donated to the club.

Featured Program:

At 7:30pm on 1 July 2015, Palomar Amateur Radio Club will present a program about 2m spectrum management. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

PALOMAR AMATEUR RADIO CLUB INC.

Since 1936

W6NWG

San Diego County, Ca

Save the Date

Club Meeting	Board Meeting	Club Events
5 August 2015	**12 August 2015**	**23 August 2015**
DX. Online tools to improve DX experience. By: W6HDG (Howard Groveman).	Palomar Amateur Radio Club board meeting at 7:00pm at W6GNI QTH.	Club Picnic! See page 11 for details. Work party on the 9th, see page 3.

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Amateur Radio will be a big part of the San Diego Maker Faire. This will be an amazing event full of all sorts of DIY techie goodness! It's the world's biggest show and tell.

If you are interested in volunteering for the Maker Faire through PARC, or volunteering directly, then contact: Michelle at w5nyv@yahoo.com

Please support our advertisers. Their support of the club is vital.

{special} THANKS to our sponsors

Work Party Announcement

I am scheduling a work party for the repeater site on August 9th, the Sunday after the meeting. Primary goal is to chip the loose paint off the freezer building and primer it. A follow up work party will paint a coat of a good outdoor paint to better blend into the area.

This is a good time for members, including new members, to help the club and learn about the repeater site.

Gathering time is 10:00 AM at Mother's Kitchen at the top of Palomar for transit to the site. Those that wish may come early to enjoy the fine food and company at Mother's before the work party.

A reminder to all, APRS units are to be disabled during the work party.

Dennis KD6TUJ
Site Chair

President's Corner

Hi all PARC members. It is now August and we are on the downhill of the year. We only have 145 shopping days to Christmas. It is time to start preparing that "Santa list" so Christmas morning finds your new radio gear under the tree!

A couple of happenings to note this month.

Publishing of the Scope newsletter will be troublesome for a few weeks, or months. We received sudden notice from the gentleman who printed Scope for mailing, that because of a health condition, he would cease his printing business the end of this month. As you can imagine, finding another person or company who can print our Scope newsletter will not be easy, so the paper version of Scope will be delayed for some time. This has no impact for those who receive Scope by email. That will continue as always. The club Board is looking at all alternatives. Some of you may consider opting to receive Scope by email. If you wish to do so, you can follow the information on our Club Website at the following link:

http://palomararc.org/news.htm

August is our Club picnic. This year it is Sunday, August 23rd at San Dieguito State Park. So come on out to the picnic, have some fun and camaraderie, and take a chance at getting a drawing prize.

Congratulations to KD6TUJ (Dennis), and KI6RXX (Gregg) on receipt of their ELMER awards on behalf of W6NWG (PARC). They received the awards for their harmonious and longstanding contribution to the efforts of many ham radio operators throughout San Diego County.

Last, but not least. Last month began too soon after Field Day. Our FD was a tremendous success as I commented last month. We we now have a carefully tallied FD score. PARC participated as a 4A station, and our point total was 8484 points. Read about FD elsewhere in this Scope.

Bylaws Committee

A Bylaws committee was formed a few months ago with the primary focus on how to adjust the bylaws so the SCOPE can be sent primarily by electronic means. Preliminary motions have passed.

Those availing themselves to the committee are Charlie NN3V, Kevin KK6FRK, Richard KG6WUY, Greg KI6RXX, Conrad KG6JEI, and Dennis KD6TUJ, who was appointed chair.

Recently, it has brought to the attention of the Board that there are items in the Bylaws that have WILL, such as "Successful applicants will be introduced at the next meeting." This might be a word change to "may". Other items may be discovered.

Reviewing the direction given to the committee, it was determined that the newsletter issue was not defined as the only issue that could be considered. The committee has now been tasked to do a review of the whole document to determine IF any changes are required. Another item that was brought up was that the Bylaws original document can not be easily located. It may be in the bank box, and will be checked. If not, there may be a question to approve the copy on the webpage as a "final" document. Research continues.

Any concerns should be directed to one of the above members for consideration, response, and action.
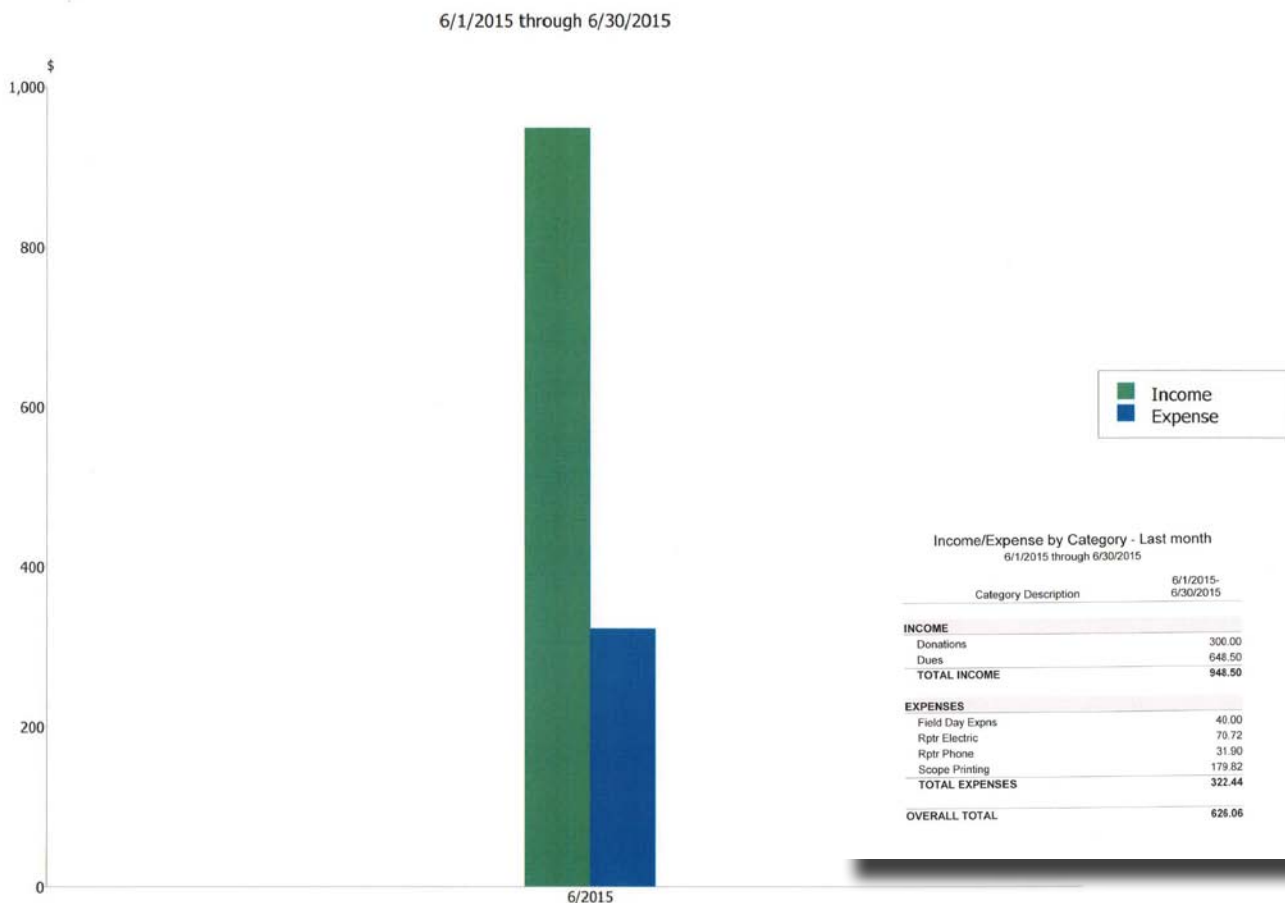
Dennis

PARC Field Day Efforts, photos by Paul KB5MU

Club Financial Update

Income/Expense by Category - Last month

6/1/2015 through 6/30/2015

Category Description	6/1/2015-6/30/2015
INCOME	
Donations	300.00
Dues	648.50
TOTAL INCOME	948.50
EXPENSES	
Field Day Expns	40.00
Rptr Electric	70.72
Rptr Phone	31.90
Scope Printing	179.82
TOTAL EXPENSES	322.44
OVERALL TOTAL	626.06

6m Repeater Repair Update

"I was very pleased to purchase from John, WB6IQS, a Hewlett Packard Model 141T 0.5 to 1.3 GHz RF Spectrum Analyzer. While studying the documentation, I realized that having the matching HP 8444A Tracking Generator would complete the instrument, making it more effective for characterizing filter networks, tuning cavities, etc. I was subsequently able to procure an 8444A in excellent condition, on eBay.

I am now practicing alignment and use of the Spectrum Analyzer, and also practicing basic cavity tuning techniques on a single 2M pass cavity that I happen to have at my QTH:

Once I get the hang of this, and have time available during daylight (since the cavities are outside, on my covered patio), I will begin to document the current state of the 6 meter cavities, prior to the start of the upgrades, and retuning."

John W6JBR

Get Better Organized

For Contests

When viewing the Southern CA Contest Club (SCCC) Website

http://www.socalcontestclub.org/

Where Jim does a great job reporting SCCC member contest score summaries, I noticed that the list of operators participating in the NX6T efforts was not complete and emailed Jim the editor and he explains below why.

Looks like several of NX6T ops have not registered/joined the SCCC - Well it would be great if you are a regular at NX6T that you might considering joining SCCC. There are NO DUES and occasionally an informative meeting is held but no requirement to attend.

What does help, if you join SCCC is that your scores when you operate from home can be added to group efforts where SCCC competes with NCCC and other clubs working same category of contest we operate.

Here is the sign-up sheet, let me know if you decide to join.

Check out SCCC website and please join SCCC so we can add your scores when we donate scores for group categories when you operate using your own call

http://www.socalcontestclub.org/join.php

You can check here to verify you are on membership list in case you are not sure whether you ever joined and that you are on the list

http://www.socalcontestclub.org/roster.php

Thanks and 73,

Dennis N6KI

For Observation

Want to keep an eye on Palomar Mountain? Bookmark this internet camera link:

http://hpwren.ucsd.edu/cameras/L/hp-n-mobo-c.jpg

For Your Shack

Check out this before and after photo set. Let it inspire you to improve your own hamshack!

How about a Shack Series? Send your shack photos/makeovers/war stories to scope@palomararc.org

Before... a box of parts. What the heck is in there.

And after! VHF station with computer integration. FLEX 1500 in the wings ready to go once appropriate antenna goes up.

Field Day Report

Field Day is over. See page 9 for our final results. Overall I would say this years Field Day went well.

Knowing that we had lost our former site in San Marcos to the California Department of Motor Vehicles, we started planning early. Since visits to the DMV are never fun, we certainly weren't going to go there for Field Day. Qualifications for a site seemed simple: an open space of about 1000 foot diameter, with the ability to point the antennas northeast with no major power lines directly in the way. Seems simple enough. After all, there are many empty lots scattered around the county. Even simpler than that was the ability to locate said potential properties on Google Maps, determine their orientation and size with Google Earth, and then go to street view in Google Maps to read the corner sign and find the number to call the owner. Except for one problem. No one seems to appreciate ham radio, Field Day and what amateurs do for the community in a time of an emergency. Even if they do, they all seem too worried about the liability of our event to offer us temporary space. I got many different colorful answers ranging from "No Thank you" to "Absolutely NOT, why would you even think of asking, you are wasting my time."

Oceanside gave its usual answer of possibly, which would include an outrageous nonrefundable upfront application fee, with them taking more than half the year to determine if the site is safe and available for us to use, and suggesting that we might want to reschedule for a later date or be more flexible about the date based on how long it could take and when they would decide to give us an approval. Oceanside even backed up that answer by stating that we would not be allowed to use water to weigh down the towers because of the fact we are in a drought situation. Basically another NO for us.

In late May as Field Day came ever closer, we got tentative approval for a site located not far from the club meeting location in Carlsbad. This was great because the site would be easy to find and in a familiar location for club members. In addition, the site being in Carlsbad should be nice and cool, which is a nice change from the San Marcos heat, and we could finally start the rest of the planning for the event and advertise the site. During the club meeting we announced that we had a site only to find out a week later

that the owners of the site got cold feet and backed out of the offer. Back to searching for a site, now with only a few weeks left.

OK, now it was time to start contacting some of the usual volunteers and see if they were still interested in attending the event considering the fact that we still did not have a site. This included our Field Day chef Gina. Gina responded with the suggestion that we use a property in Valley Center owned by the Valley Center Water District and that she could help coordinate approval. We got a same day response from them. It was YES pending we met two conditions. We had to be non-profit and had to obtain insurance. Well, we are non-profit, and we obtain insurance every year for our events like Field Day. Piece of cake! We had official approval by end of week. WOO HOO, we now had a site.

Dennis and I took a trip that Wednesday to check out the site and do further planning. We wanted to determine the exact location of the site, any necessary prep work for the site like mowing, and the site layout. We came to the location but there were multiple lots that could have been owned by the water district. Which one was ours? We decided to ask the fire department directly across the street from the potentials. Surely they would know. That's when it hit us. There was a fire department across from our site location and we still needed water for the tower supports. We stopped in to ask them. They gave us the location of the site and even agreed to fill our water supports for us. I was surprised to learn that they are required to track the amount of water taken from fire hydrants and to report that figure, but nonetheless we had a site and water. Even better was the fact that the site had just been recently graded. The site was flat, and even larger than we needed.

Setup started on Friday by collecting the gear at about 8:00 AM at Towizard. Transportation was easier because I was towing the bird cage which made for a great spacious transport vessel for all the club equipment. After collecting the gear we were on our way to the site. We arrived about 11:15. Then I was off for a quick trip around the corner to get the site key. Since we only had insurance for Friday through Sunday, they would not give us the key any earlier than Friday. We

had a lot less help for setup this year than in years past. I think this was largely caused by us not having a location until last minute. With less help, the workload was heavier on all of us. Remember, many hands make light work. This would not have been as big an issue except for the fact that it was HOT. We were in Valley Center and it was probably close to 100°F.

Setup seemed to go smoothly until we got to the station boxes. Did I mention it was HOT? One might think that if the boxes were organized last year after Field Day and not used until now that they would still be organized. This would be the case, only that certain members who inspected the equipment to ensure it was still working and reorganized it, did not know that we had discontinued the use of the internal rotators because they are nothing but trouble. Guess we were back to using one this year. After re-modifying the tower to accept an internal rotator, we were back on track. The Valley Center Fire Department, after their long journey to our site right across the street, arrived right on time. Conrad took them around to each station to ensure the trashcans were in the correct locations and to grab photos of the fills while we continued to set up the other stations.

Now if only we had enough people to raise the towers. The biggest tower requires an absolute minimum of 10 people to raise with the 11th person standing by watching for safety. We only had 9 people. We were short two people. It was HOT so time for another break at the midway. Then to my surprise, two more local hams showed up. We now had enough people to continue the work. It only took us about another 15 minutes to rest up from the heat and start working again. Off to the heaviest tower to finish and raise. We then went one by one until we were done. We finished around 6:30. After setup, we all retreated around the corner to Portinos, a local Italian and pizza place recommended by Gina, for food and libations. Boy was it good.

Saturday started out well. Breakfast by Chef Gina. Then it was time to crank up the station towers. Did I mention that internal rotators are nothing but trouble? John WB6IQS warned us. We should have gone back to Oceanside to get the other style rotator but we decided instead to use the internal. Came time to test the rotation of my antenna and get it pointed in the right direction only to find out that the rotator control wire had pinched and broken off. This was on the heaviest tower, so lowering it was not the best solution. After fixing the cable

the 20m SSB station was ready to go. All other stations were on the air by 11:00. On Saturday we were visited by ARRL Section Manager Steve Early (a former PARC President) as well as a council member from the City of Poway. We also had attendance from local CERT and our GOTA station and information booth had a lot of public participation. Our Saturday lunch and tri-tip dinner was extraordinary as usual. The 20m band seemed to be well open this year while the other bands had little action. This was in contrast to last year where 15m seemed to dominate.

Tear-down on Sunday went very smoothly until we got to my station. Did I mention that pesky internal rotator? Yep, you guessed it. They are nothing but trouble! While attempting to rotate it back to the position necessary for lowering the tower, the control cable was severed again at the base of the rotator. We could not lower the tower without risking damaging the antenna without getting the antenna rotated in the proper rotation. After solving that problem we vowed to never use internal rotators again. We finished packing up and left the site. That's when Conrad who was the tail vehicle noticed smoke coming from the wheels of the trailer that stores all the club towers. A rotator pipe had come loose, slipped over the side of the trailer and wedged itself in between the tires, wearing one completely down to nothing. We were not even a quarter of a mile away from the site when this happened. After spending almost an hour attempting to free the pipe and realizing that we would lose that tire, we also learned that there are not many tire repair shops open on Sundays. Thankfully where was one open in San Marcos and we had a spare tire on board. We would have changed it ourselves except for the fact it wasn't seated on a rim. After stopping in San Marcos to fix the tire we arrived back in Oceanside around 5PM. Richard, Conrad and I unloaded the gear and then Field Day was finally over. Now I still had to return the bird cage. Next steps would be to compile the results and submit our score. Field Day is a group effort and our club sure puts on a great effort each year. The Palomar Amateur Radio Club Field Day Extravaganza isn't accomplished without all the hard work and support from our membership. Thank you to all who helped make this year's Field Day a great success! If anyone is interested in running Field Day next year, I am more than willing to help them out. :-)

Look forward to seeing everyone next year at Field Day.

73 DE Greg Gibbs KI6RXX
760-583-9668

Palomar Amateur Radio Club Field Day Scoring Sheet 2015

Class:	4 A	Web Submission:	50

Band / Mode QSO Breakdown:

	CW	DIGITAL	PHONE	TOTAL QSO's	TOTAL PTS
160M	0	0	0	0	0
80M	6	0	64	70	76
40M	200	0	107	307	507
20M	791	0	829	1620	2411
15M	227	0	180	407	634
10M	2	0		2	4
6M	4	0	13	17	21
2M	0	0	0	0	0
1.5M	0	0	0	0	0
Other	0	0	0	0	0
Satellite	0	0	0	0	0
TOTAL:	1230	0	1193	2423	3653

Power Multiplier:	2	Total Band QSO Score:	7306

Bonus Points:

Category:	PTS	Multiplier	Total PTS
100% Emergency Power	100	4	400
Media Publicity	100	1	100
Set-Up In Public Place	100	1	100
Information Booth	100	1	100
NTS To ARRL SM/SEC	100	0	0
W1AW Field Day Message	100	1	100
NTS Messages Handled	10	0	0
Natural Power QSOs	100	0	0
Site Visit Elected Official	100	1	100
Site Visit Served Agency	100	1	100
Youth Participation	20	1	20
Educational Activity	100	1	100
Satellite QSO	100	0	0
		TOTAL BONUS POINTS:	1120

Station Scores

STATION	Total QSO's	Total Score
20/80 CW	797	3188
20/80 SSB	893	1786
15/40 CW	427	1708
5/40 SSB	287	574
10M	2	8
6M	17	17
GOTA	4	8
TOTAL:	2427	7289

TOTAL FIELD DAY SCORE:	8484

LY Score	8946	
Difference	-462	-5.45%
LY QSO's	2262	
Difference	165	+6.80%

Club Members ONLY!
PARC has a tube bank that includes many 6 & 12 volt receiving tubes (and some transmitting types) for use by club members to repair their own personal equipment. Not for commercial use or resale. If we have your requests, we will pre-check the tubes and deliver them to you at the next club meeting.

Contact John WB6IQS WB6IQS@att.net

Call To Action - Parity Act Letter Campaign

by Mark Schlesinger, N6NNI

Where should I send my letters in support of HR 1301 and S 1685?

Amateur radio operators are asked to send letters, addressed to their member of Congress, to:

American Radio Relay League
Attn: HR 1301 Grassroots Campaign
225 Main St
Newington CT 06111

If you prefer to send a signed letter, please convert it into a PDF, then email it to reginfo@arrl.org Please include the phrase "HR 1301 Grassroot Letter" as the SUBJECT of your email.

Why does the ARRL request I send my letter to the ARRL instead of simply mailing it to my Member of the US House?

There are several reasons:
First, because of security concerns, it can take from six to eight weeks for a letter sent directly to a Congressional office to be delivered. All mail to their office is delivered to a holding facility to be screened to problems before they are finally sorted and delivered.
Second, and as important, when the ARRL receives your letter, it can be combined with other letters to your Congressperson and hand-delivered to their office on Capitol Hill. This provides an additional opportunity for our Washington team to have a face-to-face meeting with the key staff in each Congressional office.

In Conclusion
I ask that you make available the following example-letters to each of your ham-radio friends at amateur radio meetings so that we can act. We can quickly get our point presented to our political representatives, our Senators and Representatives.
We need considerable support to accomplish our purpose. I ask that you do so with the same enthusiasm that the amateur radio community did in support of the hams of Poway, California to accomplish City Ordinance changes

where amateur radio communications was suppressed and in many cases prevented for nearly 30 years.
Thanking you,
Mark Schlesinger, N6NNI, Poway, California:
ARRL Member; July 10th 2015.

<The Amateur Radio Parity Act ----Example of Support Letter to Send to Your Senator>

<insert date>

<insert Senator's Name>
<insert Senator's address>

Dear Senator _____:

I am a constituent in your state and wish to bring an issue to your attention. I am a federally licensed amateur radio operator, one of nearly three-quarters of a million licensees of the Federal Communications Commission in the United States.

Annual Club Picnic Announcement

The Annual Picnic of Palomar Amateur Radio Club is scheduled for Sunday August 23rd., 2015 at the San Dieguito County Park, Area 4. The Picnic starts at 9 AM and will last through the late afternoon or so.

Each year PARC hosts an annual picnic for its members and every year it is great fun. Throughout the year, club members earn participation points for signing in at various club activities like the regular monthly meetings, repeater mountain work parties, operating days, and Field Day. This is the time for club members to redeem those participation points for tickets in the annual picnic prize drawing. A maximum of 20 tickets for each club member is allowed. Club members even get a point for attending the picnic. Multiple prizes will be awarded in various denominations.

The club will provide the main course. Members and their guests are asked to bring an item from the following list and some drinks. Last names beginning with: A-K: side dish or casserole, L-R: salad, vegetables, or fruit, S-Z: desert, and last names beginning with Lara: BROWNIES.

There is lots of fun to be had at the picnic. Transmitter hunting (also known as T-hunting, fox hunting, bunny hunting, and bunny chasing), is an activity wherein participants use amateur radio direction finding techniques to locate one or more radio transmitters hidden within a designated search area. Think of it like hide and seek, only with ham radios. What could be more fun than that! There will be at least one radio hidden within the San Dieguito County Park area for those who wish to try their attempt at finding it. Who will be the first to find the radio?

Plans are to have an HF radio setup on 10, 15, and 20 meters for those that wish to play around on HF. In the past, at the PARC picnic, we have made contacts with places as far away as Russia. Come out and see what propagation on the ham bands brings us this year.

Come and share some good food and great stories, try and find the hidden transmitter, play on HF, and most importantly, come out and have a great time with other Hams from our club.

We look forward to seeing you there!

Greg Gibbs KI6RXX and the PARC Board of Directors.

We provide communications support for public service events on behalf of our communities.

During and after local and state-wide disasters and emergencies, and when all other forms of communications are unavailable, we provide communications for first responders and Federal, state and local governmental agencies and non-governmental agencies, including the Red Cross and Salvation Army and United States Military Auxiliary Radio System (MARS).

We also do this for our neighboring communities when communications systems including cell-towers and land lines are turned off and reprogramed to exclusively serve Police, Fire and Emergency Responder Services.

On the behalf of the free services we provide, I am concerned that we cannot successfully serve our community unless an outdoor antenna can be located upon our residences.

Private land use regulations routinely include restrictions that completely preclude Amateur Radio communications' operators from installing any type of outdoor antenna.

Recently, a bi-partisan Bill, S 1685 - "The Amateur Radio Parity Act", was introduced by Senator Wicker (MS) and co-sponsored by Senator Blumenthal (CT). S 1685 directs the FCC to extend their existing PRB-1 regulations of "reasonable accommodation" of Amateur Radio communications to include private land use regulators. The "reasonable accommodation" policy has for almost 30 years applied to municipal zoning ordinances. This Bill would afford us the ability to negotiate with homeowner's associations in residential developments.

The proposed Bill, S 1685, would extend the policy to Amateur Radio Operators who reside within under land use restrictions. The Federal Communications Commission has asked Congress for guidance in this area and S 1685 provides it.

As your constituent, I am asking that you support the bill by signing-on as a cosponsor. Please contact Senator Wicker's office to do so. If you have any questions, please contact ARRL, the national association for Amateur Radio, attention Dan Henderson, at 860.594.0236. Thank you.

Sincerely,
<your signature>
<your name and call>
<your address>

<The Amateur Radio Parity Act----Example of Support Letter to Send to Your Congressperson>

<insert date>

<insert Congressperson's Name>
<insert Congressperson's address>

Dear Representative _____:

I am a constituent in your state and wish to bring an issue to your attention. I am a federally licensed Amateur Radio operator, one of nearly three-quarters of a million licensees of the Federal Communications Commission in the United States.

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Private land use regulations routinely include restrictions that completely preclude Amateur Radio communications' operators from installing any type of outdoor antenna.

Recently, a bi-partisan Bill, H.R. 1301 - "The Amateur Radio Parity Act", was introduced by Congressman Adam Kinzinger (IL-16) with Congressman Joe Courtney (CT-02) and eleven additional original co-sponsors. H.R. 1301 directs the FCC to extend their existing PRB-1 regulations of "reasonable accommodation" of Amateur Radio communications to include

private land use regulators. The "reasonable accommodation" policy has for almost 30 years applied to municipal zoning ordinances. This Bill would afford us the ability to negotiate with homeowner's associations in residential developments.

The proposed Bill, H.R. 1301, would extend the policy to Amateur Radio Operators who reside under private land use restrictions. The Federal Communications Commission has asked Congress for guidance in this area and H.R. 1301 provides it.

As your constituent, I am asking that you support the bill by signing-on as a cosponsor. Please contact Representative Kinzinger's office to do so. If you have any questions, please contact ARRL, the national association for Amateur Radio, attention Dan Henderson, at 860.594.0236. Thank you.

Sincerely,
<your signature>
<your name and call>
<your address>

PARC Field Day Efforts, photos by Paul KB5MU

DX Clusters: The first use of Crowdsourcing?

Howard Groveman W6HDG

Crowdsourcing is a relatively new term which Merriam Webster defines as "the process of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, and especially from an online community, rather than from traditional employees or suppliers."

A very cool recent example is the Cobra iRadar Car Radar Detector. For decades you had to mount a radar detector in your car and put up with those infernal beeps which registered both real speed traps and many false alarms. If you were lucky, you found the cops before they found you. Cobra Electronics wasn't satisfied with the status quo and two years ago designed a cellphone connected (Bluetooth) radar detector where speed traps, red light cameras and other hazards can get automatically or manually uploaded to a central server by each user. Rather than beeps, the detector compares your location to the vast database of collected hazards and does a voice announcement of nearby critical information. You can see how such an invention could be paradigm changing.

I mention the above because hams, being way ahead of the curve, experienced such a paradigm shift 30 years earlier. We might have even been the first true crowdsourcers – long before crowdsourcing was even a word. When packet radio was catching on in the late 80's, one industrious ham, Dick Newell, AK1A, in 1985 developed a DOS-based DX Spotting system where rare or unusual stations, when worked or heard, could be listed over nodes on the Packet Radio System. This had a profound effect on DX hunting. In the late 90's and 2000's things had transitioned to internet connected networks and robust server apps such as AR-Cluster (AR-Technologies / AB5K), CC Cluster (Lee Sawkins / VE7CC) and DX Spider (Dirk Koopman / G1TLH).

The nice thing for hams is that you don't need to be a network guru to use the Clusters. You don't even need to have a Telnet client for access, since ham radio software started to include the DX Cluster as part of their onscreen rig control and logging programs. Rather than having to stumble over a rare station, working DX became a matter of point and shoot…..

Ham Radio Deluxe ver 6 now has dual Cluster displays integrated into the electronic Logbook which can graphically present the current band you are on as well as a second window which can filter and display other bands/ modes you might want to switch to. Various "worked status indicators" have been

added to the HRD cluster window so you can see if you worked a country, continent, zone, particular station, mode or band previously. It also displays if the spotted DX is registered with Log Book of the World (LoTW) – a valuable fact if you want to amass confirmed countries in short order.

The very latest developments in this category are automated skimmers for CW, PSK, JT65 and RTTY (SSB decoders are a distant dream at this point). These use multiple geographically placed SDR's owned by various hams to look at large swaths of multiple bands and which can decode in bulk. Servers around the world can instantly post the results to Clusters, public Telnet Servers and a specialized online site called Reverse Beacon Network (RBN). You don't even need your own SDR to enjoy the benefits of these worldwide crowdsources. They can even help you to evaluate your rig and antennas by seeing who is copying you, making a subtle change and then seeing if you are being spotted any stronger. If you are a CW, RTTY, PSK or JT65 user who has been active over the previous couple of days, be sure to visit www.reversebeacon.net, www.pskreporter.info, and www.hamspots.net,

register and look up your call. You will be amazed at how many times you were automatically spotted by these skimmer bots. Look up your buddy's call and compare your results.
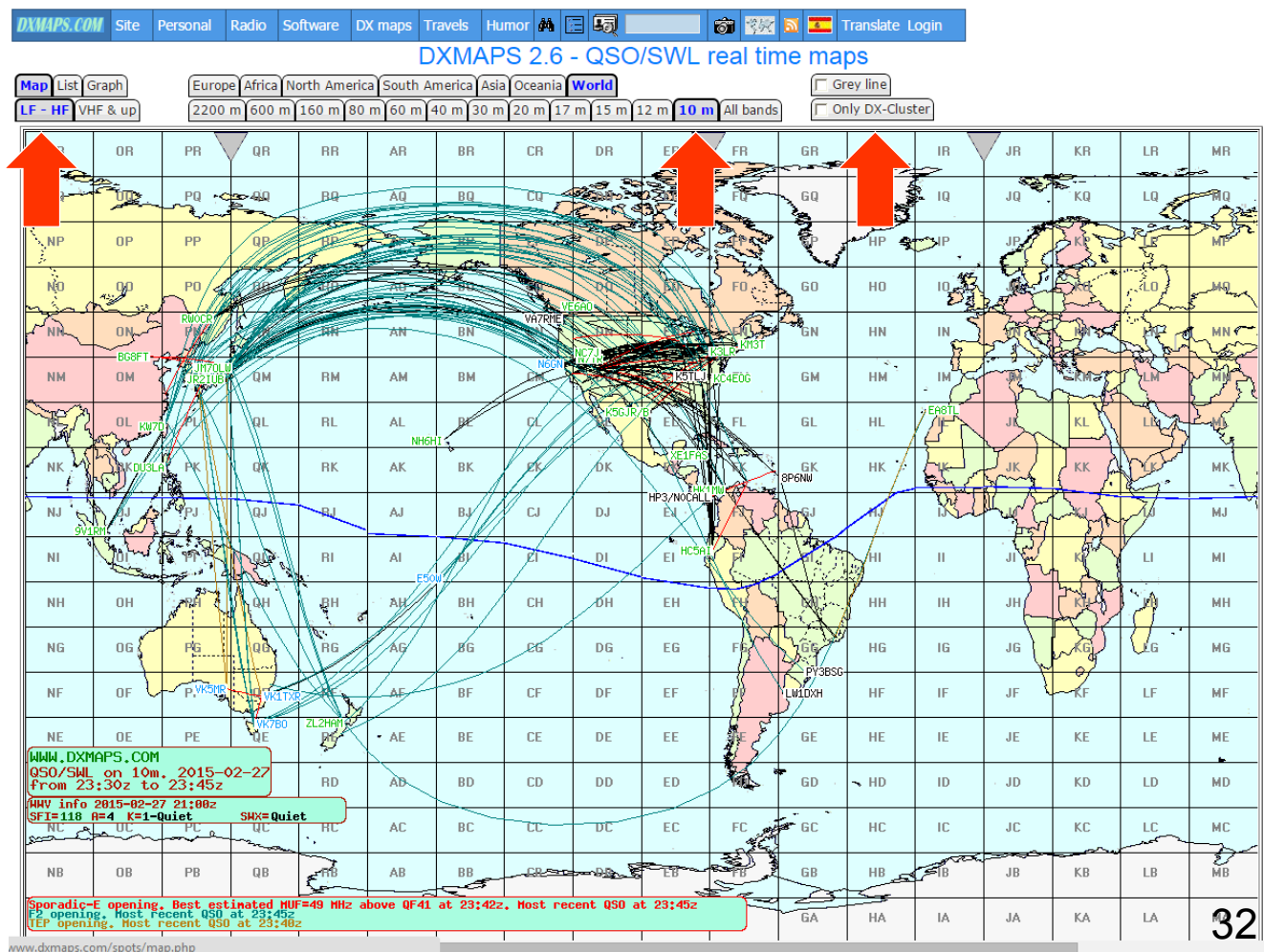
If you want a real world example of how these Clusters and RBN's can get displayed visually, be sure to go to www.DXMaps.com which displays real-time propagation maps. Click on the band segment, specific band and indicate if you want all spots from all sources, or just from the regular DX-cluster. Leave the map on screen and it will update automatically. Click on the map to get a line by line listing. Below is a map from a 10 meter afternoon opening to Asia on February 27, 2015.

And finally, if you always seem to miss those unpredictable 6 meter openings, go to

http://www.dxmaps.com/spots/warnings.php

and sign up for an automated e-mail sent when there is a VHF/UHF opening specifically workable from your QTH!

73 and GL, Howard W6HDG

PARC Field Day Efforts, photos by Paul KB5MU

SCOPE   PERIODICALS

P.O. Box 73
Vista, CA 92085-0073

Return service requested

Featured Program:

At 7:30pm on 5 August 2015, Palomar Amateur Radio Club will present a program DX. Online tools to improve DX experience. By: W6HDG (Howard Groveman).. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

W6NWG

Hi to all our Club members. I am pleased to announce that PARC has been designated a federally tax exempt non-profit entity. We are working on the details by which donations to the Club may be counted as tax deductions for the donor. Watch the newsletter for information.

You will find important information about SCOPE elsewhere in this issue. In brief, the Board of Directors is working to identify a way to continue distributing Scope. We no longer have a printer. Research as shown that to continue printing Scope in color will likely cost $700.00 a month. An alternative is printing the Scope in black and white.

Consequently we are investigating member's acceptability of going to an electronic distribution only. The two very informal, anonymous, random surveys taken at the January and August General Club meeting show that 95% of the respondents accept the idea that Scope move to electronic distribution. This has several advantages. Much more timely arrival of the newsletter, full color, interactive displays online, and significant financial savings.

Scope may be issued monthly, and distributed electronically only.
If you have strong opinions about this, please tell us!

Charlie NN3V

Save the Date

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Work Party on Palomar Mountain

13 September 2015
This will be part two of the freezer building repainting.

We could use at least 4 helpers for this project. Contact Dennis KD6TUJ to volunteer for part 2 of the work party. See page 8 for photos and report on part 1!

Maker Faire San Diego

Amateur Radio will be a big part of the San Diego Maker Faire. This will be an amazing event full of all sorts of DIY techie goodness! It's the world's biggest show and tell.

If you are interested in volunteering for the Maker Faire through PARC, or volunteering directly, then contact: Michelle at w5nyv@yahoo.com

Maker Faire® San Diego
1ST Annual Oct 3+4 2015
BALBOA PARK

Please support our advertisers. Their support of the club is vital.

{special}
THANKS
to our sponsors

Club Members ONLY!
PARC has a tube bank that includes many 6 & 12 volt receiving tubes (and some transmitting types) for use by club members to repair their own personal equipment. Not for commercial use or resale. If we have your requests, we will pre-check the tubes and deliver them to you at the next club meeting.

Contact John WB6IQS WB6IQS@att.net

From Our Social Side

Michelle Thompson
June 16 at 7:33am · San Diego, CA

Looking for comments, narratives, and articles about the VHF contest this past weekend. The guys in the San Diego Microwave Group had mixed success - how did our Palomar crew do?

Like · Comment · Share

👍 Lee Tydlaska likes this.   ✔ Seen by 28

Paul E. Dorey I wasn't part of any 'crew' but score fell short of last year. Sunday afternoon seemed to be the most productive but easterly reach on 6m was limited to Texas north to MN.
June 16 at 8:02am · Unlike · 👍 1

Paul E. Dorey Operating Time (hrs): 8:44

Summary:
Band QSOs Mults

6: 117 39
2: 6 5
222: 0 0
432: 1 1
903:
1.2:
2.3:
3.4:
5.7:
10G:
24G:

Total: 124 45 Total Score = 5,625

Club: Southern California Contest Club

Comments:

My FT-5000 is in the 'hospital' getting a facelift and tuneup so I had to use the 857. It worked ok but the frontend caved like an 1849 mineshaft with weak bracing.

Sunday afternoon in the later part of the day was about the best here with a better 6m opening to the middle part of the TX-MN areas. My goal was to look for my rover friends and try to get as close to last year's effort. But I was 11 mults and 27 Qs short of the mark. That made the score almost 3K short of last year.

Second Goal was to pick up a state or two of the 19 I needed confirmed on 6m and hopefully a grid or two - all being in the LoTW so keeping the fingers crossed.

WN6K, Paul

FT-857D @70w
SteppIR -DB18 @55ft. (40-6m)
Ringo Ranger 2m Vertical (2-70cm)
June 16 at 8:20pm · Edited · Unlike · 👍 1

Ellen Utschig Maybe K6ZH could write something up about his DXpedition to activate DM02 (pretty rare) As always, Murphy raised his ugly head but, through all the adversities (praise God & thanks to the pilot stations & Vessel Assist), the team made it home safely. I got 'em...did YOU??!?
June 16 at 9:10pm · Like

Write a comment...

Got a story about the VHF contest? Share it with the club!
Send it to scope@palomararc.org

The Ham Radio Lunch Bunch meets Fridays for lunch and socializing at any one of a number of restaurants on a rotating schedule. The Lunch Bunch signup is http://w0ni.com

Reminders are sent out on Wednesdays. All are welcome for food and fun!

Some of the restaurants on the schedule are Fuddruckers, UTC Food Court, Spices Thai, Savory Buffet, Denny's, Callahan's Pub and Grill, and Phil's BBQ.

Club Financial Update

Income/Expense by Category

7/1/2015 through 7/31/2015

Income/Expense by Category - Last month
7/1/2015 through 7/31/2015

Category Description	7/1/2015-7/31/2015
INCOME	
Donations	186.00
Dues	294.00
TOTAL INCOME	**480.00**
EXPENSES	
501C	400.00
Field Day Expns	657.40
Picnic	136.25
Rptr Electric	80.31
Rptr Phone	30.67
Scope Printing	111.74
TOTAL EXPENSES	**1,416.37**
OVERALL TOTAL	**-936.37**

Legend:
- ■ Income
- ■ Expense

7/2015
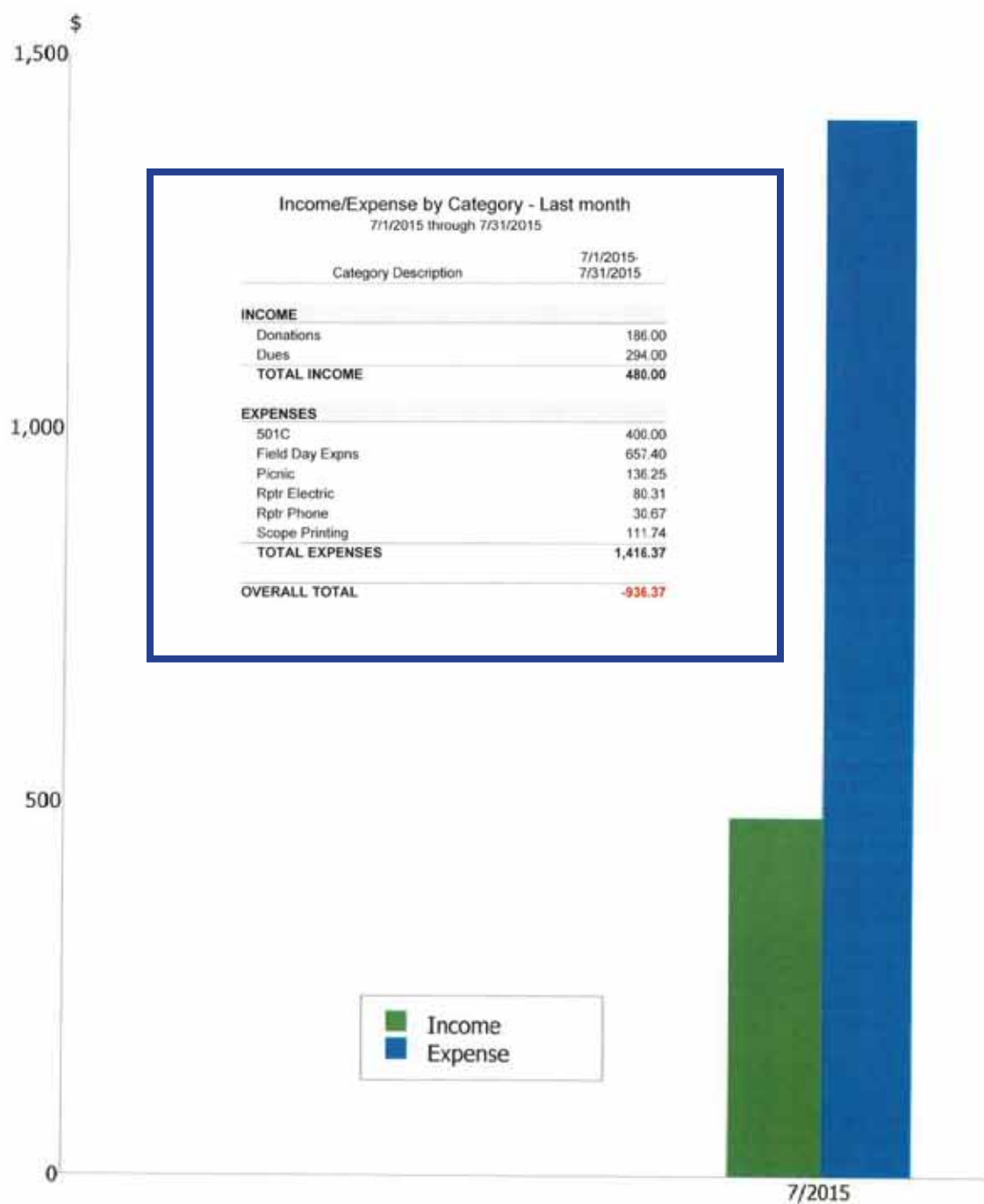
July Membership Meeting Photos

TASMA Presentation to PARC

Photos by Paul KB5MU.

We had a good work party on August 9, 2015 on the mountain. The group of Mike N6PIH, Jason KK6POP, Doug KG6ACO, andDennis KD6TUJ put a new primer coat on the freezer building.

Scraping and wire brushing were done first to remove all the loose paint. When done, minor fixes were done to repace missing/aged nails, and reseal a joint above the doorway.

The paint shop said we could color the primer, so it was asked to try to get a tree leaf green. Did not quite work out that way! [See the inset photos for the color we got. Compare against the background -W5NYV]

Oh well, we are going to come back and paint another coat to a better green with the paint we still have on the hill. Still, this is better than plain white.

As the painting was finishing, it was decided to raise the tree near the block building. Moving the tree is hard work. A tour was taken before work started including airing out the block building. Started at 10:15. Finished by 12:15.

The next work party for the repeater site is scheduled for Sunday September 13, 2015. This will be part two of the freezer building repainting.

We could use at least 4 helpers for this project. Contact Dennis KD6TUJ to volunteer for part 2 of the work party.

Dennis

Before painting

After painting. Primer is bright green!

Preparing to paint.

Diamond Antenna Failure Analysis

By Paul KB5MU

After many years of faithful service on the roof of W5NYV's minivan, and a month or two of gradual performance loss, her Diamond NR770HB dual-band mobile antenna stopped working. After we replaced it with another of the same model antenna, I undertook to take it apart and try to find out what had gone wrong.

The whip itself had no obvious failure modes, so I loosened the two set screws and saved the whip as a spare. The base unit (shown in Fig. 1) would be sacrificed for science. The base unit included a handy fold-over feature (shown in Fig. 2). By pulling up on the whip against spring tension a little hinge arrangement could be revealed, allowing the whip to fold down without removing the antenna. At first the fold-over seemed to be integral, but with a little brute force (and Vice-Grips) the fold-over was found to unscrew from the rest of the base unit (Fig. 3). I drilled out the hinge pin and found just four other parts of the fold-over: the two outer housings, the spring, and a shiny metal plunger (Fig. 4). The smooth top surface of the plunger makes contact with the top of the main base unit.

Unless of course the top of the main base unit is horribly corroded (Fig. 5). The corrosion alone was probably enough to keep the antenna from working well. For the sake of science I should have cleaned the contact, reassembled the antenna, and re-tested it. But I was on a disassembly mission and not to be distracted by a possible repair.

With more force, Vice-Grips, and another large pair of pliers I was able to unscrew the UHF-style connector from the bottom of the main aluminum tube. Once unscrewed, it resisted coming out with gentle spring tension: the inductor of the matching network. I pulled harder, deforming the inductor and pulling the connector assembly out of the tube (Fig. 6). With it came several drops of water, loaded with corrosion, and two pieces of what had once been the capacitor of the matching network (Fig. 7). The capacitor was broken in half, and the other end of both its leads were also severed. I suspect the capacitor leads corroded through, and that was the final hard failure mode. Some or all of the capacitor damage might also have occurred during disassembly.

No amount of force at my command sufficed to remove the assembly at the top end of the main tube, so I fired up an oscillating multi-tool and cut it in half (Fig. 8). Embedded inside the plastic part was a threaded stud, with one end of the inductor wire in the bottom end. The top end of the stud stuck out to contact the plunger in the fold-over. So, no electronic components were found in the top assembly. The inductor and tiny capacitor were the entire circuit.

So: corrosion. No surprise there. Corrosion is the enemy of antennas everywhere. It might seem surprising that water could get into such a tightly sealed assembly, but experience says otherwise. There is no such thing as a tightly sealed assembly.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Photos by Paul KB5MU

San Diego Microwave Group Range Party

In anticipation of round 1 of the ARRL's August 15-16 10GHz & Up contest, the San Diego Microwave Group held their annual Tune-Up party last weekend at N6IZW's QTH. Fourteen operators attended with gear covering 10-47GHz. The largest antenna and RF power award went to K6NKC (48" 25W) and the Peanut award was taken by KK6GZL (24" 27dB) who is our newest member.

The San Diego Microwave Group will be operating its antenna measurement range at 2015 MUD, which is being sponsored by SBMS and held in San Diego on Oct 15-18. For MUD 2015 information and reservations see:

http://ham-radio.com/sbms/mud2015/mud_index.html

For Mud 2015 information on the antenna range contact : Kbanke -at- sbcglobal –dot- net

Thanks!
Greg
K6QPV

Ed Munn W6OYJ tests his rig at the range party.

Drew KB9FKO says "take it down lower" in the minimum discernible signal test.

Kerry N6IZW adjusts the attitude of the command station.

Michelle W5NYV and Kerry N6IZW.

San Diego Microwave Group Range Party

Photos by Michelle W5NYV and Paul KB5MU.
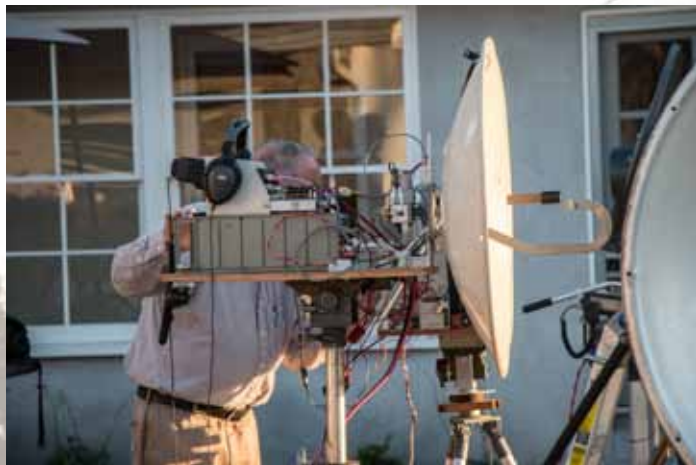
Kerry Banke N6IZW tests W5NYV's 3D-printed 10GHz horn.

Kerry N6IZW runs the two tests for the range party. Minimum discernible signal and measured output power are recorded for each station. This is a great checkup before the contest season.

Greg Bailey K6QPV assists another member with his station's range test.

SCOPE   PERIODICALS

P.O. Box 73
Vista, CA 92085-0073

Return service requested

Featured Program:

At 7:30pm on 2 September 2015, Palomar Amateur Radio Club will present our monthly program. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA. Arrive at 7:00 for socializing. Kevin KK6FRK talks about Ham Radio and Scouting. Kevin will discuss the actions being taken to get scouts interested in ham radio and electronics, and will tell us about all the ham radio activities planned leading to the 2015 Jamboree On The Air (JOTA) in October.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo
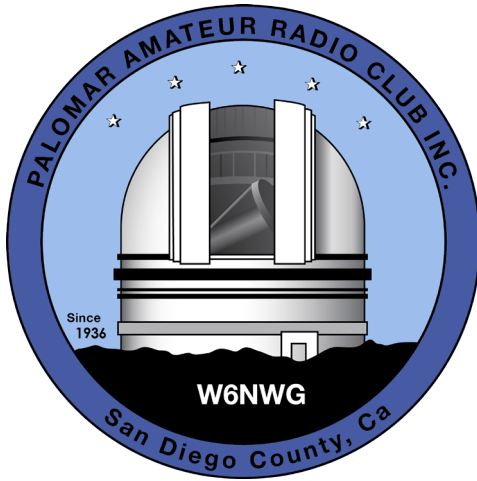
Attention All SCOPE Recipients

This is probably your last printed SCOPE

Over the past few months we here at PARC alerted you to the difficulty we experienced with the cessation of printing services from our longtime printer. That leaves us in a lurch.

Without boring you with a lengthy story, please realize that after careful investigation we only find printing services who will charge us at very least $500.00 a month ($6.000.00 a year) to print SCOPE as you are accustomed. And that does not include mailing costs. We can't afford that.

We are committed to issuing a monthly newsletter. We are required to do so by our bylaws. So we are moving to electronic SCOPE distribution!

This gives you several advantages. You will receive your SCOPE faster, it will be in sharper colors, and will include additional features such as videos, and related interactive matter.

You must opt in to receive SCOPE electronically. It is easy.

Go to the PARC website www.palomararc.org , and select "Newsletter" from the column on the left of the website screen. On the newsletter page, at the very top, you will find two options. The first way to receive SCOPE electronically is for you to subscribe to receive a PDF file of the newsletter when it is ready to be delivered. You can then print the file, or store it on your computer or smart device to read it later. The second way is to just receive a notification that the newsletter is available on line at our website. You may choose to subscribe to both forms of delivery simultaneously. That way if you are too busy to see SCOPE on line when you receive the notification that it is ready, you will also receive the PDF file separately. That way if you forget the newsletter is available, you will find it in your email anyway.

Rest assured that we are not doing this lightly. We simply cannot afford the printing prices. We remain committed to producing a newsworthy, attractive, and information filled monthly newsletter as we are required to do by our bylaws.

If this creates a grave problem for you, please notify us via snail mail at Post Office Box 73, Vista, CA or electronically via email to board@palomararc.org

Two big events in October: Jamboree On The Air (JOTA) for boy scouts and Microwave Update (MUD) for microwave enthusiasts. See the electronic version of the October Scope for more details. Electronic version can be found at www.palomararc.org in the Newsletter section.

Microwave Update 2015

MUD

October 15 to 18

San Diego, CA

Thurs 15 — **Registration, Socializing**

Fri 16 — **Tech Talks, Demos, Rig Testing, Buy & Sell**

Sat 17 — **More Talks, Demos, Buy & Sell, Banquet**

Sun 18 — **Antenna Testing, Buy & Sell, EME Meeting**

More MUD Info: http://ham-radio.com/sbms/mud2015

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By-laws Update

The club's board of directors nominated a bylaw review committee to do a review of our current bylaws. The committee was composed of KI6RXX (Greg), KK6FRK (Kevin), KJ6WUY (Richard), KJ6JEI (Conrad), NN3V (Charlie), and KD6TUJ (Dennis). Dennis was the lead of the committee, and the committee's recommended changes were submitted to the Board for review. The recommended changes are very minor, and principally adjust the bylaws to take account of the technology changes since the last time the bylaws were reviewed. For example, the means of notifying members of important events (such as an election meeting) will no longer be specified as by way of paid telegram! The Club will announce a regular general member meeting date when the modified bylaws will be subject of a general membership vote. Stay tuned!

October Meeting Program

The October meeting will carry out the Annual Club Auction.
Set-up of the Carlsbad safety center for the auction will start at 5:30 PM, Wednesday October 7th. Hams wishing to sell items may enter the Carlsbad safety center between 6:00 PM until 6:30 PM. Buyers may examine the merchandise between 6:30 PM and 7:00 PM. The auction will begin at 7:00 PM. Our auctioneer is our very own AK6R (Bob).

November Operating Day

November 7th, 9:00 AM – 4:00 PM. At Fry's in San Marcos. Volunteers requested to meet the public, and participate in the event along with other ham radio organizations. Good opportunity to attract possible new hams. Contact scope@palomararc.org to volunteer for Operating Day.

Above, Phase 4 equipment arrives for PARC and Lake Dixon. PARC has been asked to host a Groundsat development station for the AMSAT Phase 4 project. Right and below, two repeater site work party photos from 13 September 2015. Find more in the electronic version of the October 2015 Scope.

Current Board of Directors

Charlie NN3V President
Joe K6JPE Vice President
Jim NE6O Director
Gregg KI6RXX Director
Gary W6GDK Secretary
Richard KJ6WUY Treasurer
Dennis Baca KD6TUJ Repeater Site Chair
Glen KJ6ZQH Membership
Mark KF6WTN Repeater Technical Chair

Elections for 2016 Board will be held at the
November 2015 membership meeting.

Save the Date

Club Meeting	Board Meeting	Club Events
7 October 2015	**14 October 2015**	**October 2015**
Annual Auction!	Palomar Amateur Radio Club board meeting at 7:00pm at Poway Fire Station.	3-4 SD Maker Faire 15-18 JOTA+Microwave Update! 24-25 SSB CQWW
See page 21!		

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Club Members ONLY!
PARC has a tube bank that includes many 6 & 12 volt receiving tubes (and some transmitting types) for use by club members to repair their own personal equipment. Not for commercial use or resale. If we have your requests, we will pre-check the tubes and deliver them to you at the next club meeting.

Contact John WB6IQS WB6IQS@att.net

Helpful DX Tools!

Howard Groveman has provided a link to the websites he talked about in the August general meeting. Check out the list of links here:

http://qsl.net/w6hdg/DXTools.html

Please support our advertisers. Their support of the club is vital.

(special) **THANKS** to our sponsors

Club HF Remote Station? Proposal Time!

Current status: PARC has obtained 501(c)(3) status, and we have begun putting our HF remote station proposal in writing. This is an exciting time! We expect to complete our proposal by January 2016.

If you would be interested in helping write a club remote HF station proposal for Palomar Mountain, then please join up by writing me at scope@palomararc.org and I'll add you to the mailing list!

Mailing list archive located at
http://palomararc.org/pipermail/hfremote/

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

NORTH SENTINEL ISLAND DX CLUB

EXPRESSES OUR SUPPORT FOR HF REMOTE STATIONS. BECAUSE HOW ELSE ARE YOU GOING TO OPERATE HERE?

Club Financial Update

Income/Expense by Category - Last month

8/1/2015 through 8/31/2015

Category Description	8/1/2015-8/31/2015
INCOME	
Donations	140.00
Dues	906.00
Rentals	150.00
TOTAL INCOME	**1,196.00**
EXPENSES	
Field Day Expns	112.69
Operating Day	219.20
Rptr Electric	104.73
Rptr Maint	231.06
Rptr Phone	30.26
TOWER TRAILER	95.00
TOTAL EXPENSES	**792.94**
OVERALL TOTAL	**403.06**

4   A Protocol for Leibowitz; or, Booklegging by HF in the Age of Safe Æther

by Travis Goodspeed and Muur P.

Howdy y'all!

Today we'll discuss overloading of protocols for digital radio. These tricks can be used to hide data, exfiltrate it, watermark it, and so on. The nifty thing about these tricks is that they show how modulation and encoding of digital radio work, and how receivers for it are built, from really simple protocols like the amateur radio PSK31 and RTTY to complex ones like 802.11, 802.15.4, Bluetooth, etc.

We'll start with narrow-band protocols that you can play with at audio frequencies. So if you don't have an amateur license and a shortwave transceiver, you can use your sound card to do most of the work and run an audio cable between two laptops to send and receive it.[10]

— — —   — — —   — — — —

Suppose that sometime in the future, our neighbor Alice lives in an America of modern–day Nehemiah Scudder,[11] whose Youtube preachers and Twitter lynch mobs have made the Internet into a Safe Zone for America's Youth, by disconnecting it from anything unsafe. So Alice's only option to get something unsafe to read is from Booklegger Bob in Canada, by shortwave radio.

But it ain't so easy. President Scudder has directed Eve at the Fair Communications Commission[12] to strictly monitor and brutally enforce radio regulations, defending the principles of Shortwave Neutrality and protecting the youth from microunsafeties.

So Alice and Bob need to make a shortwave radio polyglot, valid in more than one format. Intent on her mission, Eve is listening. So when Alice and Bob's transmissions are sniffed by Scudder's National Safety Agency or overheard by the general public, they must appear to be a popular approved plaintext protocol. It must appear the same on a spectrum waterfall, must decode to a valid message (`CQ CQ CQ de A1ICE A1ICE Pse k`), and nothing may draw undue attention to their communications. Bob, however, is able to find a secret, second meaning.

In this article, we'll introduce you to some of the steganographic tricks they could use, as well as some less stealthy—and more neighborly—ways to combine protocols. We'll start with PSK31 and RTTY, with a bit of CW for good measure. And just to show off, we'll also bring wired Ethernet into the mix, for an exfiltration trick worthy of being shared around campfires![13]

4.1   All You Need Is Sines

Well, not really. But it sure looks that way when you read about radio: sines are everywhere, and you build your signal out of them, using variations in their amplitude, frequency, phase to transmit information.[14] This stands to physical reason, since the sine wave is the basic kind of electromagnetic oscillation we can send through space. Of course, you can add them by putting them on the same wire, and multiply them by applying one signal to the base of a transistor through which the other one travels; you can also feed them through filters that suppress all but an interval of frequencies.

You can see these sines in the signal you receive on the waterfall display of Baudline or FLDigi, which show the incoming signal in the frequency domain by way of the Fourier transform. PSK31 transmissions, for example, will look like nice narrow bands on the waterfall view, which is the point of its design.

The waterfall view is close to how a mathematician would think about signals: all input whatsoever is a bunch of sine waves from all across the spectrum, even noise and all. A perfectly clean sine wave such as a carrier would make a single bright pixel in every line, a single bright 1-pixel stripe scrolling down. That line would expand to a multi-pixel band for a signal that is the carrier being modulated by changing its amplitude, frequency, or phase in any way, with the width of the band being the double of the highest frequency at which the changes are applied.[15]

Of course, the actual construction of digital radio receivers has very little to do with this mathematician's view of the signal. While a mix of ideal sines would neatly fall apart in a perfect Fourier transform, the real transform of sampled signal would have to be discrete, and would present all the interesting problems of aliasing, edge effects, leakage, scalloping, and so on. Thus the actual receiving circuits are specialized for their intended protocols particular kinds of modulation, designed to extract the intended signal's representation and ignore the rest—and therein lies Alice's and Bob's opportunity.

4.2   Related Work

In 2014, Paul Drapeau (KA1OVM) and Brent Dukes released `jt65stego`, a patched version of the JT65 mode that hides data in the error correcting bits.[16,17] The original JT65 by Joe Taylor (K1JT) features frames of 72 bits augmented by 306 error-correcting bits,[18] so Drapeau and Dukes were able to hide encrypted messages by flipping bits that normal radios will flip back. This reduces the odds of successfully decoding the cover message, but they do correct for some errors of the ciphertext.

Our concern in this article is not really stego, though that will be covered. Instead, we'll be looking at which protocols can be combined, embedded, emulated, and smuggled through other protocols. We'll play around with all sorts of crazy combinations, not because these combinations themselves are a secure means of communication, but because we'll be better at designing new means of communication for having thought about them.

4.3   Classic PSK31

PSK31 is best described in an article by Peter Martinez, G3PLX.[19] Here, we'll present a slightly simplified version, ignoring the QPSK extension and parts of the symbol set, so be sure to have a copy of Peter's article when implementing any of these techniques yourself.

This is a Binary Phase Shift Keyed protocol, with 31.25 symbols sent each second. It consumes just a bit more than 60 Hz, allowing for many PSK31 conversations to fit in the bandwidth of a single voice channel.

The PSK31 signal is commonly generated as audio then sent with Upper SideBand (USB) modulation, in which the audio frequency (1 kHz) is upshifted by an RF frequency (28.12 MHz) for transmission. For reception, the same thing happens in reverse, with a USB shortwave receiver downshifting the radio frequencies to the audio range. In older radios, this is performed by an audio cable. More modern radios, such as the Kenwood TS-590, implement a USB Audio Class device that can be run digitally to a nearby computer.

Because many different PSK31 transmissions can fit within the bandwidth of a single voice channel, modern PSK31 decoders such as FLDigi are capable of decoding multiple conversations at once, allowing an operator to monitor them in parallel. These parallel decodings are then contributed to aggregation websites such as PSKReporter that collect and map observations from many different receivers.

4.3.1   Varicode

Instead of ASCII, PSK31 uses a variable-length character encoding scheme called Varicode. This

---

[10]You could also use loud speakers, but please don't. Pastor Laphroaig reminds us that there is a special level of hell for such people, who will spend Eternity next to those who scratch fingernails on chalk boards.

[11]`unzip pocorgtfo08.pdf ifthisgoeson.txt`

[12]Which some haters call Fundamentalist instead of Fair, but that's unsafe speech. Unsafe speech has consequences, neighbors. You don't want to find out about the consequences, so stay safe!

[13]Campfires are definitely not safe, so enjoy them while they last!

[14]Some combinations are useful, such as amplitude and phase, used, e.g., in DOCSIS; others aren't so useful, such as phase and frequency, because changes in one can't always be told from changes in the other.

[15]This is easy to see for frequency and phase, since these changes are added to the argument of the sine $A \cdot sin(\omega \cdot t + \theta)$, the frequency ω and the phase θ. Seeing this for the amplitude A is a bit trickier, but imagine A to be another sine wave, modulating the carrier. Then we deal with the product of two sines, and this is, by the age-old trigonometric identities $sin(\alpha + \beta) = sin(\alpha)cos(\beta) + cos(\alpha)sin(\beta)$ and $sin(\alpha - \beta) = sin(\alpha)cos(\beta) - cos(\alpha)sin(\beta)$; hence adding these and remembering that the cosine is the sine shifted by $\pi/2$, $sin(\alpha)sin(\beta + \pi/2) = \frac{1}{2}(sin(\alpha + \beta) + sin(\alpha - \beta))$. That is, a product of sines is the arithmetic average of the sines of the sum and the difference of their arguments. If α is the carrier and β is the change, the rainfall diagram will show the band from $\alpha - \beta$ to $\alpha + \beta$, that is 2β-wide.

Seeing this sum and knowing the carrier frequency, one might wonder: can't we make do with just one term of the sum $\alpha + \beta$, and ignore $\alpha - \beta$? Indeed, if one applies a filter to cut the frequencies less than the carrier from the transmitted signal, one can save half the bandwidth and still recover the signal β. This trick is known as the Upper Side Band, and it used for the actual digital radio transmissions.

[16]`https://github.com/pdogg/jt65stego`

[17]Steganography in Commonly Used HF Protocols, Drapeau and Dukes, Defcon 22

[18]`unzip pocorgtfo08.pdf jt65.pdf`

[19]`unzip pocorgtfo08.pdf psk31.pdf`

character set features many of the familiar ASCII characters, but they are rearranged so that the most common characters require the fewest bits. For example, the letter `e` is encoded as `11`, using two bits instead of the eight (or seven) that it would consume in ASCII. Lowercase letters are generally shorter than upper case letters, with uncommon control characters taking the most bits.

A partial Varicode alphabet is shown in Figure 2. Additionally, an idle of at least two `0` bits is required between Varicode characters. No character begins or ends with a `0`, and for clock recovery reasons, there will never be a string of more than six `1` bits in a row.

4.3.2 Encoding

To encode a message, letters are converted to bits through the Varicode table, delimited by `00` to keep them distinct. As PSK31 is designed for live use by a human operator in real time, any number of zeroes may be appended. That is, "e e" can be rendered to `110010011`, `110000010011`, or `1100100011`; there is no difference in meaning, only transmission time.

PSK31 encodes the bit `1` as a continuous carrier and the bit `0` as a carrier phase reversal. So the sequence `11111111` is a boring old carrier wave, no different from holding a Morse key for a quarter-second, while `00000000` is a carrier that inverts its phase every 31.25 ms.
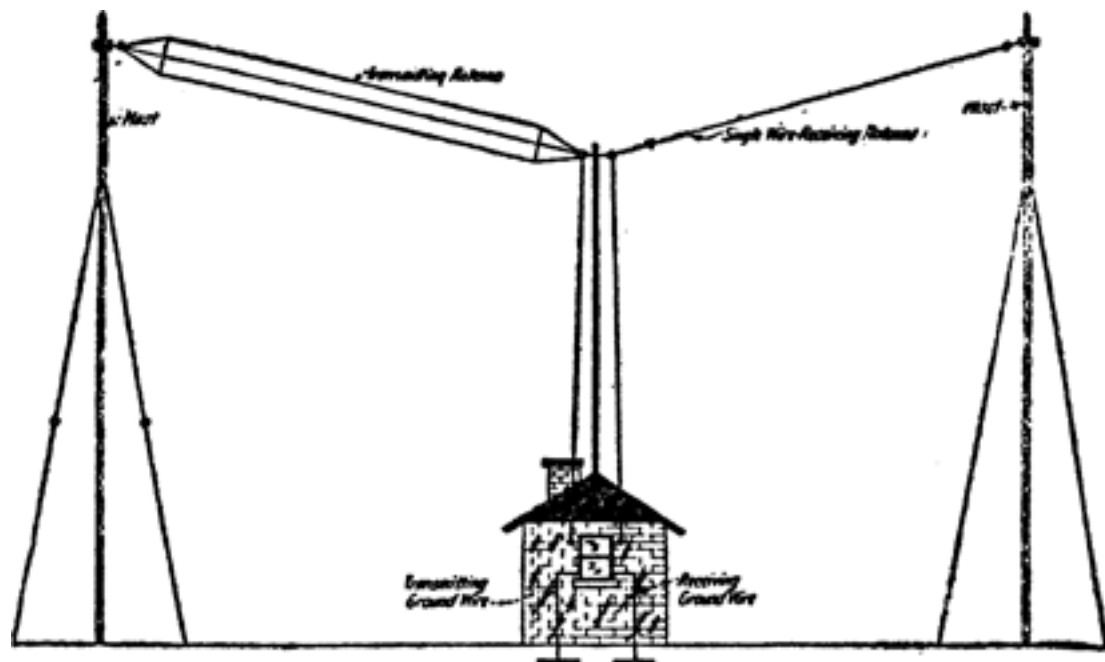
So what's a phase reversal? It just means that what used be the peak of the wave is now a trough, and what used to be the trough is now a peak.

4.3.3 Decoding

As described in Martinez' PSK31 article, a receiver first uses a narrow bandpass filter to select just one PSK31 signal.

It then multiplies that signal with a time-delayed version of itself to extract the bits. The output will be negative when the signal reverses polarity, and positive when it does not.

Once the bits are in hand, the receiver splits them into Varicode characters. A character begins as the first `1` after at least two zeroes, and a character ends as the last `1` before two or more zeroes. After the characters are split apart, they are parsed by a lookup table to produce ASCII.

4.4 PSK31 Stego

4.4.1 Extending the Varicode Character Set

G3PLX's original article contains a second part, in which he notes that his original protocol provides no support for extended characters, such as the British symbol for pounds sterling, £. Wishing to add such characters, but not to break compatibility, he noted that the longest legal Varicode character was ten

Figure 1: PSKReporter, a Service for Monitoring PSK31

bits long. Anything longer was ignored by the receiver as a damaged and unrecoverable character, so PSK31 uses those long sequences for extended characters.

Reviewing the source code of a few PSK31 decoders, we find that Varicode still has not defined anything with more than twelve bits. By prefixing the character Alice truly intends to send with a pattern such as `101101011011`, she can hide special characters within her message. To decode the hidden message, Bob will simply cut that sequence from any abnormally long character.

4.4.2 Hiding in Idle Lengths

PSK31 requires *at least* two `0` bits between characters, but it doesn't specify an exact limit. It's

not terribly uncommon to see forgotten transmitters spewing limitless streams of zeroes into the ether as their operators sit idle, never typing a character that would result in a zero. Alice can abuse this to hide extra information by encoding data in the variable gap between characters.

For an example, Alice might place the minimal pair of zero bits (`00`) between characters to indicate a zero while a triplet (`000`) indicates a one.

4.4.3 Extending the Symbol Set

In its classic incarnation, PSK31 uses Binary Phase Shift Keying (BPSK), which means that the phase flips 180 degrees. This is sometimes called BPSK31, to distinguish it from a later variant, QPSK31, which uses Quadrature Phase Shift Keying (QPSK).
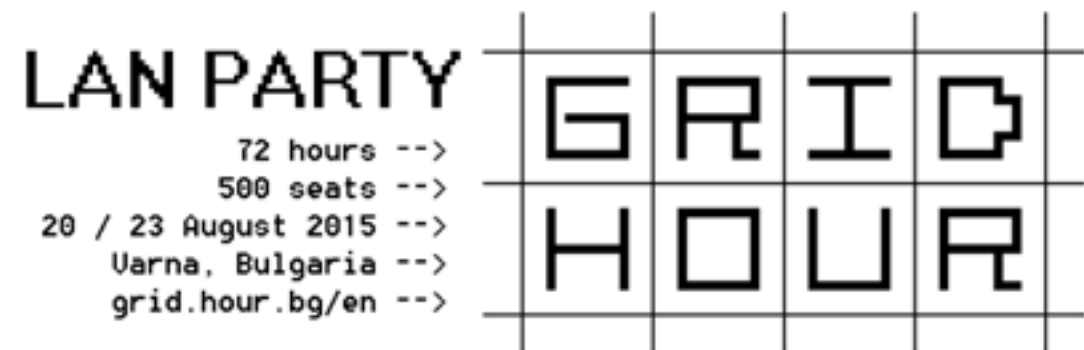
11101	LF		1011	a		1111101	A
11111	CR		1011111	b		11101011	B
1	SP		101111	c		10101101	C
10110111	0		101101	d		10110101	D
10111101	1		11	e		1110111	E
11101101	2		111101	f		11011011	F
11111111	3		1011011	g		11111101	G
101110111	4		101011	h		101010101	H
101011011	5		1101	i		1111111	I
101101011	6		111101011	j		111111101	J
110101101	7		10111111	k		101111101	K
110101011	8		11011	l		11010111	L
110110111	9		111011	m		10111011	M
			1111	n		11011101	N
			111	o		10101011	O
			111111	p		11010101	P
			110111111	q		111011101	Q
			10101	r		10101111	R
			10111	s		1101111	S
			101	t		1101101	T
			110111	u		101010111	U
			1111011	v		110110101	V
			1101011	w		101011101	W
			11011111	x		101110101	X
			1011101	y		101111011	Y
			111010101	z		1010101101	Z

Figure 2: Partial PSK31 Varicode Alphabet

QPSK performs phase changes in multiples of 90 degrees, providing G3PLX extra symbol space to perform error correction.

Alice can use the same trick to form a polyglot with BPSK31, but this presents a number of signal processing challenges. Simply using the 90-degree shifts of QPSK31 would be a bit of an indiscretion, as BPSK interpreters would have wildly varying interpretations of the message, often decoding the hidden bits to visible junk characters.

Using a terribly small shift is a tempting idea, as Alice's use of balanced 170 and 190 degree transitions might be rounded out to 180 degrees by the receiver. Unfortunately, this would require *extremely* stable and well tuned radio equipment, giving Bob as much trouble receiving the signal as Eve is supposed to have!

Instead of adding additional phases to BPSK31, we propose instead that the error correction of QPSK31 be abused to encode additional bits. Alice can encode data by *intentionally inserting errors* in a QPSK31 bitstream, relying upon Eve's receiver to remove them by error correction. Bob's receiver, by contrast, would know that the error bits are where the data really is.

4.5 Classic RTTY (ITA2)

RTTY—pronounced "Ritty"—is a radio extension of military teletypewriters that has been in use since the early thirties. It consists of five-bit letters, using shifts to implement uppercase letters and foreign alphabets. Although implementation details vary, most amateur stations use 45 baud, 170Hz shift, 1 start bit, 2 stop bits, and 5 character bits. The higher frequency is a mark (one), while the lower frequency is a space (zero).

As more digital protocols other than CW and RTTY weren't legalized until the eighties, all sorts of clever tricks were thought up. Figure 4 shows RTTY artwork from W2PSU's article in the September 1977 issue of 73 Magazine. Lacking computerized storage and cheap audio cassettes, it was the style at the time to store long stretches of paper tape as rolls in pie tins, with taped labels on the sides.

Figure 6 describes Western Union's ITA2 alphabet used by RTTY, which is often—if imprecisely—called Baudot Code. In that figure, 1 indicates a high-frequency mark while 2 indicates a low-frequency space. Note that these letters are sent almost like a UART, least-significant-bit first with one start bit and two stop bits.

4.6 Some Ditties in RTTY

4.6.1 Differing Diddles

Unlike a traditional UART, RTTY sends an idle character—colloquially known as a Diddle—of five marks when no data is available. This is done to prevent the receiver from becoming desynchronized, but it isn't strictly mandatory. By not sending the diddle character (11111) when idle, the mark bit's frequency can be left idle for a bit, encoding extra information.

Additionally, there are not one but *two* possible diddle characters! Traditionally the idle is filled with 11111, which means Shift to Letters, so the transmitter is just repeatedly telling the receiver that the next character will be a letter. You could also send 11011, which means Shift to Figures. Sending it repeatedly also has no effect, and jumping between these two diddle characters will give you a side-channel for communication which won't appear in normal RTTY receivers. As an added benefit, it is visually less conspicuous than causing the right channel of your RTTY broadcast to briefly disap-

BPSK	10101101	00	111011101	000	1	00	10101101	000	111011101	00	1	00
PSK31	C		Q		[SP]		C		Q		[SP]	
Idle		0		1		0		1		0		

BPSK	101101	00	11	000	1	00	1111101	000	10111101	00	1111111	00
PSK31	d		e		[SP]		A		1		I	
Idle		0		1		0		1		0		0

BPSK	10101101	00	1110111	0	0	0	0	0	0	0	0	0
PSK31	C		E									
Idle		0										

Figure 3: 010100101000 Hidden in PSK31 Idle Bits

	Letter	Figure		Letter	Figure
00000	Null	Null	11010	G	&
00100	Space	Space	10100	H	#
10111	Q	1	01011	J	'
10011	W	2	01111	K	(
00001	E	3	10010	L	)
01010	R	4	10001	Z	"
10000	T	5	11101	X	/
10101	Y	6	01110	C	:
00111	U	7	11110	V	;
00110	I	8	11001	B	?
11000	O	9	01100	N	,
10110	P	0	11100	M	.
00011	A	−	01000	CR	CR
00101	S	Bell	00010	LF	LF
01001	D	WRU?	11011	FIGS	
01101	F	!	11111		LTRS

Figure 6: RTTY's ITA2 Alphabet
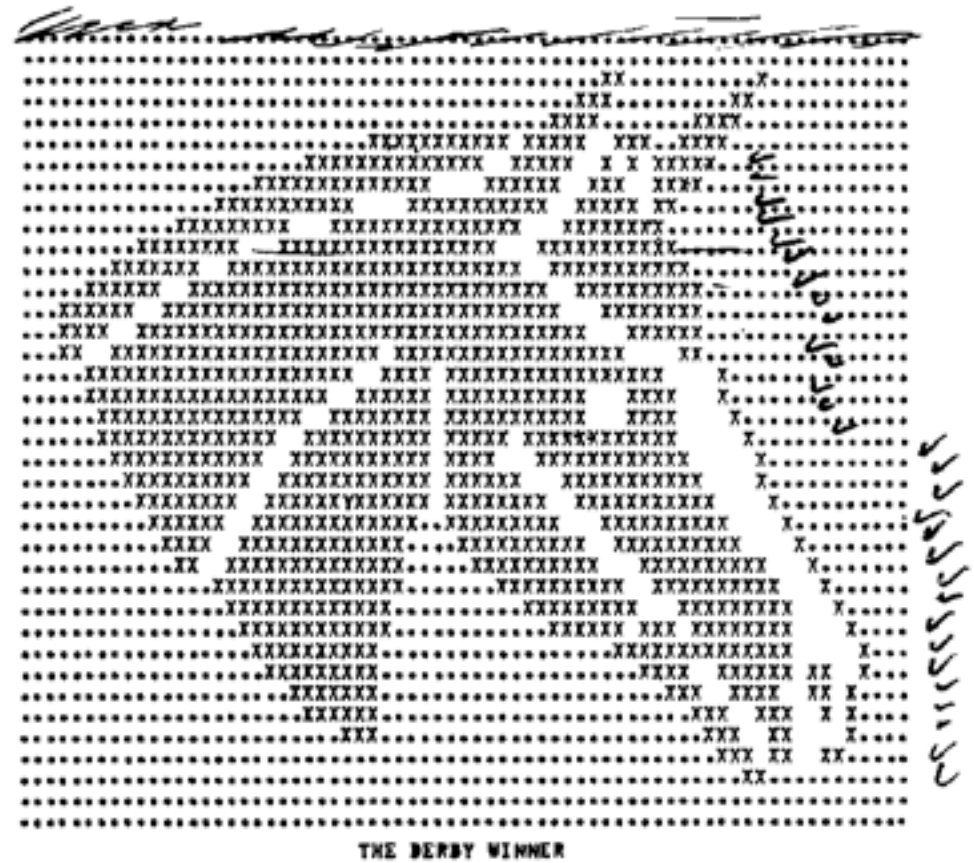
Figure 4: RTTY Art of Seattle Slew from the mid 1970's

Figure 5: Weather Fax

pear!

4.6.2 Stop with the Stop Bits!

RTTY is described in the old UART tradition as 5/N/2, meaning that it has 5 data bits, No parity bits, and 2 stop bits. There's a cool trick to UARTs that's worth remembering: the transmitter can always have *more* stop bits than the receiver demands, and the receiver can always demand *fewer* stop bits than the transmitter sends.

4.7 Toe Tappin' CW

Carrier Wave (CW) modulation—better known as Morse code—was the first widely deployed digital mode to replace spark-gap transmitters. Designed for a human operator to manually use, CW is a perfect choice for easy polyglots.

As a quick review, CW consists of dots and dashes. A dash is three times as long as a dot. The off-time between elements of a letter is as long as a dot, and the off-time between letters in a word is as long as a dash. The off-time between words is seven times as long as a dot, or a bit more than twice as long as a dash.

4.7.1 QRSS

While other protocols have standard data rates, Morse relies on the recipient to adjust to the rate of the transmitter. Operators often find themselves unable to keep up with an expert or impatiently waiting on a station that transmits slowly, so shorthand was developed to ask the other side to change rate. QRQ requests that the other side transmit more quickly, and QRS requests that the other side slow down.

QRSS is a variant of CW in which the message is sent very, *very* slowly. Rather than a dot lasting a fraction of a second, it might last as long as a minute! A receiver can then take a recording of a very weak signal, slow down the recording, and visually observe the signal to determine its meaning.

While protocols such as RTTY and PSK31 don't take kindly to the sorts of frequent interruptions that normal CW would impart, these protocols can easily produce QRSS transmissions that are legible by slowing down recordings. For example, Alice might send "A1BOB A1BOB de A1ICE" for a dot and "A1BOB A1BOB de A1ICE. A1BOB A1BOB de A1ICE. A1BOB A1BOB de A1ICE." for a dash.

This is of course a bit easy to recognize from a waterfall, but it might be a fun way to meet your neighbors!

4.7.2 From Ethernet to Æther with Madeline

In a row house in Philly
      that was covered with vines
Was an Ethernet network
      in four twisted lines
In four twisted lines
      they ran to the laundry
And to the satellite dish
      and to the pantry
The twists ended too soon
      and ceased to align
Interfering with 10 meters
      all down the line
The protocol
      was Madeline.

It's clear enough that you could transmit Morse code through Wifi by sending bursts of traffic, but what about wired Ethernet?

Some folks are very particular when wiring CAT5e cable, ensuring that the twisted pairs are untwisted at the last possible position before the connector. Other folks—such as your neighborly authors—are far less particular in their wiring, and when the wiring is performed poorly, interference is observed near 28.121 MHz!

Still better, the interference varies with traffic! When the network is idle, the interference appears as a nice thin carrier wave. When the network is busy, the interference grows to be nearly four hundred Hertz wide.

The following is a letter of Morse code transmitted from (poorly) wired Ethernet to the 10-meter band through what we are calling the Madeline protocol. This transmission isn't strong enough to carry very far, but the Baudline-generated waterfall in that figure was recorded from outside of a real house, with a signal generated by a real Ethernet network. The recording was made by an Upper SideBand receiver tuned to 28.120 MHz.[20] The narrow-band signal at 28.121 MHz becomes wide whenever lots of traffic goes across the wired network; in this case, from activity on a VNC session.

---

[20]unzip pocorgtfo08.pdf madelinek.wav

Dah

Di

Dah

4.8 Patching FLDigi

All of this high-falutin' theorizin' don't do a lick of good without some software to back it up. Supposing that Alice is a modern unix programmer, but that Bob hasn't written code for anything more modern than a Commodore 64, Alice will need to provide him with a GUI application that easily interfaces with his radio.

The most direct route for this is to patch FLDigi, a popular open source application for digital communication over ham radio with a live operator. Internally, FLDigi implements softmodems for CW, PSK31, RTTY, WEFAX, and several other protocols.

4.9 Part 97; or, Don't be a Jerk!

Be aware that in general, it's both illegal and immoral to be a jerk on the amateur bands. Interference is forbidden in amateur radio, not because jamming research is bad, but because it's rude to stomp on someone else's transmission. Cryptography is forbidden in amateur radio, not because of any evil conspiracy to destroy privacy, but because cryptography makes a transmission opaque, preventing newcomers from joining the conversation.

So for those of you who do not live in Nehemiah Scudder's oppressive theocracy, please be so kind as to keep your polyglot messages unencrypted. Make a fox hunt of sorts out of your protocol experimentation, with the surface PSK31 message advertising your callsign along with the name and parameters of your real protocol.

  — — —   — — —   — — — —

We hope that this article has taught you a little about radio and signal processing. Get an amateur license, build a station, and start experimenting with new protocols on the friendly airwaves.

73's from Appalachia,
—Travis and Muur

Amateur Radio at DEFCON 23

by Michelle W5NYV

DEFCON 23 was held August 6-9 in Paris and Bally's hotels in Las Vegas, Nevada. This four-day event is a seething mass of information overload, activities, talks, contests, villages, workshops, vendors, demonstrations, proofs of concept, parties, pranks, music, and networking. An estimated 20,000 people attended DEFCON 23.

To kick off the event at 10am Thursday August 6th, a track of talks called DEFCON 101 was presented. One of these was "Introduction to SDR and the Wireless Village". Presented by DaKahuna and satanklawz, two hams "keeping it legal", the talk introduced the current crop of commonly encountered SDRs with an emphasis on how not to fail in efforts to get one on the air. Speaking to an audience that they had to assume might have limited RF experience, they underlined the importance of having an appropriate antenna.

"Success depends on antennas and filters. Do not transmit with mismatched antenna system. You will cry," explained DaKahuna. Satanklawz nodded sagely. Other good advice included picking he right tool for the job. To illustrate, the pair discussed BladeRF, HackRF, USRP, and RTL-SDR, comparing and contrasting the capabilities and strengths of each type of SDR.

Satellite, EME, packet, RTTY, IRLP, Morse code, and how all these ham activities apply directly to expanding a security researcher's signal intelligence capabilities were discussed in a conversational and accessible style.

"Software LIES to you. There are harmonics!" satanklawz thundered from the podium. He counseled the full-to-capacity crowd to "know your antenna" and learn propagation for the frequencies of interest, warning that signals can experience diffraction, reflection, refraction, and multipath. All of this was old hat for some hams in the audience, but the DEFCON crowd has many brand-now "I have my license, now what?" hams as well as people who have never heard of ham radio or signal intelligence before.

The pair recommended gqrx and SDR# for browsing spectrum on SDRs. They recommended GnuRadio as a decoding platform. Baudline was mentioned as a non-GPL albeit quirky package that deserved a look.

They warned about SDR lab problems like antennas, lightning, static, noise, clocks and drift. They explained that connectors were sometimes "super sucky", and to be aware that different cables behaved very differently at different frequencies. They warned that the cheaper SDRs don't have ESD protection, and that a reading of Naval RFI Handbook would be highly educational. They shared stories of battling the unintended consequences of unshielded power receptacles, galvanic corrosion, frequency drift due to heating, and noisy clocks.

They then discussed another aspect of DEFCON where amateur radio loomed large – the Wireless Village. Villages at DEFCON are theme camps where specific activities, lecture series, workshops, contests, hands-on training, and interactive exhibits can be found.

Set aside in their own spaces, Villages provide a specific subject matter experience. Wireless Village was, as you might have guessed, focused on wireless technologies. Other Villages included Crypto & Privacy, Hardware Hacking, Lockpick, Packet Hacking, Tamper Evident, Car Hacking, Bio Hacking, Social Engineering, Data, ICS, and Internet of Things. Some of these villages hosted their own contests.

Tamper Evident village has a contest where you take apart tamper evident packaging. The challenge is to open a series of packages that are each inside the other, from a large box sealed with tamper evident tape down to a small tamper evident envelope. The final envelope contains some sort of evidence that proves you've reached the most interior package. Then, you have to put them all back together without revealing that they've been opened. If you have a Uline catalog, pretty much every product in the tamper evident section is represented. The winners are the ones where the evaluation team cannot tell the packages have been opened.

Wireless Village hosted its own lecture series, had all sorts of SDRs available for experimentation, held a wireless capture the flag contest, and also supported the DEFCON amateur radio exam session. For DEFCON 23, the exam session was open all day long on Saturday. Exams were available as a reservation or one could walk in. Results are summarized
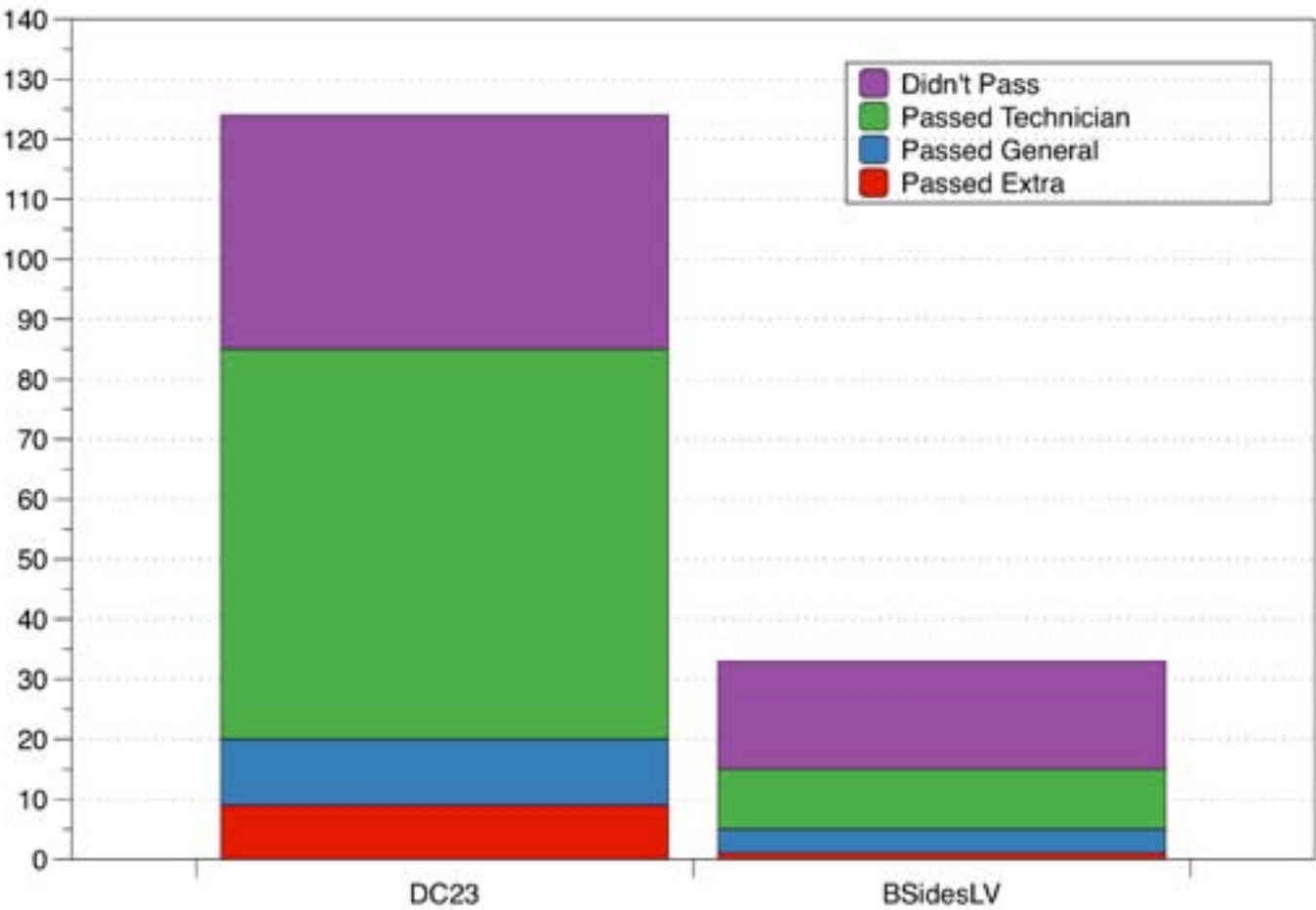
in the chart. For comparison, the ham radio exams from BSides Las Vegas are also included. BSides is a series of hacker conferences that draw a very similar crowd to DEFCON. They are usually much smaller. It's very exciting to see so much licensing activity within the technical communities of DEFCON and BSides.

All three of my children attempted the amateur radio exam during the DEFCON test session. My son, KK6OOZ, attempted to upgrade to a General license. My two daughters went for their Technician. Unfortunately, none of them passed this time around, but their interest was certainly revitalized and the spark has only grown since our 5 days in Vegas. My son attended the SDR 101 talk and greatly enjoyed it. My son and I attended the all-day Raspberry Pi Workshop on Saturday, where we had an incredibly good time learning the Raspberry Pi ropes.

Here's the biographies of the presenters for the SDR and Wireless Village talk.

By day DaKahuna works for a small defense contractor as a consultant to large government agencies providing critical reviews of customer organizations compliance with Federal Information Systems Information Security Act (FISMA) requirements, effectiveness of their implementation of National Institute for Science and Technology (NIST) Special Publication requirements, cyber security policies, cyber security program plans, and governmental standards and guidance. By night he enjoys roaming the airwaves, be it the amateur radio bands or wireless networks. He is a father of two, grandfather to three, 24 year Navy veteran communicator, holder of an amateur radio Extra Class license and a staunch supporter and exerciser of his 2nd Amendment rights who enjoys shooting targets out to 1200 yards.

Satanklawz has been in the information security realm for 15 years. He built and sold a wireless ISP, worked info sec in the financial services industry and now is a public servant of sorts. His hobbies and interests have always involved radio in some sort of fashion. When he has spare time, he is completing his PhD, teaches, create mischief, and is working on his dad jokes.

Amateur Radio at Burning Man - SDR

RTL-SDR at Burning Man
Spying on Planes!

By Michelle W5NYV

After learning about RTL-SDR at the "Introduction to SDR and the Wireless Village" talk given at DEFCON 23, I bought one in the DEFCON vendor area. It was $20 and included a small whip antenna. The size of a pack of gum, it could easily fit in a pocket. I decided to take it to Burning Man and track airplanes.

At DEFCON 22, I'd learned about ADS-B. Automatic Dependent Surveillance Broadcast or ADS-B is the latest advance in airspace surveillance. ADS-B uses a Trig transponder, typically combined with a GPS, to transmit position of the aircraft to both ground controllers and also directly to other aircraft. Essentially, ADS-B replaces radar. It has several advantages over radar, including working over "non-radar" areas, allowing more aircraft to operate in a given airspace and enabling direct routing. There is some evidence that it has improved flight safety in the US.

However, since ADS-B can be turned on or off, a plane could theoretically hide from the public. Without radar, an uncooperative plane would seem to be a big problem.

In time ADS-B is expected to supersede existing surface-based radar systems. Radar is expensive and has some limitations that ADS-B gets around, such as geographical limitations, false returns, and delays. ADS-B is much cheaper than a radar installation.

According to Trig Avionics, an ADS-B systems supplier, "ADS-B surveillance technology that does not rely upon ground controllers was first trialled in Alaska. This region was selected as an early proving ground for ADS-B and associated FAA 'Next Gen' technologies. This was due to the significant commercial aviation accident rate suffered in this harsh operating environment. Aircraft were fitted with ADS-B, GPS moving maps and improved communications to enhance safety. In South West Alaska ADS-B (combined with these other initiatives) helped to reduce fatal accidents by 47%."

Phil Karn and Franklin Antonio had both set up ADS-B monitoring systems at home using Raspberry Pis. I decided to set up the RTL-SDR at burning man for ADS-B. To make the challenge a bit harder, I only downloaded GnuRadio and gqrx on the macbook before leaving. I didn't look up or read anything about ADS-B. I'd figure it out on the relatively remote dry lakebed home to Black Rock City.

This self-imposed limit proved to be a somewhat silly idea. I rapidly figured out how to connect the RTL-SDR to the macbook and successfully received BMIR, Burning Man Information Radio, on 94.5 FM. I then successfully demodulated APRS from the other Burner hams that were puttering around the city. I then hunted down FRS communications between camps and volunteers. All were accomplished using gqrx out of the box. However, I didn't have a demodulator for ADS-B. I needed yet more software. It turned out the right tool for the job was a package on github called dump1090 (https://github.com/antirez/dump1090).

Normally, there is no data service on the playa. However, this year, the very thinnest connection over cellular could be had if you were patient and opportunistic. Using the command line on the macbook, I tried over and over until, during a moment of connectivity, I was able to grab the repository and clone it on the computer.

I then followed the simple instructions to build dump1090. I ran it in interactive mode, and there they were. Airplanes! The 1090 stands for the frequency used by ADS-B, which is (as you've probably guessed) 1090MHz.

I could see both low-altitude local traffic coming in and out of Burning Man's airport, as well as commercial aircraft that were much higher in altitude. I took the laptop, SDR, and antenna outside and put the antenna on the hood of the truck. The mag-mount whip's antenna performance dramatically improved. I took a screenshot and declared victory.

I greatly enjoyed watching the aircraft come and go over the next few days. Although I didn't have enough of a connection to Google maps to do this, a feature of the dump1090 is that it will draw the planes on the map for you, with their headings and tracks noted.

This experience should illustrate one of the great advantages of SDRs. With one tiny $20 radio and a small whip antenna, I was able to receive a commercial broadcast station, decode APRS packets from my fellow hams, search for and find FRS communications, and spy on aircraft skulking around Burning Man, all in the space of about an hour. With a wide variety of other software packages, or with software I write myself, the RTL-SDR can do an enormous additional amount of receiving. Reconfiguring a radio on the fly is a remarkable and thrilling capability to have!
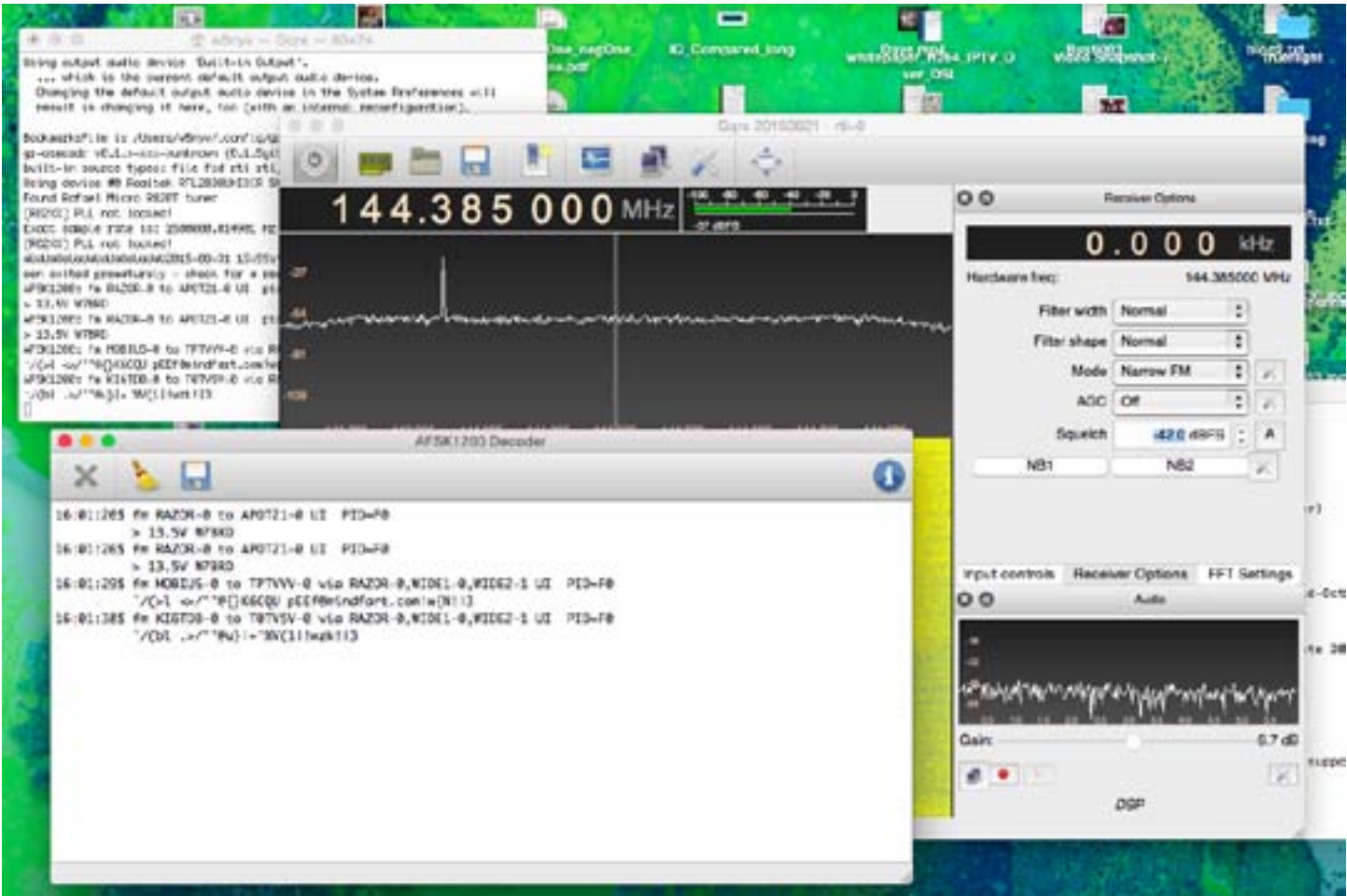
Above, gqrx decodes APRS from Burning Man stations. Below, a screenshot of dump1090 interactive mode, and the station itself set up on the hood of the truck. The SDR is in the USB port on the righthand side of the laptop.
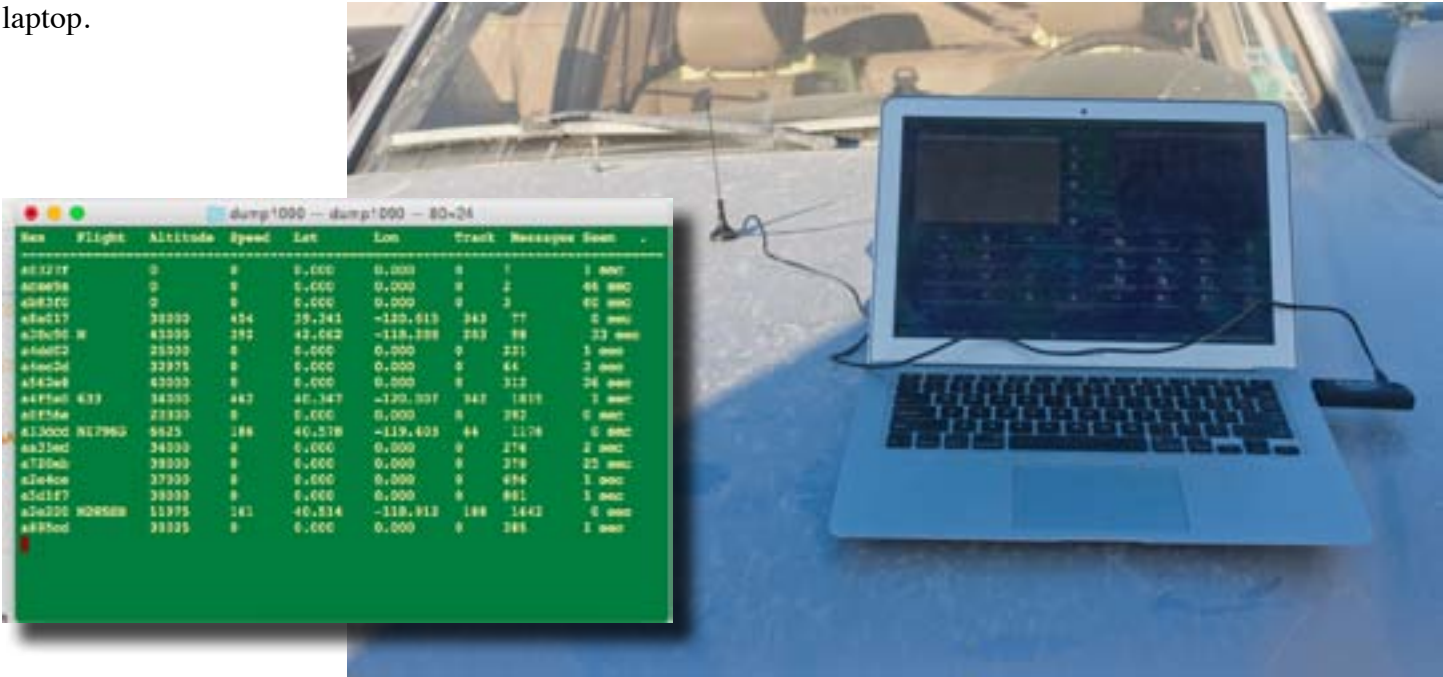
Source vs. Process

There are many ways to structure and define collaborative work. If you work on projects with other people, where does yours fall in the chart below?

Open source projects currently get a lot of press. Usually, open source means that the source code or schematics are freely published, instead of being held secret. However, the work product itself isn't the whole story. The process of creating the work can be either open or closed or somewhere in between. Looking at both dimensions, the work product along with the work process, provides a more complex view of the charactistics of a project.

If you're drawn to open source projects, it's worth digging deeper into how things are structured in order to avoid any communications problems along the way.

While many amateur radio projects are open source, some are not (e.g. Winlink). Some are open source, but closed process (e.g. some AMSAT projects). The reaons for this vary, but a thumbnail sketch of possible mindsets for each quadrant is summarized below.

Text and graphic by Michelle W5NYV.
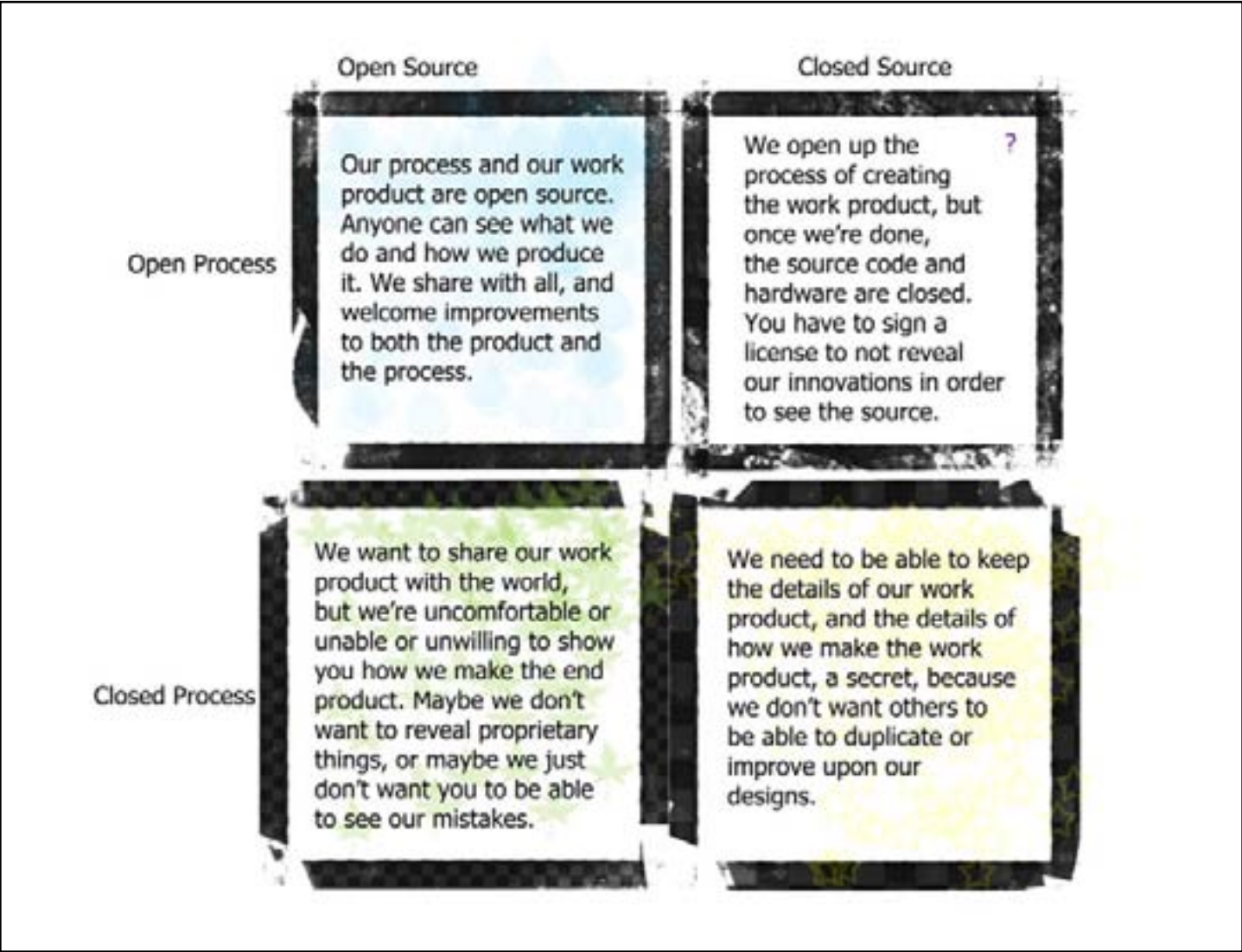
Arduino + Wifi = Particle Development Board

Arduino, Raspberry Pi, and other development boards have taken the amateur radio world by storm. Being able to experiment with small microcontrollers has never been easier.

Another entrant into the world of embedded development kits is Particle. Particle recently introduced the Photon.

The Photon is an Arduino plus Wifi. The video above shows what's inside the Photon development kit. Notice that the processor is already installed on a breadboard, and that a paper label shows exactly where to place components for the first experiment. Learning the basics is easy and fun.

The Electron, also by Particle, is an Arduino plus cellular. Remote sensing is the intended market.

August - September 2015 Work Party Reports

On 13 September 2015, a work party was held at the PARC repeater site. Dennis KD6TUJ and Richard KJ6WUY worked on the exteriors of some of the buildings in order to apply a layer of green paint over the brilliant green primer paint previously applied.

John Kuivinen WB6IQS and Mark Raptis KF6WTN repaired two aspects of the 146.700 Packet Repeater.

John, WB6IQS Reports:

Report on 146.700 activities:
Update, Sept. 7, 2015

Rich, NI6H and John, WB6IQS

Rich, Mark Raptis and I have been fighting an intermittent problem for some months and finally I believe that we have nailed it.

After repairing a bad antenna connection last week (See Bigfoot on the Mountain page 26) another old problem again reappeared. Today when we first got to the mountain the PTT (Push to Talk) test button was not working on the Station Control Module but after wiggling it in the socket it began to work. This behavior has been an on-going problem for some months. The card was seated in the card cage, but never felt really "tight" and as secure as the other cards had been. I was unable to push it any further into the socket without fear of breaking something.
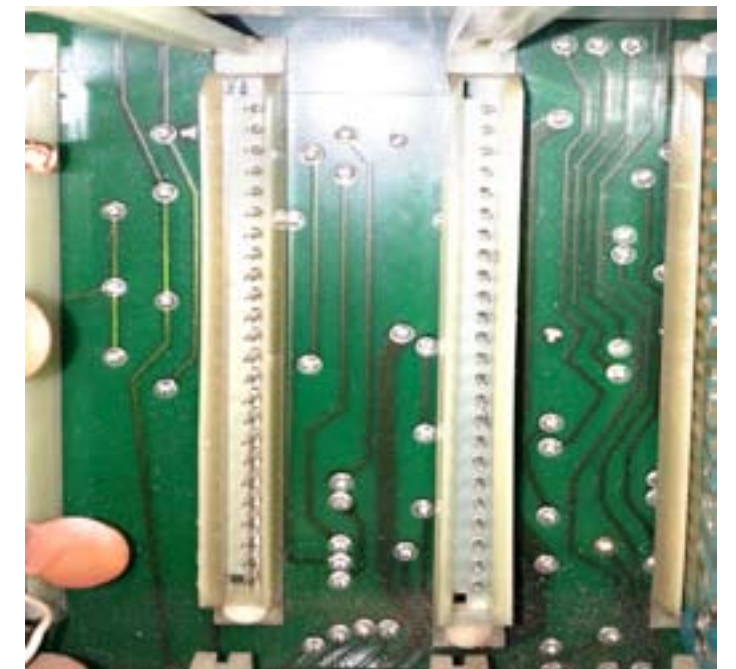
On close visual inspection from the front of the motherboard the problem became apparent. A 24 socket vertical plastic pin guide rail was at a cockeyed angle and prohibiting the card from becoming fully seated.

I needed new plastic hardware snap locks to reseat the pin guide but none were immediately available. Removing other cards in the rack allowed me to hold the pin guide in place when seating the board fully into the rack. I then replaced all the other cards to finish the repair.

Hopefully this is the last nail in the coffin of this on-going problem. When installing PCBs in older equipment you never want to just force something into place, your equipment may not survive the efforts.

Top pins are extended about 0.375" out from the plastic guide rail, the bottom pin are only extend about 0.125".

This 40 year old nylon hardware is very brittle and the snap lock pins are not reliable holders of the pin guide rails. I am going to try to find some replacement motherboard snaps at Frys or through the Internet.

John Kuivinen, Vista, CA
WB6IQS
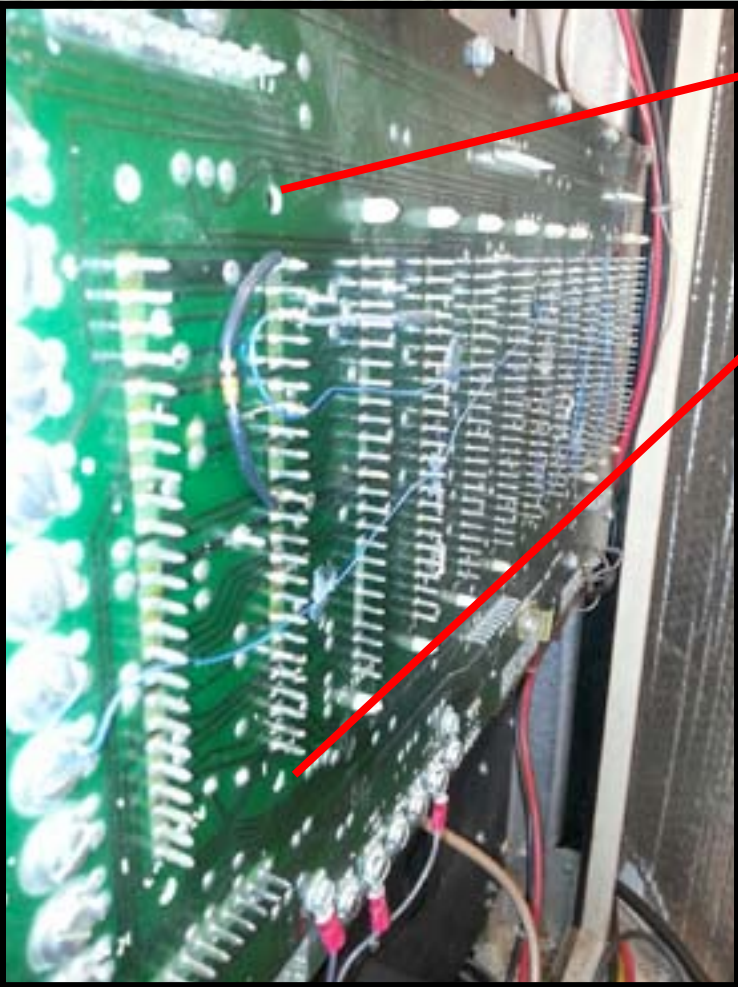
Broken snap pins that held the pin guide rail (see below for guide rail photo) in place. This allowed the pin guide rail to go out of position.

Here's what a pin guide rail looks like.

When last we left, Mr. Tor had escaped, but Ms. Ohm was still trapped. Her prison seems to be getting less and less comfortable. Who or what could possibly be behind this nefarious game?

Rear Door Cover: An example of the many years of modifications and "improvements" that were required to allow cables and control wiring to enter the cabinet.

The bottom vents were once similar to the upper right vent. They have been replaced with metal screening using pop rivets.

Sediment in the battery bank. Mark KF6WTN is designing a charge equalizer to head off this problem and extend the life of the battery bank.

"Ms Ohm! I found something that might work! An old cabinet cover!"
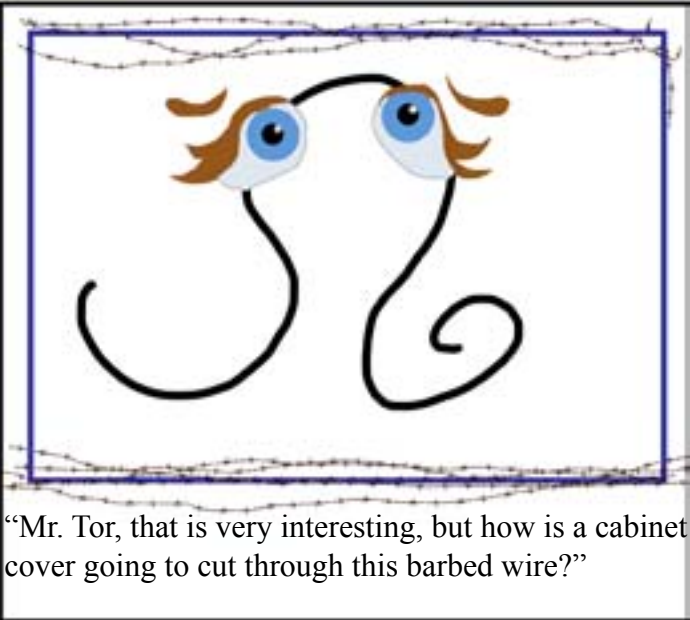
"Mr. Tor, that is very interesting, but how is a cabinet cover going to cut through this barbed wire?"
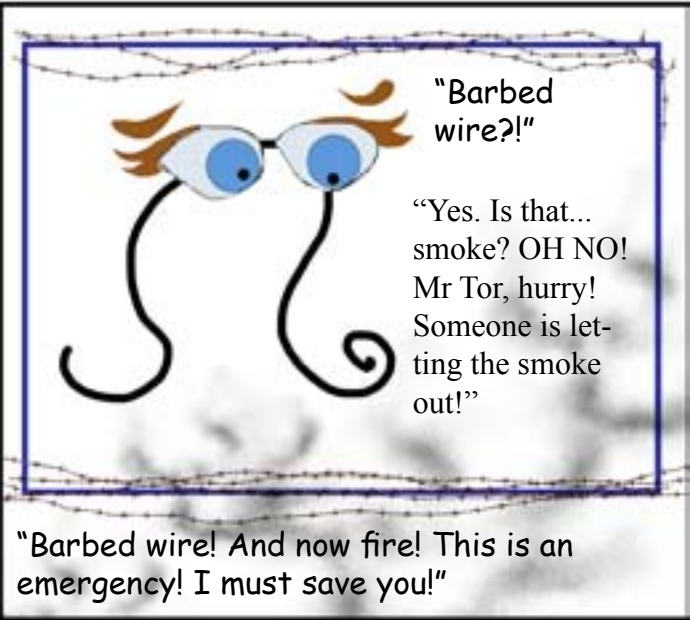
"Barbed wire?!"

"Yes. Is that... smoke? OH NO! Mr Tor, hurry! Someone is letting the smoke out!"

"Barbed wire! And now fire! This is an emergency! I must save you!"

Bigfoot Loose on the Mountain
Repeater Repair 101

John WB6IQS, August 29, 2015

On August 8 at 11 AM (keep that date / time in mind) it was later reported that the 146.700/.100 digital packet repeater was inoperative. However, no one was immediately available to do a work party at the repeater site.   Rich, NI6H and I planned on going up early last week but after a number of discussions about what was required Mark Raptis, KF6WTN and I went up today.

Repair Procedures:
Arrived at the site about 11 AM:

First thing was to check the 54 VDC primary input voltages, OK.   We then checked the output 13.8 VDC power supply voltages, OK.   Dragged out the RF service instruments and warmed them up.   Receiver input OK, transmitter power output into the cavities OK. FM deviation on the transmitter checks OK. Hmmmmm?

Checked VSWR before the cavities, shows OK but this is not a true indication since the isolation cavities can mask an antenna problem. We have RF circulators on the repeater's output. A circulator is kind of magnetic diode to RF where RF power can go out but if you have a high VSWR or other repeaters in the area then RF is not returned back to the transmitter. This prevents spurious emissions and cross modulation from the other solid state repeater transmitters at the site.   If circulators were not present we would have more "birdies" and mixing products due to the high level of RF (both from our tower and other towers in the area) at the site. Comment: Tube repeaters were not typically subject to this problem, but transmitting tube repeaters went out of style years ago.

We next checked the antenna's VSWR after the cavities.   The output power is almost 100% being reflected back into the cavities.   This is about a 20:1 VSWR. A 1:1 VSWR is optimal (zero power returned) and less than 1.5:1 is required for proper cavity operation.   I was hoping for less than ¼ - ½ Watt reflected output.   This is a no-go situation.

We then checked the lightning arrestor on the grounded skin of the building.   All looks OK. It was reported that lightning was common during the last few weeks with the summer storms, but that is not the problem.

Then checked the ½" hard-line output cable from the lightning arrestor, hmmmmm – the center pin of the coaxial cable is recessed about 3/8" back from the front ring of the type N connector. It should be nearly flush with the center ring.   The center pin of the coaxial cable was not connected at all to the lightning arrestor so the electrical connection was open to the antenna.

Evidently "Big Foot" was loose on the mountain during the last work party.   With Big Foot walking around, the cable was stepped on and the N connector was pulled back as the refrigerator building was being painted.

We rebuilt the RF connector and re-tightened the locking ring. The VSWR is now measured at less than 1.05:1 (nearly perfect). Next we did some over the air tests with Rich, NI6H from his mobile packet radio station.   All checked out OK.

Black nylon tie wraps finished the site clean up. The cables are tied up tightly so that it is obvious that this is a "DO NOT STEP" area.   I will investigate making some short (6') waterproof jumper cables with male / female N fittings so that the RF cables will to lie properly on the ground.   With good service loops and weatherproof sticky heat shrink tubing this problem will (should?) not happen again.

Closed up all the buildings, locked and double checked.   Left the site about 2 PM.

John Kuivinen, WB6IQS
Vista, CA.

Mark KF6WTN maintains the locks to keep them in good working order for future work parties. Foreground, John WB6IQS prepares to share his Moscow Coup photo album. What a great story!

Mark KF6WTN shows the safety signage for the tower.

Mark KF6WTN puts up the safety signs.

Mark prepares to descend into the sunken building for guide rail renovation.

Mark and John organize for the renovation of the guide rails.

Guide rail renovation in progress.

Guide rail replacement parts.

Prepared for almost anything!

Connector renovation explanation.

Small cuts to spread the connector collar.

Marking the collar for cuts.

Collar ready for refitting.

Weatherproofing!

Tightening up renovated connector.

Refitting the renovated connector.

More weatherproofing.

Michelle W5NYV did LNT duty. Four nails, trash, and a section of barbed wire were found in the driveway.

Amateur Radio at Burning Man - 10m Antenna

After the first few days at Burning Man, we had the art projects installed and under control. Our days from there were structured around scheduled music performance gigs, which left periods of time where we'd be free to hang around camp. I had installed an ISOpwr auxiliary battery isolator from West Mountain Radio and brought along a largish deep-cycle battery, to enable free use of the ham radios in the trailer without worrying about drawing down the main batteries. We had a VHF/UHF vertical mounted on a telescoping mast, but nothing for HF. In the past we had brought along a multiband vertical antenna for HF, but found the HF bands useless due to local noise. Lacking an HF antenna, I had no good way to exercise the IC-7000 in the trailer. So, I was inspired to rig up a wire antenna from junk on hand.

Rummaging through the storage bays of the trailer, I found some useful stuff leftover from previous antenna installations. I didn't find the big HF vertical hiding there, but I did find the length of coax and lightweight guy ropes we had used with it. Even better, I found a used SO-239 connector that I could use at the center of a dipole. Sometimes, the junk box provides exactly what you need.

The junk box did not contain any wire, though. It's hard to make a wire antenna without wire. I had one other resource: the bins of stuff I'd brought along for repairing the art project, a MIDI-controlled pipe organ. I knew it contained soldering tools and a bunch of short lengths of hookup wire (salvaged from a scrounged length of 50-pair telephone cable). I was about resigned to soldering together lengths of hookup wire, when I stumbled upon a nice spool of insulated stranded wire I'd forgotten about. Just the thing I needed!

Dipole construction was by the book. I calculated the nominal length for a dipole resonant at 28.500 MHz using the formula we all learned for the license exam. Cut each side to length. One wire soldered to the flange, one wire soldered to the center pin. Getting fancy, I rigged up a short length of wire connected to the flange on the opposite side to serve as a strain relief for the center pin. I didn't have a balun, but then I'm not a big believer in the need for baluns with dipoles, so I wasn't worried. I tied the guy ropes to the ends of the antenna, and looked around for antenna supports. I ended up with the center connector hanging by ty-wraps from the telescoping mast. One guy rope was tied to a camp shade structure, and the other was tied to the makeshift wooden superstructure on the flatbed trailer we'd used to transport another part of the art project. It only had to last a few days, but it needed to be secure enough to withstand the high winds that are common on the playa. It was good enough. It lasted until we needed to use the flatbed trailer again.

This is where I'd like to tell you about all the amazing DX I worked with the junkbox dipole. It's a short story. 10m was dead, dead, dead, with no stations heard at all. With a tuner we could try the antenna on other bands, but only a few signals were audible. Noise levels were high, but not as high as on the vertical. Between band conditions and my compromise antenna, it was going to be tough going.

Worse, the radio was misbehaving. Whenever I tried to tune the antenna, the radio would shut off. The battery wasn't able to supply enough current, so the voltage was dropping below the radio's lower limit. This happened on both the auxiliary battery and the trailer's house battery. Apparently both batteries are at the end of their useful lives, most of which were spent sitting idle. The brownout problem disappeared when we plugged the trailer into a generator. To my surprise, the built-in house battery charger could supply plenty of current to run the transceiver at full power. I wasn't excited about running the noisy generator to get on the air, though, so that put an end to the HF experiment for this trip.
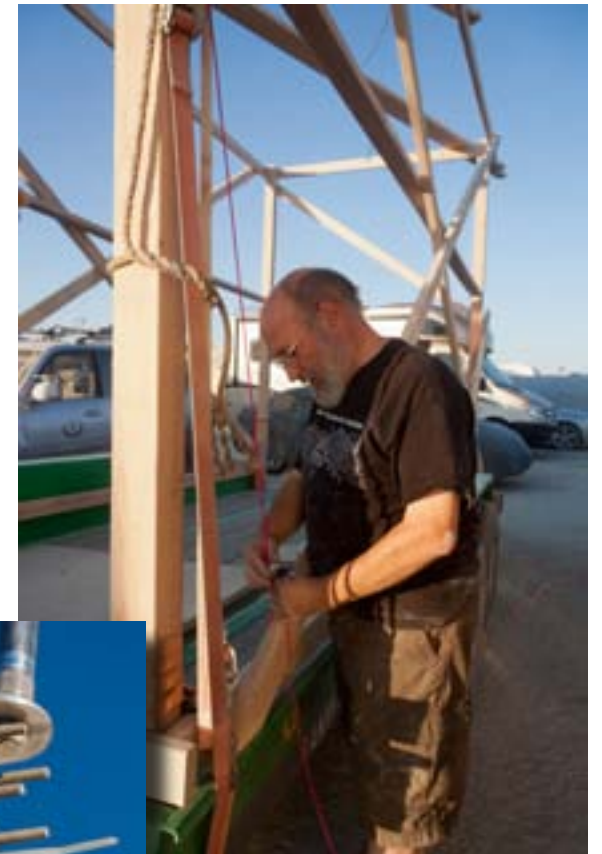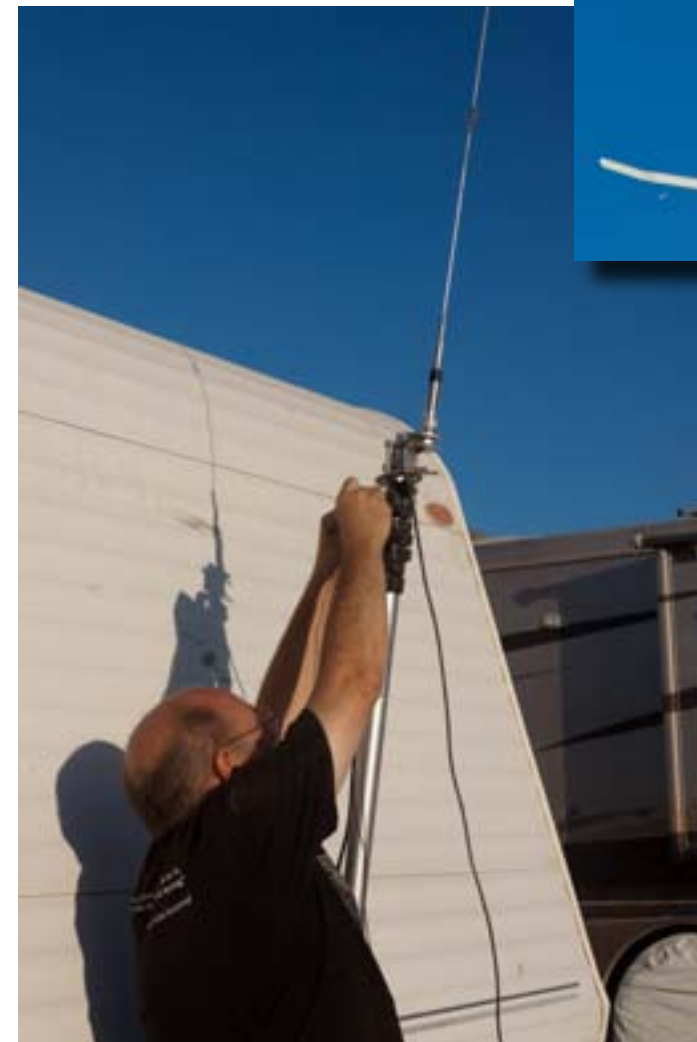
Previous page top: Wire for 10m antenna on playa surface. The soil is exremely alkaline and a very fine powdery dust.

Previous page bottom: completed 10m antenna was front and center of our art support camp. From the tent on the left, to the trailer skeleton on the right, were the Wonderlust Arcade vehicles.

This page left: detail of the 10m antenna center mast.

This page right: wire on the playa facing the street called Ersatz. It does actually look a lot like Mars!

Phase 4 Project - Site Evaluation

View of Phase 4 Groundsat (at or near the Palomar Mountain Amateur Radio Club repeater site) from the Lake Dixon Phase 4 Amateur Radio Access Point (ARAP) site.

In order to develop the hardware and software for AMSAT's Phase 4 digital satellite communications project, several terrestrial sites will be set up to simulate the system. San Diego has three proposed infrastructure sites. Two others are located in Texas and Maryland.

Components of the Phase 4 system include a satellite (the Groundsat), the gateways (Amateur Radio Access Points or ARAPs), and operators (User Terminals or UTs). The term ARAP was newly coined for our purposes. An ARAP is a gateway that allows conventional terrestrial communication links to be routed through the satellite. We will leave it open enough to include narrowband voice channels (like FM or P25) and also terrestrial data networks (like conventional wifi). Handhelds (P25, etc) that operate in support of Lake Dixon will be able to use the ARAP as an exercise and experiment. This demonstration was specifically encouraged during Bob N4HY's meeting with FEMA.

While this system is being deployed in order to more easily develop an amateur satellite service product, the development system will exist beyond the service life of the satellite, operating as a microwave amateur radio system. Mesh networking and many other services and modes are planned. Frequencies of operation include 5GHz and 10GHz. Infrastructure frequencies currently consist of links at 2.4GHz and 5GHz.

User Terminals and handhelds and any other device we can figure out how to talk to will be encouraged to join the demonstrations. We plan on deploying Phase 4 UTs with mesh networking capability built-in. The Palomar Amateur Radio Club has been asked to promote this aspect of the demonstration. Phil KA9Q has agreed to chair a PARC technical committee in order to coordinate and

promote mesh networking. Our intent is to be compatible with terrestrial mesh networks such as HSMM, BBHN, AREDN, and others.

The Groundsat will be located on Palomar Mountain. PARC has been asked to host the hardware, donated by Ettus Research and Virginia Tech. The Groundsat simulates a satellite. ARAPs are either fixed or mobile aggregators. Operaters with radios insufficiently strong enough to close a satellite link communicate with the ARAP, and the ARAP communicates with the satellite. UTs are radios that are satellite capable, and communicate either with an ARAP or directly with the Groundsat.

The second proposed site for Phase 4 infrastructure in San Diego County is at Lake Dixon. This is proposed to be an ARAP site.

The third proposed site for Phase 4 infrastructure is a mobile unit that will be based from Phil KA9Q's QTH. Equipment purchased will be donated to PARC.

Preliminary approval for the Groundsat has been granted by PARC. Discussions are ongoing with Dixon Lake Ranger Station for AC power for the ARAP.

Site evaluation for Lake Dixon and Palomar

The water tank already serves as a cell tower.

revealed a line of sight path (see image on previous page). Radiomobile link evaluations were carried out at Virginia Tech.

A visual evaluation was made at KA9Q's QTH. Several other sites around San Diego are being considered for additional hardware, but the minimum configuration is Palomar and one other ARAP site. With at least three sites in negotiations, Phase 4 is in great shape for hardware and software development!

This pole at Lake Dixon was considered as a possible place for mounting infrastructure hardware.

The view towards Palomar Mountain over Lake Dixon.

Phase 4 Project - Backhaul Configuration

Unboxing! Thank you Zach at Virginia Tech!

Sorting the equipment at Lake Dixon.

Kathy KA6OYD and Paul KB5MU and Bob N4HY

Kathy, Paul and Phil KA9Q

Some good expressions from the sorting and planning session.

Join us! Volunteers welcome. Must be US citizen due to ITAR. Contact w5nyv@yahoo.com.

Paul, Bob and Phil continue the configuration at Paul's QTH. This was a successful and enjoyable evening spent configuring the development system, eating out at a local restaurant, and telling lots of tall tales!

Kathy and Paul notice one bullet won't reset.

With a special tool (golden paper clip), the reset function was finally activated and the last bullet could be updated and configured.

Phil KA9Q reviews the troops. All bullets communicated successfully at the configuration party.

Phase 4 Project - Dixon Equipment Installation
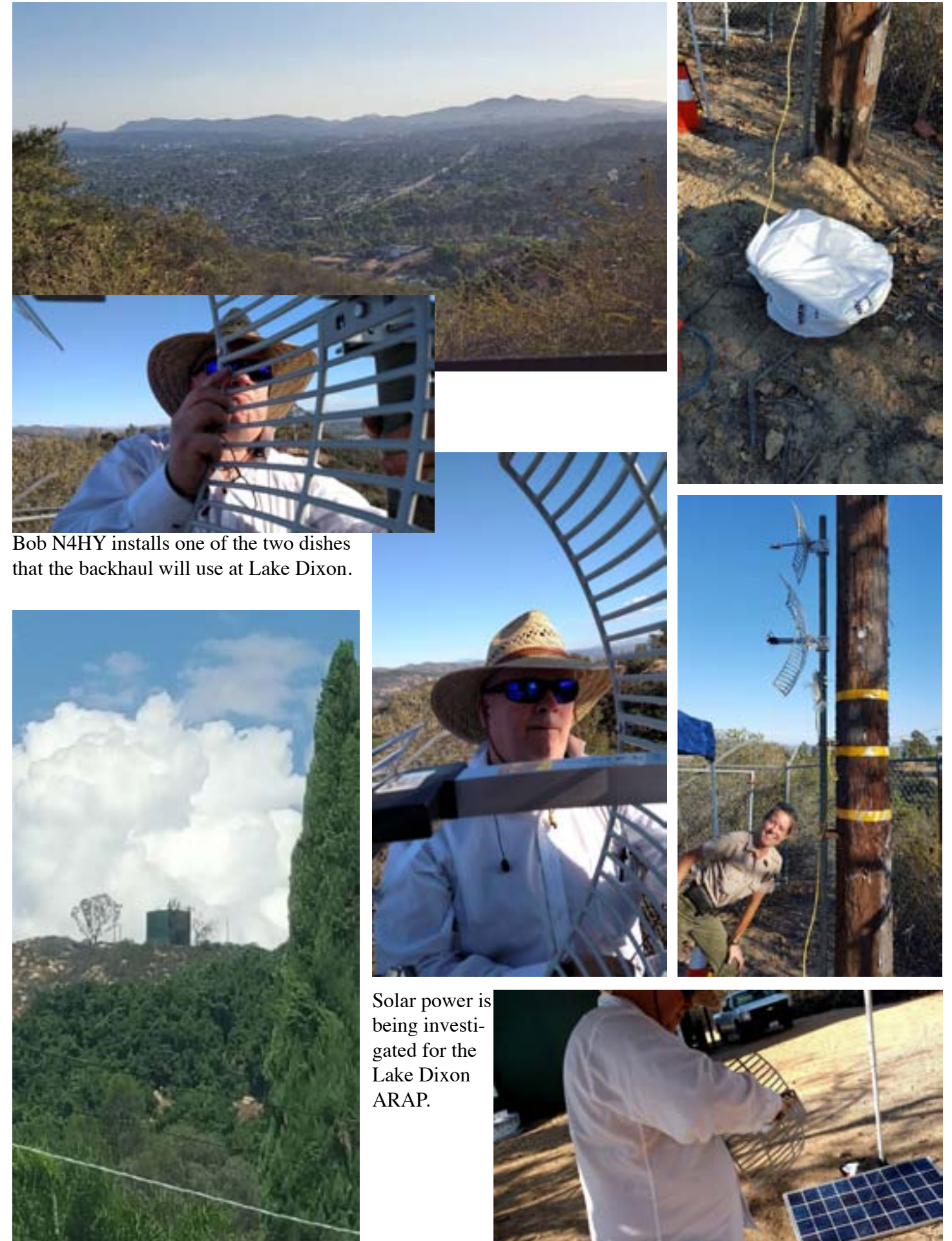
Bob N4HY installs one of the two dishes that the backhaul will use at Lake Dixon.

Solar power is being investigated for the Lake Dixon ARAP.

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DOWN TO MEET OURS!

FOR MORE INFORMATION:
760-435-4101

The Ham Radio Lunch Bunch meets Fridays for lunch and socializing at any one of a number of restaurants on a rotating schedule.
The Lunch Bunch signup is http://w0ni.com

Reminders are sent out on Wednesdays.
All are welcome for food and fun!

Some of the restaurants on the schedule are Fuddruckers, UTC Food Court, Spices Thai, Savory Buffet, Denny's, Callahan's Pub and Grill, and Phil's BBQ.

Return service requested

Featured Program:

On 7 October 2015, Palomar Amateur Radio Club will present our annual auction. See page 21 for details. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

November/December 2015 Scope

Over the past few months we here at PARC alerted you to the difficulty we experienced with the cessation of printing services from our longtime printer. That leaves us in a lurch.

Without boring you with a lengthy story, please realize that after careful investigation we only find printing services who will charge us at very least $500.00 a month ($6.000.00 a year) to print SCOPE as you are accustomed. And that does not include mailing costs. We can't afford that. We are committed to issuing a monthly newsletter. We are required to do so by our bylaws. So we are moving to electronic SCOPE distribution! This gives you several advantages. You will receive your SCOPE faster, it will be in sharper colors, and will include additional features such as videos, and related interactive matter.

You must opt in to receive SCOPE electronically. It is easy.

Go to the PARC website www.palomararc.org , and select "Newsletter" from the column on the left of the website screen. On the newsletter page, at the very top, you will find two options.The first way to receive SCOPE electronically is for you to subscribe to receive a PDF file of the newsletter when it is ready to be delivered. You can then print the file, or store it on your computer or smart device to read it later. The second way is to just receive a notification that the newsletter is available on line at our website. You may choose to subscribe to both forms of delivery simultaneously. That way if you are too busy to see SCOPE on line when you receive the notification that it is ready, you will also receive the PDF file separately. If you forget the newsletter is available, you will find it in your email anyway.

Rest assured that we are not doing this lightly. We simply cannot afford the printing prices. We remain committed to producing a newsworthy, attractive, and information filled monthly newsletter as we are required to do by our bylaws. If this creates a grave problem for you, please notify us via snail mail at Post Office Box 73, Vista, CA or electronically via email to
board@palomararc.org

Upcoming Programs

November Program: AMSAT Phase 4 technical discussion panel on status and plans for the geosynchronous amateur radio satellite, and PARC's participation in hosting developmental capabilities that lead to the satellite's launch and effective operation.

December Program: Annual PARC Christmas social. Date: Wednesday December 2nd at Carlsbad Safety Center. Club members are welcomed to bring goodies for exchange with friends, and sumptuous treats for merriment.

By-laws Update

The club's board of directors nominated a bylaw review committee to do a review of our current bylaws. The committee was composed of KI6RXX (Greg), KK6FRK (Kevin), KJ6WUY (Richard), KJ6JEI (Conrad), NN3V (Charlie), and KD6TUJ (Dennis). Dennis was the lead of the committee, and the committee's recommended changes were submitted to the Board for review. The recommended changes are very minor, and principally adjust the bylaws to take account of the technology changes since the last time the bylaws were reviewed. For example, the means of notifying members of important events (such as an election meeting) will no longer be specified as by way of paid telegram! The Club will announce a regular general member meeting date when the modified bylaws will be subject of a general membership vote. Stay tuned!

November Operating Day

November 7th, 9:00 AM – 4:00 PM. At Fry's in San Marcos. Volunteers requested to meet the public, and participate in the event along with other ham radio organizations. Good opportunity to attract possible new hams. Contact scope@palomararc.org to volunteer for Operating Day.

NOVEMBER 2015

Current Board of Directors

Charlie NN3V President
Joe K6JPE Vice President
Jim NE6O Director
Gregg KI6RXX Director
Gary W6GDK Secretary
Richard KJ6WUY Treasurer
Dennis Baca KD6TUJ Repeater Site Chair
Glen KJ6ZQH Membership
Mark KF6WTN Repeater Technical Chair

Nominations for the 2016 Board will be
announced at the November membership
meeting.

Elections for 2016 Board will be held at the
December membership meeting.

Save the Date

Club Meeting
4 November 2015

Learn about how PARC is supporting AMSAT's Phase 4 satellite service project.

There will be presentations and a panel discussion. See page 3 for details.

The slate for the 2016 PARC board of directors will be announced.

Board Meeting
11 November 2015

Palomar Amateur Radio Club board meeting at 7:00pm at Poway Fire Station on Community Road

Club Events
7 November 2015

Operating Day at Fry's in San Marcos! 9am - 2pm
See page 63
YES! 63! Wow!

Operating Day at Fry's Electronics in San Marcos

November 7th, 9:00 AM – 4:00 PM. At Fry's in San Marcos. Volunteers requested to meet the public, and participate in the event along with other ham radio organizations. Good opportunity to attract possible new hams. Contact Tom Martin K6RCW at (619) 778-3866 to volunteer for Operating Day, or send an email to scope@palomararc.org and your message will be forwarded to Tom.

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

Club Members ONLY!
PARC has a tube bank that includes many 6 & 12 volt receiving tubes (and some transmitting types) for use by club members to repair their own personal equipment. Not for commercial use or resale. If we have your requests, we will pre-check the tubes and deliver them to you at the next club meeting.

Contact John WB6IQS WB6IQS@att.net

President's Corner

A very Happy Thanksgiving wish to each of you and your family!

Well, as I am sure you are aware, the holidays are upon us and family time will become more and more important as the year winds down. Please take the time to enjoy the season, and don't forget to leave clear requests for the ham radio goodies you are wanting!

The November General meeting program will be very informational and exciting. The AMSAT folks, those who developed many of the ham satellites in orbit, are planning to launch a geosynchronous ham satellite. In preparation to do so, AMSAT is implementing a network of ground stations that simulate the satellite as well as the user terminals that directly connect to the satellite. But, that's not all. There is a third type of station in the works that collects local radio traffic and bundles it up for transmission to the satellite.

PARC is going to host one of the satellite simulators at our Palomar site. This will put us in the forefront of developing future ham technology, and will give San Diego County hams an opportunity to communicate with the simulated satellites by using their ham station equipment. You will not want to miss the program!

The Club has a busy season ahead. We start with Operating Day at Fry's on Saturday November 7th. A great opportunity for you to come out and participate in actually getting on the air with a good antenna for the HF bands. No antenna restrictions in the Fry's parking lot! Furthermore, participating is a way to receive Club participating points which turn into picnic prize tickets! An inexpensive way to increase the probability you will win a prize at the Club's picnic. We need volunteers to help at the event.

The Club's Board of Directors is evaluating several projects to undertake for the benefit of you the Club member. They are projects that involve implementation and installation of new equipment at our repeater site. As the projects are evaluated, and a decision is reached to implement one or more of them, stay tuned!

There will be excellent opportunities for club members to be involved in the installation of equipment, the testing of capabilities, and then the regular use of the equipment by all club members, as well as hams throughout San Diego County. This will give us the chance to get new hams involved in "getting their hands dirty" in ham radio technical work!

In accordance with the Club's bylaws, a nominating committee was appointed to identify Club members willing to volunteer their services for the Club Board Of Directors in 2016. The result of their deliberations will be announced at this month's general meeting. Election for officers will be held in December.

Contents

New Committee Chairs

It's been a while since PARC had an active committee system. In the October 2005 Scope, the list included ARES Info, ARES Net, Attendance, ATV, Auction, Badges (New), Batteries, BBS Monitor, Billing Ads/etc, Contest Info, Control Ops, Del Mar Fair, EmComm, Field Day Tech, Inventory, New Member, Nets, Newsletter, Patch Info, Patch Electronics, Picnic, Power AC/DC, Programs, Publicity, QSL Cards, RACES Info, RED Flag, Repeater Site, Repeater Tech, SANDARC, Seller Table, Testing, VE, Trustee, and Web.

The club is reviving the committee system and will be welcoming new chairs. If you are willing to serve, or have an idea for a particular chair that you believe the club needs, please contact the board at board@palomararc.org.

Some of these positions are no longer relevant. For example, since we don't have a phone patch, we don't currently need a committee chair for that position.

It's our pleasure to announce two new Committee Chairs for PARC. Both report to our repeater technical chair, Mark Raptis KF6WTN.

New Chair for EchoLink

An EchoLink Chair has been established for Palomar Amateur Radio Club. Bernie Lafreniere N6FN has operated PARC's Echolink node since it was established in 2010, has written a book about EchoLink, and owns and operates http://www.niftyaccessories.com/index.php

Contact Bernie Lafreniere at n6fn@niftyaccessories.com

The biggest task for the EchoLink subcommittee is figuring out how to integrate EchoLink into the System Fusion repeater system. Mark Raptis KF6WTN is currently assisting in researching how best to accomplish this.

PARC's EchoLink node is currently offline while the committee works on the best way to integrate it with the repeaters.

Bernie has recently been writing guides for the new Yaesu transceivers that incorporate the WIRES-X Internet linking capability. PARC has been offered a WIRES-X box as a donation.

If you're interested in EchoLink, then dust off that EchoLink registration and get ready for more activity!

Find out a lot more about EchoLink at http://www.echolink.org

New Chair for Mesh Networking

Phil Karn KA9Q has agreed to serve as Mesh Networking commitee chair.

Phil writes:

"I've been a ham since high school in 1971. After college I went to work for Bell Labs and became involved in AMSAT and in amateur packet radio development. In the mid 1980s I wrote the KA9Q NOS TCP/IP software package. It's long obsolete now, but it first brought the Internet to many non-hams as well as hams. I've lived in San Diego since 1991 when I came here from New Jersey to work for Qualcomm. I retired from Qualcomm in 2011, so I have time to get active in ham radio again.

I'm one of several adult mentors to the Mount Carmel High School Amateur Radio Club. We help the students design, build and fly high altitude balloon payloads. They've done three so far and are working on their fourth.

In the late 1980s, fellow AMSAT members Jan King, W3GEY, Tom Clark W3IWI (now K3IO), Bob McGwier N4HY and I conceived the "Pacsat" satellite concept: an orbiting digital mailbox with four uplink receivers, a computer and one common downlink. I am now proposing a very similar architecture for the Phase 4 project, updated to 21st century technology: a software defined receiver, able to locate and demodulate many 5 GHz uplink signals at once, feeding a single 10 GHz high speed digital downlink. Because the satellite will be in geostationary orbit, communications will be real-time (unlike the low altitude Pacsat). We are designing the system primarily for digital voice, but it will also support low to medium speed data. Because the ground terminals will be very small (< 1 meter) we expect it to get many hams onto satellites that cannot do so now because they lack the room to erect the VHF/UHF arrays now needed. We also expect it to be very useful for the early stages of a regional disaster that takes out commercial communications."

Thank you to Bernie and Phil for volunteering!

SANDARC Meeting Report

Paul KB5MU and Michelle W5NYV are serving temporarily as Palomar Amateur Radio Club's delegates to SANDARC. The most recent meeting was held 29 October 2015. Meeting minutes were approved, no treasurer's report was given.

A report about the Volunteer Examiners Appreciation Luncheon report was given. 23 SANDARC VEs enjoyed a social celebration at Giovanni's Restaurant. Reviews were very positive. Giovanni's also donated two $50 gift cards for future use.

SANDARC Committees include Education, Website Advisory, Policies and Procedures, and Convention Review and Feasibility. The Convention report is due in January.

ARRL Section Manager Steve Early talked about the successful Boy Scouts Jamboree on the Air (JOTA) event held on 18 October, and discussed Jay's upcoming license examination classes. There will be one held November 7th in La Mesa, and on the first Saturday of December. Contact SANDARC for more information on these classes.

The Miramar Air Show drew a lighter crowd than expected. Volunteer hams helped with Air Show communications support. Incidents were reported to be minimal. The Miramar Air Show will be held the last weekend of September in 2016.

250 people attended the inaugural San Diego Hamfest, sponsored by LARC. It was completed $15 in the black. The delegates congratulated LARC on a job well done. They anticipate having next year's San Diego Hamfest the first weekend of October. Due to the Miramar Air Show moving to late September, there will not be a conflict between these two events. [This also bodes well for San Diego Maker Faire, if it is held the first weekend of October for 2016.]

Southwestern REACT announced their upcoming "Silver Strand Half Marathon" on 15 November, from 6am to 11am. The race starts at the Naval Air Station and concludes at Imperial Beach. This event is encouraged as an opportunity for hams new to volunteering at public service events to give it a try. New hams are paired up with experienced volunteers to help the race run more smoothly.

Another event sponsored by SW-REACT is the Mother Goose Parade, held 21st of November.

10 different points are staffed in order to keep announcers advised and updated. 1-2 people are needed at each station, plus people to staff step-off and assembly. SW-REACT has most of these stations staffed but enthusiastically welcomes more. If interested in volunteering with SW-REACT events, let teaminfo@southwesternreact.org know.

Another event sponsored by SW-REACT is the Toy Land Parade. Held 4 December 2015 in North Park, this is also an event that welcomes hams new to volunteering in event support.

Operating Day at both Fry's Electronics on 7 November 2015 was announced (see page 63 for our flyer!)

ROARS gave a report about an upcoming event. On November 14th, there will be an open house at the Ramona airport. Antique aircraft and helicopters museum will be open. The event is from 8:30am to 4:00pm.

ROARS also reported on a successful, albeit small, JOTA in Ramona. ROARS is working hard to build membership and include both Boy and Girl Scouts in radio activities. They were advised by Steve Early to contact Kevin Walsh KK6FRK, the regional Boy Scout radio activities organizer.

Mountain Empire's involvement in an inter-agency emergency drill held last Tuesday was described by their delegate. The goal was to practice a coordinated law enforcement response. The headquarters was described as being almost like a full-blown EOC. Mountain Empire strongly recommends that "if you ever get invited to one of these things, by all means go!"

San Diego Section Emergency Coordinator Bruce Kripton KG6IYN announced a 19 November 2015 statewide hospital drill. The drill will be held in the morning and will last until approximately 1pm. They need additional people to be "comfortable" with staffing, but can proceed as of today with the number of volunteers that have come forward.

Glen KJ6ZQH and Charlie NN3V from PARC described their highly successful educational outreach and support program with Mira Costa Colllege. More details will be in the December 2015 Scope.

Arduino Keyer Project - Success!

PARC member Guido Sansoni NO6I has been busy making an Arduino keyer. He has shared his projcct on the club's Facebook group. After this project he has plans for an Arduino-controlled antenna rotator. Here are photos from Guido documenting the build process.
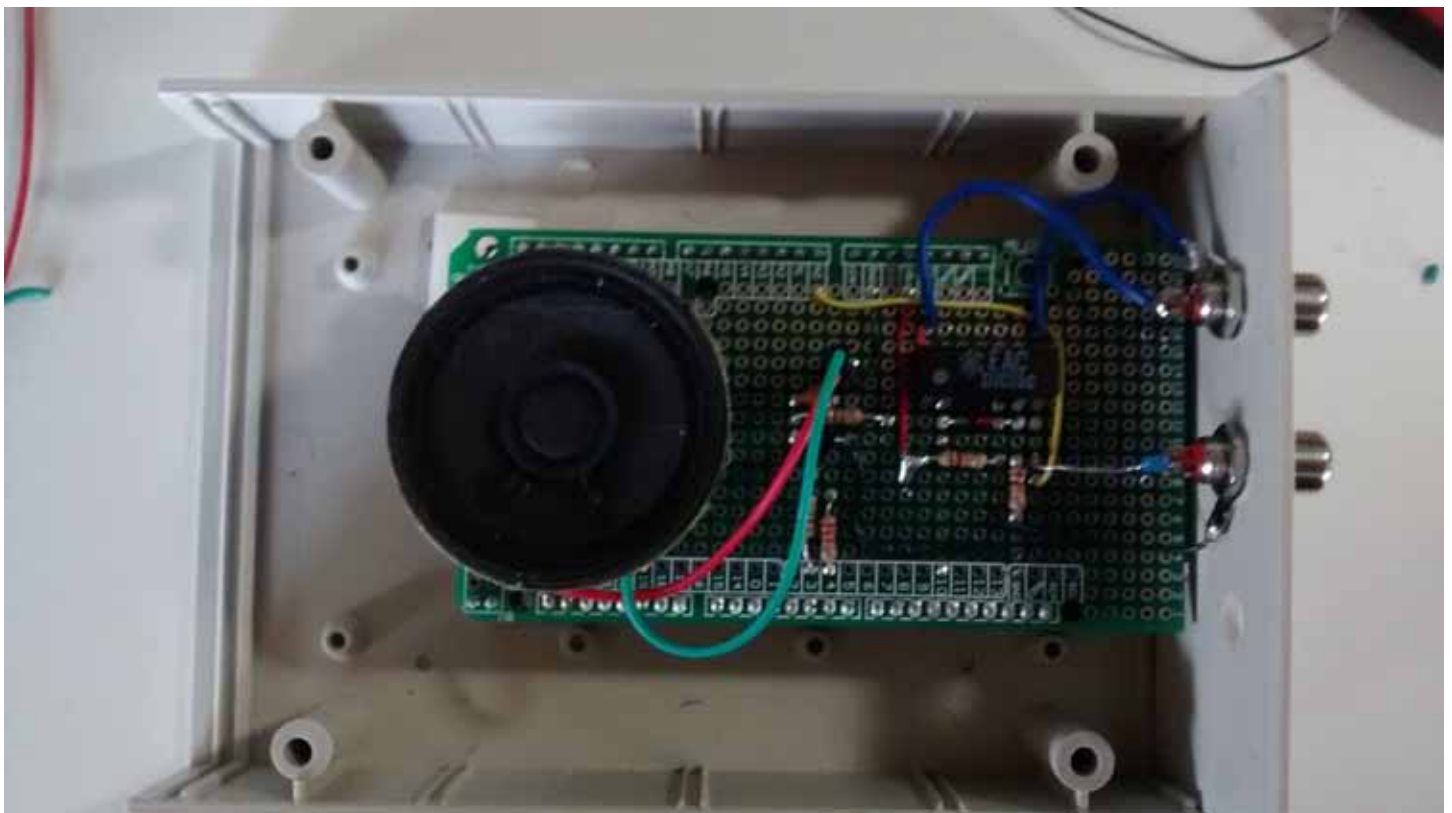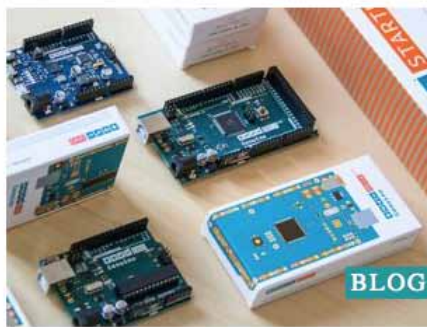
Guido Sansoni
20 hrs

Arduino keyer pre-final
Almost finished! everything works fine. Need only the jack for the paddles which seems to be lost in the snail-mail outer space.
Decoding ARRL prop bullettin, but works nice also on weak signals.
I set up the bandwitdh of the arduino dsp around 150, but it can go as narrow as 50Hz !

Here's Guido's finished keyer, working! See the video on the Palomar Amateur Radio Club Facebook group, which can be found at:
    https://www.facebook.com/groups/194674987710/

Find out more about arduino at:
    https://www.arduino.cc

Please support our advertisers. Their support of the club is vital.

{special} **THANKS** to our sponsors

Club HF Remote Station? Proposal Time!

Current status: PARC has obtained 501(c)(3) status, and we have begun putting our HF remote station proposal in writing. This is an exciting time! We expect to complete our proposal by January 2016.

If you would be interested in helping write a club remote HF station proposal for Palomar Mountain, then please join up by writing me at scope@palomararc.org and I'll add you to the mailing list!

Mailing list archive located at
http://palomararc.org/pipermail/hfremote/

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

What's your opinion?

Portrait or landscape (or other option) for the digital version of the Scope?

Let us know at scope@palomararc.org

Michelle Thompson asked a question.
2 hrs

For the digital version of the Scope, how do you prefer it to look?

☐ **portrait (the way it is now in PDF form)**   +2

☐ **But with landscape pages as needed (e.g., for diagrams).**

☐ **landscape (wider than it is tall)**   +1

Add an option...

Club Financial Update

Income/Expense by Category - Last month

9/1/2015 through 9/30/2015
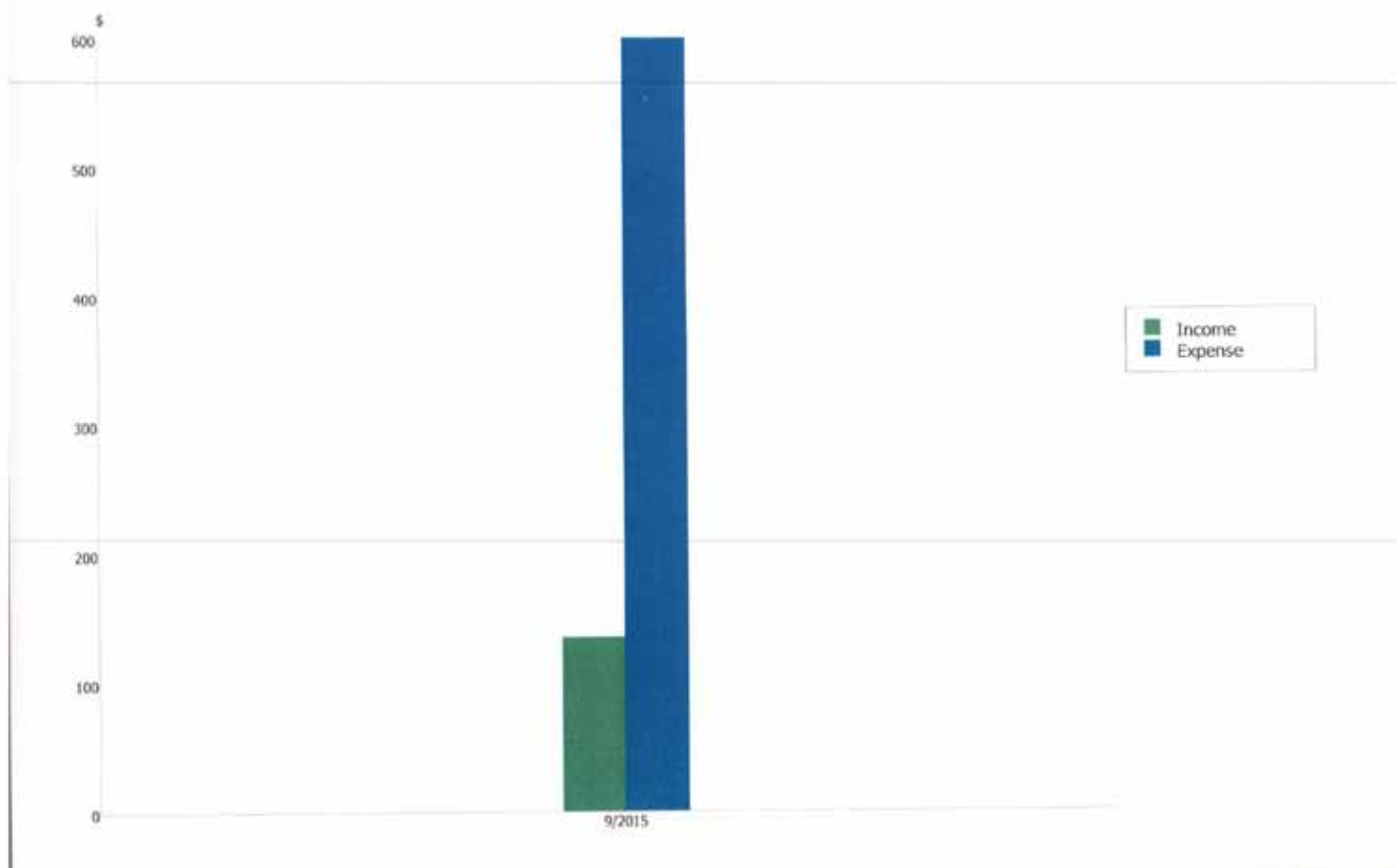
Income/Expense by Category - Last month
9/1/2015 through 9/30/2015

Category Description	9/1/2015-9/30/2015
INCOME	
Donation 501 C	100.00
Donations	15.00
Dues	20.00
TOTAL INCOME	135.00
EXPENSES	
Picnic	429.98
Rptr Electric	107.73
Rptr Maint	30.64
Rptr Phone	30.65
TOTAL EXPENSES	599.00
OVERALL TOTAL	-464.00

GIVE ME MY MONEY

memegenerator.net

Newsletter Committee Update

by Michelle W5NYV

Greetings all. There have been a lot of changes lately for our club newsletter!

First of all, we've moved to offering only a digital publication. This is the second digital issue of the Scope since our transition from print. There are a lot of advantages to going digital, but there are some disadvantages as well. The decision was not taken lightly and was discussed over many months.

Our intent is to continue to provide a print issue to those that require it. If you require a printed Scope due to not having convenient access to a computer or for another reason, please contact the board at board@palomararc.org.

Aside from the cost and the growing scarcity of small-volume printers, the lack of a volunteer team to fold, staple, and deliver the Scope to the post office proved to be a very large factor in deciding to move to digital. While Charlie NN3V has communicated some of these challenges in the past few months, I'd like to not only reiterate them, but also emphasize the advantages to going to a freely-available digital publication.

At the close of the 2015 Microwave Update, I had the opportunity to talk with Marty Woll, the Vice Director of Southwestern Division of the ARRL. Among many other subjects, we discussed print vs. digital publications, advertising revenue, and how subscription numbers and advertising rates work within a membership organization that also provides publications.

While ARRL has over 160,000 members, and we are three orders of magnitude smaller, we face many of the same issues when it comes to providing printed publications. We are hardly isolated in wrestling with how to deal with expensive printing costs.

ARRL provides both digital and print QST, but they opted to publish QST with DRM (digital rights management). In other words, not just anyone can read the digital version of QST. You have to pay for a subscription.

We offer the Scope in PDF format, without DRM, and without limiting it to our membership. Anyone on the internet can read our newsletter. While our costs are lower, they are not zero. We have to pay for the hosting and file storage. These costs are much lower than printing and

postage. However, without income from the dues from membership, there is no PARC website, and therefore no home for the Scope. With no members, there's no primary audience.

In other words, we are giving the newsletter away, essentially for free. This has not been an entirely uncontroversial choice over the years!

Why do we do this? Mainly because we want to attract new members. We feel that if someone local finds the newsletter to be a worthwhile read, and becomes interested in the club and all the activites supported by the club, that there is a very good chance that they'll join the club.

That is not the only reason. Open access to information is a philosophical and cultural ideal that we as a club have actively embraced. Our newsletter is free for all to read not just as an advertisement of how totally awesome we are, but also as a unimpeded contribution to the conversation in the amateur radio community.

Making the newsletter freely available is a different approach than ARRL takes with a publication like QST, but it is in line with what other clubs in San Diego County do with their newsletters.

For example, EARS has the current issue of their newsletter available for download on their website as a PDF. It's on the lefthand side of the home page at http://www.earsclub.org

While EARS doesn't seem to have links to past issues, if you know the month and year, you can create the right URL and download back issues.

Fallbrook Amateur Radio Club has their newsletter on their website as a webpage. Newsletters for the current year are available from their newsletter page at http://www.fallbrookarc.org/bulletin.html

Other clubs in the area have moved to digital publications of their newsletters. Just this week, North County Photo Society announced their newsletter would soon go digital.

However, not all of them have. The San Diego Astronomy Association maintains both digital and print newsletter options for members.

Many major magazines have found their

advertising revenues falling to the point where the entire magazine goes out of business. Some convert to digital, some completely go away.

QST retains good advertising revenue by, in part, providing advertisers a full-service experience. An advertiser with QST may get graphics and ad copy support and valuable feedback on what subscribers want or do not want to see.

The advantages to digital are numerous. We can include videos, animations, audio files, and other interactive content. An observant member would point out that we were already including these sorts of things with the digital version of the newsletter while we were still sending out a printed copy. The single biggest advantage that dropping print allows us to enjoy is that there is no longer a page limit.

A smaller print version could be printed each month, while putting a much larger digital version online. However, the Scope committee did not feel that this was a fair thing to do. Members should get the same content for their membership fee regardless of whether they get a printed copy or a digital download.

As we embark upon a new era for the Scope, it's more important than ever to create fun, entertaining, and educational articles and content for the membership.

The Scope committee currently consists of myself, Michelle W5NYV, as chair, Ellen N6UWW as copyeditor, Paul KB5MU as copyeditor, writer, and photographer, and a large number of situational and regular contributors.

Our newest addition is Kerry Banke N6IZW, who has agreed to keep us up to date about local microwave activity. One of our longest-serving and most reliable contributors is Dennis N6KI, who provides regular updates on the many contest activities that he organizes or is aware of, along with many other entertaining observations.

I want to continue to expand the committee. Interested PARC members are encouraged to consider joining. With so much more additional space, there are so many more opportunities for articles and content. This also means more work.

If you've always wanted to have a regular (or irregular) column about amateur radio, then why not start out by writing one for the Scope? It just might turn into a bigger opportunity.

Do you have a mobile installation that you would like to share?

Are you working on a technical project?

Volunteering in emergency communications?

Have an opinion about some commercial gear and want to write a review?

Need to get rid of a few things? Looking for a few things?

Have an idea for a quiz or challenge? Feel up to the challenge of constructing amateur radio themed puzzles?

See a local regulatory need?

Attended a ham convention or conference and want to share your experiences? Know about an upcoming conference?

These are the things we love to publish and that club members love to read about.

Something that will return to the Scope, now that we have less of a limit on space, is the "boilerplate" that used to make up a large fraction (up to 40%) of the Scope. Recurring content, such as the repeater frequencies and other lists was moved to the PARC website to make more room for articles in the print publication. While it did dramatically increase the amount of space available for interesting articles, it did force members to find the information on the website instead. We're going to return to running "boilerplate" information about the club, such as repeater frequencies, nets, board members, and other information, in the Scope.

Something that vanished not only from the Scope, but also from the club in general, is a list of active committee chairs. The committee chair system from several years ago showed a diverse and active volunteer corps that assisted the board in achieving many club goals.

Reviving this tradition and filling in the many roles has great potential to substantially improve the level of club activity and enjoyment.

As you can see, there's a committee behind each issue of the newsletter. The quality goes up with more voices, more collaboration, and more points of view represented. Our goal is to make this newsletter the best amateur radio publication that we can. You are the reason we research, explore, and write, and you are welcome to be part of the process!

11   Naughty Signals; or, the Abuse of a Raspberry Pi

by Russell Handorf

There are a lot of different projects that have rejuvenated interest in HAM Radio, more notably Software Defined Radio (SDR). The more prominent projects and products are the USRP by Ettus Research, BladeRF by Nuand, and the HackRF by Mike Ossmann (in the order from the most expensive to least expensive). These radios vary in capability and have their own distinct utility, depending on what radio communication you'd like to study; however, if all you are specifically interested in is receiving a simplistic signal, then the Realtek SDR is typically the best and cheapest choice. This article will show you how to combine a Realtek SDR and a Raspberry Pi into a poor man's software defined radio tool for exploring how to receive and transmit in related radio systems.

11.1   Bandpass Filter

It is very important to have and to use a bandpass filter when using the Raspberry Pi as an FM transmitter, because PiFM is essentially a square wave generator. This means that you'll have a lot of harmonics as depicted in Figure 21. While the direct operational frequency range of PiFM is approximately 1 MHz to 250 MHz, the harmonics are still strong enough to reach frequencies below 1 MHz and as high as 500 MHz.

Because of these square wave characteristics, a mechanical SAW filter would be ideal to be able to control the frequencies you wish to transmit. However, there filters can set you back more than the Raspberry Pi, and may be hard to come by, unless there's a neighborly Ham Radio Outlet near you. So you may have to make your own band-pass filter.

To make your own high band and/or low band pass filters, you can assemble them based on the schematic in Figure 19.[54] Parts for the various amateur bands are listed in Figure 20.

11.2   Raspberry Pi FM Transmitter

For over a year now, it has been documented how to turn the Raspberry Pi into an FM transmitter by using the PiFM software.[55] Richard Hirst first demonstrated this technique in some C and Python

code that generated spread-spectrum clock signals to output FM on GPIO pin #4. Oliver Mattos and Oskar Weigl have since enhanced PiFM to add more capabilities.

Be aware, however, that this technique has another problem beyond bleeding RF and having to use filters. Namely, the transmitter doesn't shut down gracefully after you quit PiFM. Therefore, you'll need a script to silence the transmission. We'll call it `pi-shutdown.sh` in the various examples that follow.

```
1  #/bin/bash
   #pi-shutdown.sh
3  touch /tmp/empty && /home/pi/pifm /tmp/empty
```

11.3   AFSK

Audio Frequency Shift Keying (AFSK) is simply a method to modulate digital data as an analogue tone; you'll certainly recognize this as the tones your modem made. AFSK characteristically represents 1 as a "mark" and 0 as a "space". While not fast, AFSK does work very well in many applications where data is communicated over a consistent radio frequency. Because of these attributes, AFSK is frequently used for radio communications in industrial applications, embedded systems, and more. Using a program called `minimodem`, you'll be easily able to receive and transmit AFSK with a Realtek SDR and a Raspberry Pi. Marc1 from `kprod.eu` demonstrated some very simple techniques for doing so, which a few other neighbors have been tweaked and updated in the examples to follow.

To receive 1200 baud AFSK transmissions, a one-line script is all that's needed:

```
1  rtl_fm -f 146.0M -M wbfm -s 200000      \
       -r 48000 -o 6                        \
3  | sox -traw -r48k -es -b16 -c1 -V1 -     \
       -twav -                              \
5  | minimodem --rx -8 1200
```

What's happening here is that the program `rtl_fm` is tuned to 146.0 MHz, sampling at 200,000

---

[54]http://www.kitsandparts.com/univlpfilter.php
[55]https://github.com/rm-hull/pifm

samples per second and converting the output at a sample rate of 48000 Hz. The output from this is sent to `sox`, which is converting the audio received to the WAV file format. The output from `sox` is then sent to `minimodem`, which is decoding the WAV stream at 1200 baud, 8 bit ASCII.

Transmitting an AFSK signal is just as easy:

```
1  echo "knock knock... : `date +%c`"      \
   | minimodem --tx -f -8 1200             \
3           -f /home/pi/sentence.wav
   /home/pi/pifm /home/pi/sentence.wav     \
5           146.0 48000
   /home/pi/pi-shutdown.sh
```

11.4   Other Transmission Examples

Because of the scriptability and simplicity of PiFM, other forms of transmissions become easily achievable too.

Morse Code (CW)

Either done by playing a pre-made audio file with dits and dahs, or by using the `cwwav` program written by Thomas Horsten to output directly to PiFM.[56]

```
   echo hello world                        \
2  | cwwav -f 700 -w 20                     \
          -o /home/pi/morse.wav
4  /home/pi/pifm /home/pi/morse.wav         \
          146.0 48000
6  /home/pi/pi-shutdown.sh
```

---

[56]https://github.com/Kerrick/cwwav
[57]http://www.qsl.net/py4zbz/eni.htm
[58]http://www.hides.com.tw/product_cg74469_eng.html

Numbers Station

A numbers station is typically a government-owned transmitter that sends encoded messages to spies, operators, or employees of that said government anywhere in the world, where the messages are typically one way and seemingly random. The script below mimics the Cuban numbers station identified as HM01.[57] What is interesting about it is that the data it sends is encoded with a common HAM Radio protocol called RDFT. Transmitting RDFT on a Raspberry Pi can be difficult, therefore using a simple FM transmission of THOR8 or QPSK256 should be adequate; using FLDIGI should be of great help to create these messages.

A script can easily speak a series of words into the air by piping them into the `text2wave` utility:

```
   system("echo $text | text2wave -F 22050 - "
2        "| /home/pi/pifm - 144 22050");
```

DVBT with Metadata

One common practice for those who work with the RTL dongle is to remove to remove the DVB-T digital television kernel module. To receive this challenge, however, you will need to re-enable that module. To transmit it, you'll need hardware from Hides,[58] which can be had for a very low cost. The script below works with the UT-100C.
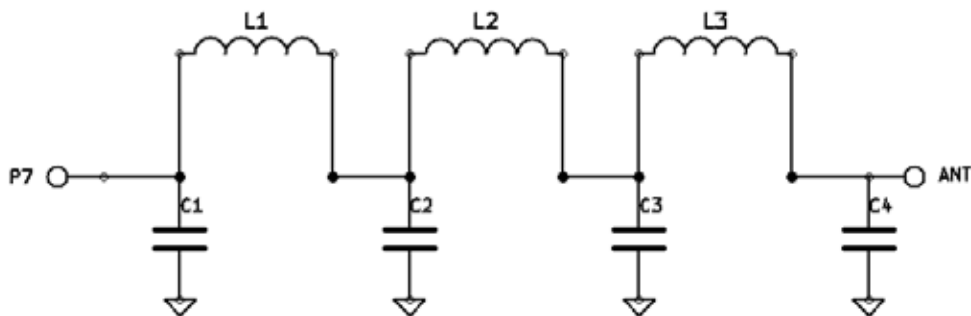

Figure 19: Bandpass Filter for Reducing PiFM Harmonics

```
   modprobe usb−it950x
 2 mkfifo ~/desktop
   avconv −f x11grab −s 1024x768              \
 4   −framerate 30 −i :0.0                     \
     −vcodec libx264 −s 720x576               \
 6   −f mpegts                                 \
     −mpegts_original_network_id 1            \
 8   −mpegts_transport_stream_id 1            \
     −mpegts_service_id 1                      \
10   −metadata                                 \
         service_provider="FCC CALL SIGN"     \
12   −metadata                                 \
         service_name="Dialin for Dollars!"  \
14   −muxrate 3732k −y ~/desktop &
   tsrfsend ~/desktop 0 730000 6000 4         \
16                       1/2 1/4 8 0 0 &
```

SSTV

Gerrit Polder developed a simple means of converting an image into a SSTV signal and then sending it out via the PiFM utility. Using his program, *PiS-STV*, command line transmissions of SSTV broadcasts with the Raspberry Pi are easy to achieve with-

out the need for a graphical environment.

11.5 Howdy to the caring Neighbors

Thanks to the PiFM program, there are many portable options allowing HAM operators, experimenters, and miscreants to explore and butcher the radio waves on the cheap. The main goal of this article is to document the work of many friendly folks in this arena, gathering in one place the information currently scattered across the bits and bobs of the Internet. Owing to the brilliant hacks of these neighbors, it should become apparent why any radio nut should consider having a Raspberry Pi armed with a filter and some code. While out of scope for the article, it should also become clear how you too can make a very inexpensive and portable HAM station for a large variety of digital and analog modes.

I'd like to extend a warm, hearty, and, eventually, beer-supplemented thank-you to Dragorn, Zero_Chaos, Rick Mellendick, DaKahuna, Justin Simon, Tara Miller, Mike Ossmann, Rob Ghilduta, and Travis Goodspeed for their direct support.

Band λ Meters	C1, C4	C2, C3	L1, L3	L2
160	820	2200	$4.44\mu H, 20T, 16''$	$5.61\mu H, 23T, 18''$
80	470	1200	$2.43\mu H, 21T, 16''$	$3.01\mu H, 24T, 18''$
40	270	680	$1.38\mu H, 18T, 14''$	$1.70\mu H, 20T, 15''$
30	270	560	$1.09\mu H, 16T, 12''$	$1.26\mu H, 17T, 13''$
20	180	390	$0.77\mu H, 13T, 11''$	$0.90\mu H, 14T, 11''$
17	100	270	$0.55\mu H, 11T, 9''$	$0.68\mu H, 12T, 10''$
15	82	220	$0.44\mu H, 11T, 9''$	$0.56\mu H, 12T, 10''$
12	100	220	$0.44\mu H, 11T, 9''$	$0.52\mu H, 12T, 10''$
10	56	150	$0.30\mu H, 9T, 8''$	$0.38\mu H, 10T, 9''$

Figure 20: Filter Bill of Materials
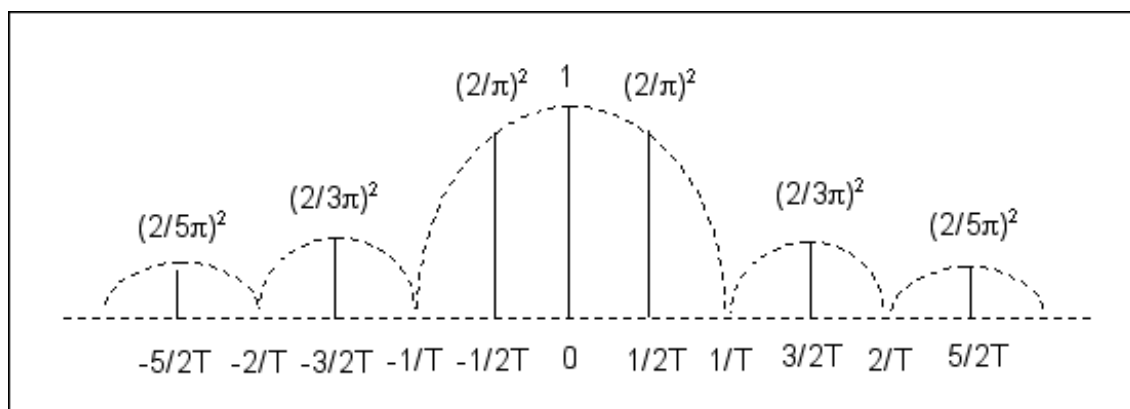
Figure 21: PiFM Harmonic Emissions

PARC, SDMG Dominates Microwave Update

Club members from Palomar Amateur Radio Club and San Diego Microwave Group dominated the just-concluded Microwave Update 2015, held in San Diego.

Kerry Banke N6IZW, Andre Hanson K6AH, and Michelle Thompson W5NYV all had papers accepted for the proceedings. Each also made presentations in the main lecture hall. All three papers are reprinted in this issue of the Scope as a special section.

This annual event draws microwave enthusiasts from all over the world. This year, 78 participants came from all across the United States, Great Britain, Australia, and Japan.

A proceedings and lecture schedule, dinner with keynote speaker, awards presentation, numerous prizes, ample opportunity for socializing and scheming, test lab, antenna range, vendor area, and flea market are all Microwave Update traditions handily upheld this year by the 2015 sponsoring club, San Bernardino Microwave Society.

At the Saturday evening banquet, Ed Munn W6OYJ was awarded the Don Hilliard Award for Technical Contributions to the Microwave Community. This award is given annually at Microwave Update for outstanding technical contributions. Ed is pictured above (center) with fellow San Diego Microwave Group members Kerry Banke N6IZW at left and Greg Bailey K6QPV on the right.

The next Microwave Update will be held in St. Louis, Missouri on 14-16 October 2016.

One tradition that was not continued at the San Diego Microwave Update was a tour or visit to a local surplus site. The number and variety of surplus stores and facilities allowing amateurs to come in and take surplus gear in San Diego has declined to the point where there was no compelling options to schedule. This caused quite a bit of conversation over the weekend, with many participants remarking upon how they've switched most of their gear-hunting to eBay and Craig's List.

Members from the sponsoring club, San Bernardino Microwave Society, are generally based in Riverside County, and have more access to the surplus sites that remain "up North".

The Australian amateurs that came to Microwave Update gave a repeat performance of their talk about their Microwave DXpedition on Monday evening at the San Diego Microwave Group meeting. Alan Devlin VK3XPD and David Minchin VK5KK made an additional presentation of "A VK Millimeter-Wave DX Expedition to Europe" to an enthusiastic group of microwavers before heading home on Tuesday.

One of the most remarkable achievements of their expedition was the deployment of 122GHz transceivers.

A special track about earth-moon-earth (EME) modes and equipment was presented on Sunday morning. Chaired by Doug Millar K6JEY, this session covered EME from beginner, and relatively inexpensive, to extremely advanced and expensive.

Microwave Update (MUD)
October 15th – 18th, 2015
Crowne Plaza Hotel – San Diego, California

Microwave Update - N6IZW

A Simple, Experimental 10 GHz Transmitter Hunt Setup
K.Banke N6IZW and Drew Arnett KB9FKO – SDMG (San Diego Microwave Group)

The second Maker Faire[1] in San Diego[2] scheduled for October this year, just before MUD. I was trying to come up with a hands-on microwave related activity that might be of interest to the kids, families, and grown-ups who will be there. At a previous SDMG meeting, Drew demonstrated an experiment using a LNB with the IF connected to an AD8307[3] log amplifier/ detector connected to an audio amplifier and speaker. An inexpensive DRO type intrusion alarm module is supplied with a 5V square wave turning it on and off at 1 KHz rate. The receiver detected the signal and produced an audio tone. I thought this might be used for a simple T-Hunt activity. (Several members of the SDMG are into serious transmitter hunting.[4])

Prototyping
The prototype I put together used one of the Avenger PLL type KU Band LNBs. The first attempt at duplicating Drew's setup showed me that the compressed audio square wave out of the AD8307 would make it hard to determine signal strength from the audio amplitude. More on that below.

I thought it would be important to add some IF filtering to narrow the BW to improve sensitivity and, perhaps more importantly, to reduce the likelihood of interference from actual intrusion alarms or perhaps Walter Clark's excellent X band demonstrations he brought to the first San Diego Maker Faire.
I purchased a 638 MHz 11 MHz BW SAW filter off the web which puts the received X band center frequency at 10388 MHz. The DRO unit easily tuned down to that frequency with the DRO puck tuning slug, and the frequency stability was well within the SAW filter BW.

I modified a W1GHZ Sensitive RF Detector for Sun Noise board[5] that also used the AD8307. It is being operated above its rated frequency but the gain of the LNB makes up for the reduced sensitivity at IF. The DC log output from the AD8307 is used to vary the frequency of a CD4046 PLL chip using just the VCO as an audio oscillator. A LM386 audio amp is used to drive a pair of headphones with plenty of output for a speaker if needed. With this setup, the DRO provides a CW carrier only with no modulation and the receiver tone pitch indicates received signal strength. The higher the received signal strength, the higher the audio tone frequency is.

Power for the DRO is provided by 4 AA batteries with the unit drawing about 40 ma. The receiver needs a minimum of about 7V at 140 ma to operate the LNB. I used 8 AA batteries but may eventually replace them with a 7.4V LiPo battery.

The dynamic range of the receiver IF/audio system is about 50 dB with the MDS around -45

dBm and max tone at about +5 dBm in to the AD8307. The minimum sensitivity is determined by the noise BW out of the LNB after the SAW filter. The sensitivity is good enough that difference between pointing the receiver to cold sky and warm earth is very obvious. Both the TX and the RX have linearly polarized antennas. It's suspected that the antenna polarities need to be matched, or it may result in confusion from reflected signals. Tests performed at about 220 feet provided about 44 dB margin indicating this system should be good for several miles LOS.

The transmitter is hunted by sweeping the receiver from side to side and heading in the direction of highest frequency tone. Early backyard testing showed that it is easy to determine the location of the transmitter by sweeping the RX direction to find where the signal drops off to the left and right and splitting the difference.

10 GHz T-Hunt System Block Diagram

Transmitter

DRO Intrusion Detector ← 6V Battery

10388 MHz ↓

638 MHz IF

638 MHz 11 MHz BW

AD8307

Ku-Band LNB → Bias T → SAW Filter → Log Amp Det → CD4046 Audio VCO → LM386 Audio Amp → Head Phones

+12V

12V Battery → 5V Reg → +5V

Receiver
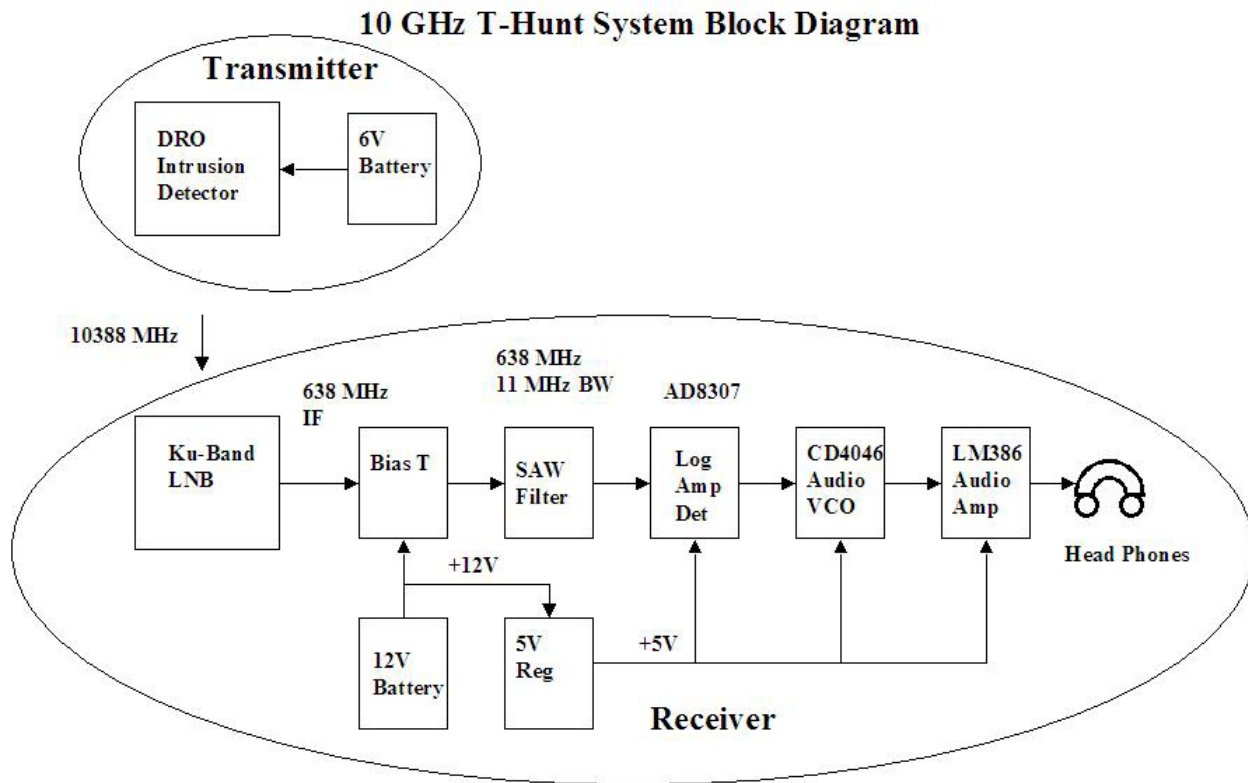
The photograph below shows the prototype as described in the block diagram above.
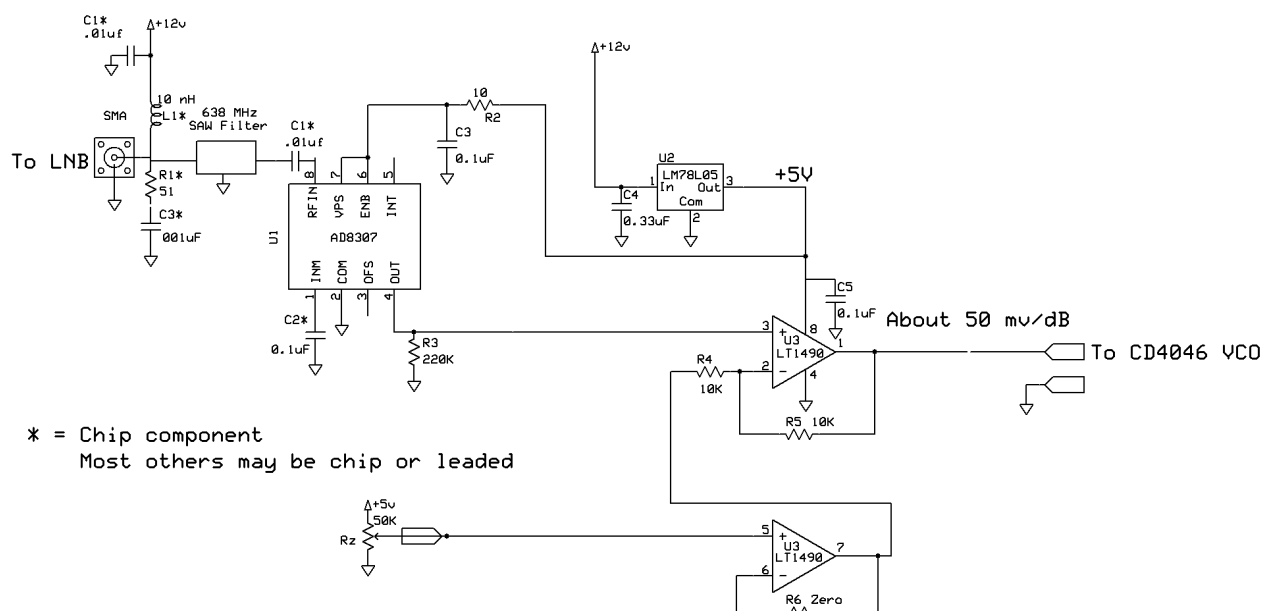
Modified W1GHZ Board

W1GHZ		
VHF Power Detector and Amp		
For Sun Noise	Rev 1.1 6/26/2013	Schematic

N6IZW		
X-Band T-Hunt Audio		
K. Banke	Rev 1.0 8/26/2015	Page # or name
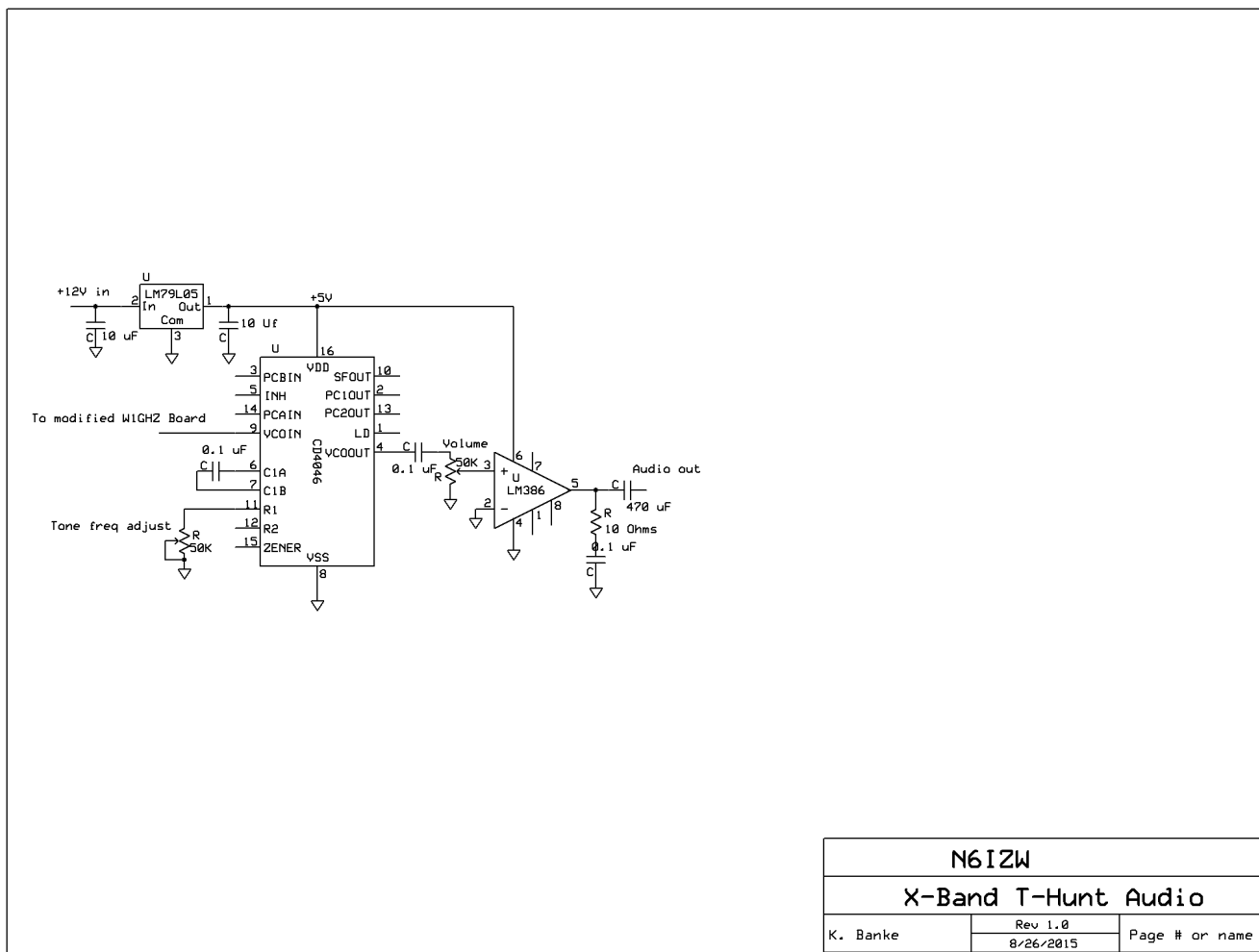
Drew's Demonstration

I had been hearing about the DRO modules, available for about $6 delivered, for a while from a number of sources. One of which is at least one writeup[6] from Walter Clark who has been doing a number of outstanding, fascinating physics demonstration experiments. Even though these modules lend them selves readily to FM as Gunnplexor modules also did, I wanted to try AM style detection with them. These modules have a DRO oscillator, splitter, mixer diode, and patch antennas for TX and RX. Connections are power, ground, and IF. Pout is about 15 dBm EIRP, and the antenna patterns have a 40 by 80 degree 3 dB beamwidth.

First, I wanted to AM the DRO modules. Later, I spent some time in the lab and looked over the supply voltage range to see if there was a useful range for somewhat linear AM. My measurements did not look promising, but my methodology wasn't careful. It wouldn't hurt for this experiment to be repeated.

Kerry would whip up an analog circuit to do so, likely with a 555. I had a few Arduino UNOs[7]

available (which are available from Digikey and others for $20) and had been using one with the outstanding K3NG CW keyer application[8] for HF CW contesting. Recalling the square wave sidetone output, I wired that up to a transistor switch to the supply connection of a DRO module.

Now for detection. There were many candidates, and I was interested in diode detectors, but didn't have anything built up, yet. I did have both an Avenger LNB and one of the RTL DVB-S USB SDR dongles. The SDMG had demonstrated this pairing used for 10 GHz EME reception. Before that, though, I grabbed an AD8307 based RF power meter described by W7ZOI and W7PUA and kitted by KangaUS. The AD8307 output is available on a connector which I connected to a Radio Shack amplified speaker.
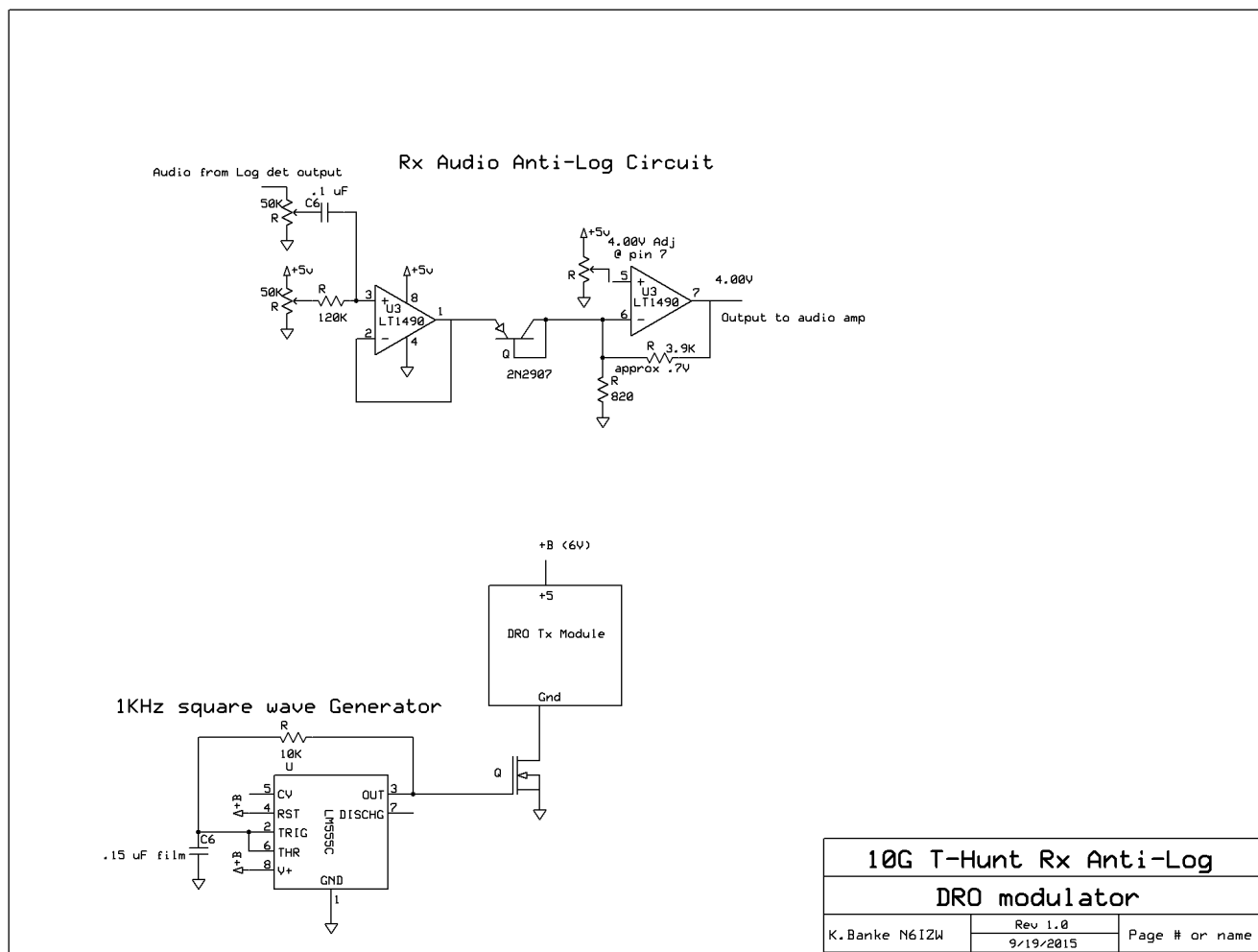
It worked great. The RF power meter has an input LPF at 500 MHz greatly reducing sensitivity to the approximately 800 MHz IF. A backyard measurement at about 80 feet showed enough signal margin that 300 feet or more of range should be possible. This system is what I demonstrated at the SDMG.

To Do
The working prototype as it is now will be sufficient for an excellent hands-on activity at the 2015 SD Maker Faire. However, we have plans for several improvements and future experimentation.

Arduino Shield: Drew is currently designing an Arduino shield to be ready for the Maker Faire. A battery pack will plug into it, and it will provide power to the Arduino UNO it is plugged into as well as the DRO module that will plug into it. A trim pot will allow adjustment of the supply voltage to the DRO module, which may be used for frequency fine tuning. A rotary hex switch will allow the unit to be configured in one of several different modes. TX always off, TX always on CW, TX always on with constant AM tone, CW Morse via key jack, AM tone Morse via key jack, Morse beaconing with single letter ID, A through F, and perhaps with different audio tones for each letter.

Better AM RX: It would be great to have a real AM RX, so we could hide several transmitters for the kids to find. We will try the log amplifier/detector to test our hypothesis as to how that will work in a multiple TX environment. It certainly doesn't allow for easy discernment of signal strength. One idea is to take the 50 dB log signal and antilog it over about 30 dB. (30 is a rough guess as to the audio levels that would fit between not too quite to hear in a noisy Faire and not too loud to be a safety concern.) We have several other ideas, but we would welcome ideas and suggestions from the reader.

Rx Audio Anti-Log Circuit

Audio from Log det output

.1 uF
C6
50K R

+5v
50K R
R 120K

+U3 3
LT1490
2 −
4
8
1

Q
2N2907

+5v
4.00V Adj
@ pin 7
R
5
+U3
6 −
LT1490
7
4.00V

Output to audio amp

R 3.9K
approx .7V
R 820

+B (6V)

+5
DRO Tx Module
Gnd

1KHz square wave Generator

R
10K
U

5 CV   OUT 3
4 RST   DISCHG 7
2 TRIG
6 THR
8 V+   GND 1

.15 uF film
C6

Q

10G T-Hunt Rx Anti-Log		
DRO modulator		
K.Banke N6IZW	Rev 1.0 9/19/2015	Page # or name

References

1. http://makerfaire.com
2. http://sdmakerfaire.org
3. http://www.analog.com/en/products/rf-microwave/rf-power-detectors/non-rms-responding-detector/ad8307.html
4. http://www.sdthunters.com
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6. http://www.ham-radio.com/sbms/presentations/Walt_Clark/DROplexer.pdf and correspondence with Walter Clark
7. http://www.arduino.cc
8. http://blog.radioartisan.com/arduino-cw-keyer/

A 2 meter Direct Conversion DSB Transceiver for use with Transverters

K. Banke (kbanke@sbcglobal.net) N6IZW San Diego Microwave Group

As we have new members join our SDMG, the need for entry level IF radios for use with transverters is becoming more and more an issue. The low cost, single band 2 meter radios capable of operation in Sunlight are becoming harder to find and are aging to the point of self destruction. This project was an experiment to convince myself whether a very basic 2 meter DC DSB transceiver would be useful. Fortunately the basic requirements of an IF radio for use with a 10 GHz transverter are fairly easy to achieve. Noise figure and narrow selectivity are typically not an issue as a transverter IF radio and +10 dBm in Tx is easy to achieve. LO leakage in to the front end is also much less an issue when used with a transverter.

What prompted me to give this approach a try was a recent project (Portable ERP/MDS Test Box)
I had just finished which utilized a low cost ($50) SI570 board as the signal generator covering 3-160 MHz with down to 1 Hz tuning steps and an LCD display easily readable in direct Sunlight.

I wanted to try the simplest form of DC transceiver to keep the cost and construction effort to a minimum. That meant DSB for both Tx and RX with no quadrature and phasing networks.

That being said, I became intrigued with some articles describing "Binaural" reception and wanted to give it a try even though it added complexity to the unit. Striping out the components required for the Binaural capability would simplify the design and construction considerably. The Rx sensitivity is about -135 dBm for MDS and TX output is about +10 dBm. The Rx Binaural audio is interesting in that as one tunes through a CW signal the tone appears to pass from one head phone to the other. Of course the disadvantages with DSB are only half the Tx power is in one sideband that SSB radios will be receiving and Rx noise from two sidebands. With those caveats in mind, it can provide a very useable radio for outdoor operation.
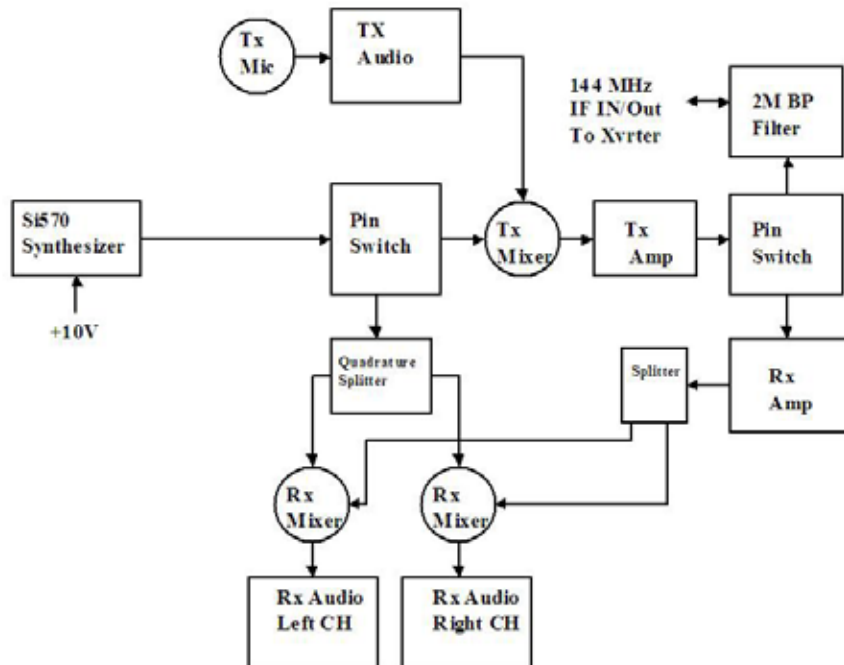
2 meter DSB transceiver for transverters Binaural Rx
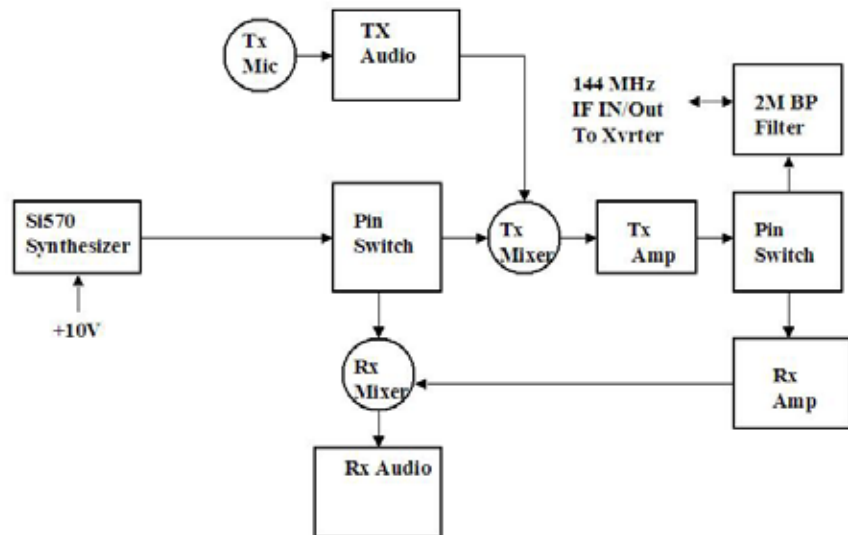
2 meter DSB transceiver for transverters simplest form

A Portable ERP/MDS Test Box
K.Banke N6IZW kbanke@sbcglobal.net

This experimental test box was developed to replace the 145 MHz range RF signal generator and power meter setup used to perform ERP/MDS testing in the field. It is used as the IF signal source and power meter in conjunction with a microwave up/down converter. The unit is designed to operate at an IF frequency in the 2 meter range but the log amplifier and variable attenuator components are good from DC to 500 MHz. The SI 570 signal source is good from 3-160 MHz.

With the ERP/MDS switch placed in the MDS mode, the variable attenuator control
is manually set (CW)for maximum output power and then reduced.
The level in dBm supplied to the IF in/out port is displayed on the digital display in -dBm.
This unit was calibrated to operate next to the transverter without the long IF cable.
Recalibration can be done to accommodate a long IF cable.

In the ERP mode, the attenuator control is turned to minimum (CCW) to
prevent the RF generator output from interfering with the ERP measurement.
The digital display has been calibrated to display the ERP value directly as when using the attenuator, amplifier and power meter setup.

N6IZW Portable ERP/MDS Test Box
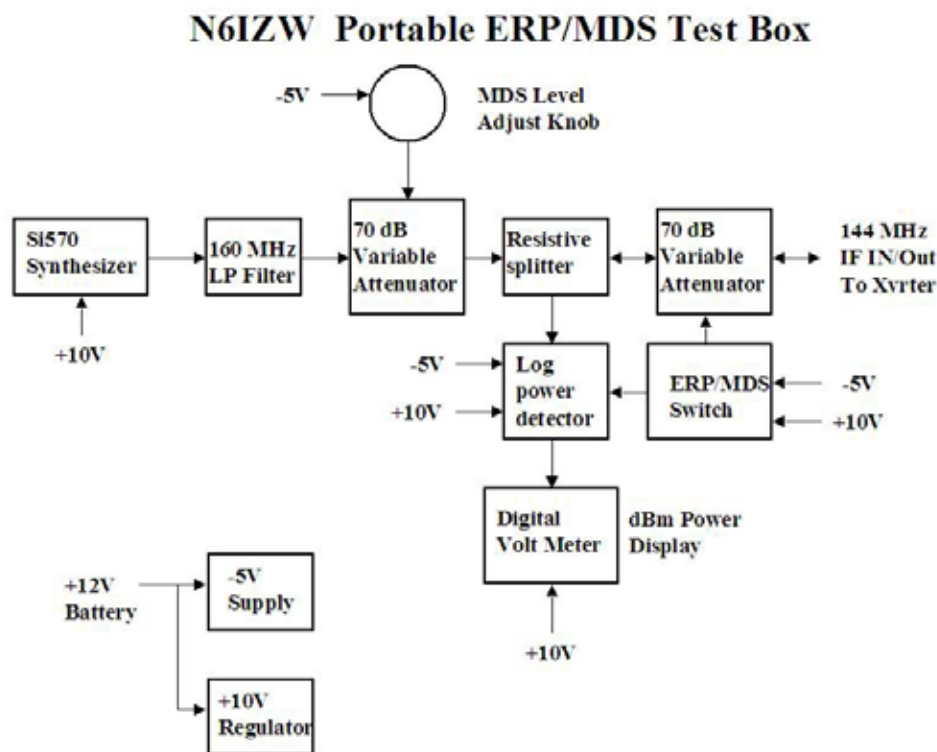
Block diagram Description
The SI570 synthesizer is the The Si570 Controller and Frequency Generator Kit #2
from http://www.qsl.net/k5bcq/Kits/Kits.html
The unit is a complete synthesizer covering 3-160 MHz with variable step size down to1 Hz and an output of about +10 dBm.

The 160 MHz LP filter is a basic three pole filter to remove harmonics.

The 70 dB variable attenuator blocks are each two 35 dB voltage variable attenuator chips (MACOM at-635TR) in series using a control voltage of about 0 to -4V DC.

The MDS variable attenuator is controlled by the 10 turn MDS pot.
The second 70 dB variable attenuator is used to apply attenuation as required for calibration in both ERP amd MDS modes and is controlled by the ERP/MDS switch.

The resistive splitter allows the log power detector to measure both output of the Si570 in MDS mode and the receive power level in ERP mode.

The log power detector is a modified "Sensitive RF Detector for Sun Noise and other uses" board by W1GHZ. It is built around an AD8307 log amplifier/detector providing up to 80 dB of dynamic range.

The dBm power meter display is a 200mvFS DC digital panel meter.
The ERP/MDS switch changes both the output attenuator level as well as the AD8307 detector offset between modes.

Schematic 1: Portable ERP/MDS (N6IZW)

+12V Battery

100 uH

C 10uF   C 10uF

+In -Out   -9v
-In +Out   LM7905
         In Out
         Com

C 10uF   1   C 10uF   -5v

U 7810
In Out
Com

C 10uF   2   C 10uF   +10v

Note: pins 2-7 & 9-13 GND on all AT-635

160 MHz LP Filter   MDS Generator Variable Attenuator

K5BCQ
SI570
Signal Generator
Board

+10 dBm 144 MHz   80 nH   80 nH

C 12pF   C 40pF   C 12pF

AT-635
Attenuator   14   8

AT-635
Attenuator   14

Splitter
R 50

AT-635
Attenuator   14   8   To Microwave
Up converter

AT-635
Attenuator   14

C R 100   100   R C
1000 pF

R 50   R 50

C R 100   100
1000 pF

C R 100
1000pF

-5v
R 3.9K

MDS Signal Level Adj

5K Ten Turn
R

Set for 14.8K

R 20K

ERP/MDS Scale Shift

R 100K

R 50K
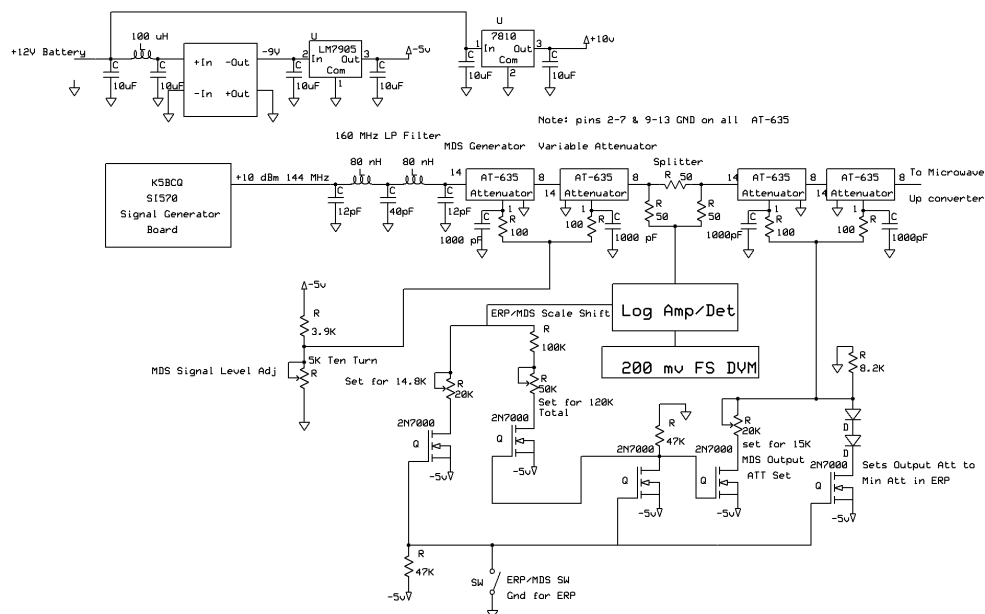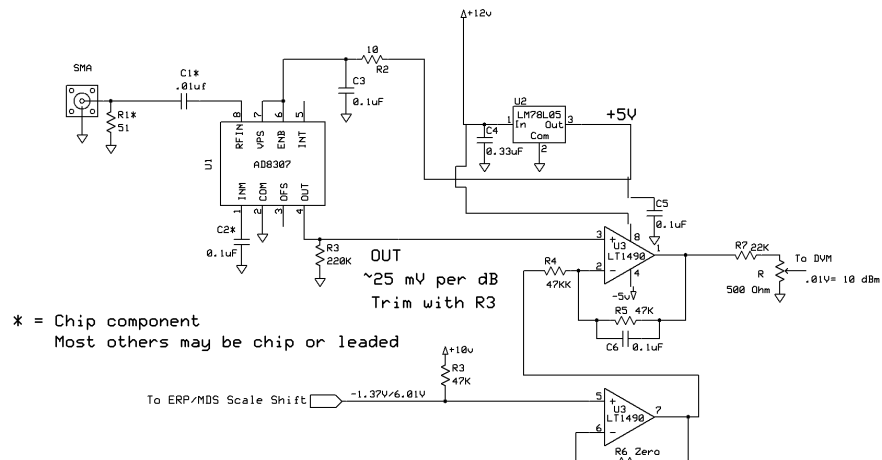Set for 120K
Total

Log Amp/Det

200 mv FS DVM

R 8.2K

2N7000
Q

-5v

2N7000
Q

-5v

2N7000
Q

R 47K

2N7000
Q

-5v

2N7000
Q

-5v

R 20K
set for 15K
MDS Output
ATT Set

2N7000
Q

-5v

D

D

Sets Output Att to
Min Att in ERP

R 47K

-5v

SW   ERP/MDS SW
Gnd for ERP

N6IZW
Portable ERP/MDS

Designer's name	Rev 1.0	Page # or name
	8/26/2015	

Schematic 2: Modified Log Amp/Det for ERP/MDS Unit (W1GHZ)

SMA

R1*
51

C1*
.01uf

U1
AD8307
RFIN 8
VPS   7
ENB   6
INT   5
INM   1
COM   2
OFS   3
OUT   4

R2 10

C3 0.1uF

+12v

U2
LM78L05
In Out
Com

C4 0.33uF   +5V

C5 0.1uF

C2*
0.1uF

R3 220K

OUT
~25 mV per dB
Trim with R3

R4 47KK

U3
LT1490
-5v

R5 47K

C6 0.1uF

R7 22K   To DVM

R 500 Ohm   .01V= 10 dBm

* = Chip component
   Most others may be chip or leaded

R3 47K   +10v

To ERP/MDS Scale Shift   -1.37V/6.01V

U3
LT1490

R6 Zero

W1GHZ
VHF Power Detector and Amp

	Rev 1.1	Schematic
	8/27/2015	

Portable ERP/MDS unit advantages:
Portable, compact, battery powered, Sunlight readable LCD display
Low cost

Disadvantages:
Unit needs to be built and calibrated
Careful attention to RF shielding/leakage at 145 MHz range

Standard test equipment setup advantages:
Calibration accuracy/stability
Off the shelf equipment
Shielding/leakage at 145 MHz range usually not a problem

Disadvantages:
Multiple pieces of equipment not easily portable
Requires AC power or large inverter with battery
Most equipment not easily Sunlight readable
Relatively expensive signal generator and power meter

by Michelle Thompson W5NYV with Kerry Banke N6IZW

Introduction

3D printing is a set of tools and techniques that allow the creation of custom objects with a 3D printer. The 3D printer technology described in this paper is heated filament deposition printing. This is analogous to having a CNC hot glue gun. Plastic filament is extruded through a nozzle in a heated head. The printer that I use has two stepper motors to move the heated head for print length and width, one stepper motor to raise and lower the heated bed for print height, and a stepper motor that moves the filament into the heated head. These motors provide three-dimensional control of the print space as well as control over the rate and direction of filament feed.

Melted filament forms the layers of a 3D printed object. After each layer is printed, the bed is lowered, and the next layer printed on top of the previous one. Each layer adheres to the previous layer due to heat fusion. In general, the Z axis (up and down) is considered to be perpendicular to the deposited layers, which are on the X Y plane. The usable thickness in the Z direction of the melted filament determines the resolution along the Z axis. If the next layer is started too high above the previous layer, there will not be sufficient adhesion. If the next layer is started too low in relation to the previous layer, then the previous layer will be damaged or disturbed by the heated head as it attempts to cram new melted filament on top of older already-cooled filament.

3D models of objects are created in software by either scanning or specification. The 3D model is then sliced into layers that correspond to the thickness of the layer of heated filament that the 3D printer produces. The process of taking a concept or drawing all the way from a sketch to a set of instructions that the printer will understand is generally referred to as 3D modeling.

There are two main types of plastic used in 3D printers, PLA (polylactic acid) and ABS (acrylonitrile butadiene styrene). The plastic filament is generally purchased on reels, and is on the order of 2mm in diameter. Matching the filament size to the size of the nozzle in the heated head is important. Matching the material to the purpose and characteristics of the type of object printed is important.

Similar to machining, sewing, software programming, and other crafts, there is an ensemble of skills involved in successfully producing a quality 3D print. Troubleshooting, materials selection, experimentally determining the right settings for any particular job, cleaning, and maintenance are all very much part of the 3D printing process.

The main reward of 3D printing is the ability to make shapes that are difficult to manufacture otherwise. For the case of microwave horn antennas, experimenting with non-rectangular horns means more difficult fabrication techniques. The ease of cutting shapes out of sheet metal and bending them into rectangular horns is undeniable, especially compared to making horns with curved sides.

Instead of the straight sides of a rectangular horn, the sides of a microwave horn antenna can be curved. This is called a taper. Some examples of tapers are elliptically or exponentially tapered sides. An example of an audio horn with tapered sides can be seen in Figure 1.
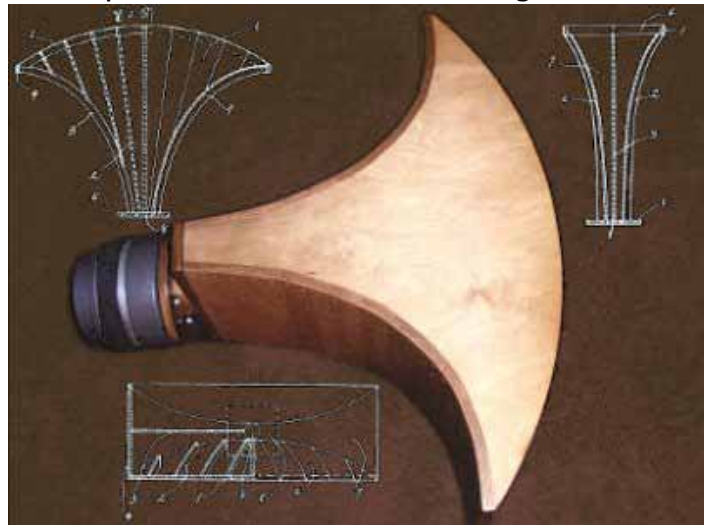
Figure 1

In order to control the taper, either a form or some sort of press would be required to control the creation of the specified curve. When the cost and hassle of making equipment to make equipment is substantially more time and trouble than an easy-to-make alternative, then the easier alternative will be chosen, even if the performance is compromised.

3D printing allows the specification in software of arbitrary shapes, like elliptically tapered sides,

or other complex curves. Printing a horn or other part, then applying a conductive coating, allows experimentation with almost any shape. This opens up tremendous possibilities for microwave enthusiasts to try out all sorts of crazy ideas. Adding in the recent trend towards circuit printers, the possibilities expand even more. The question under consideration for this paper was whether or not new horn designs could be successfully printed that would allow experimentation with complex tapers.

Printing a Rectangular Horn Antenna

A rectangular horn design by Kodera2t was obtained from Thingiverse (http://www.thingiverse.com/thing:87574) and printed on my Ultimaker2 3D printer. See Figure 2 for an image of the horn as printed by Kodera2t in Japan, and
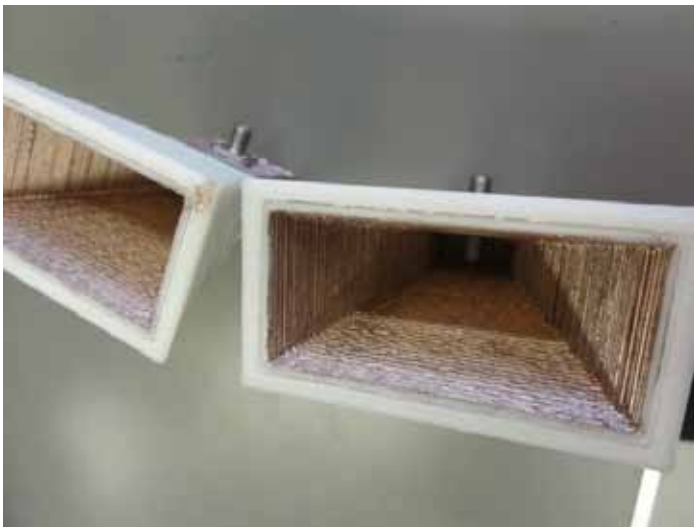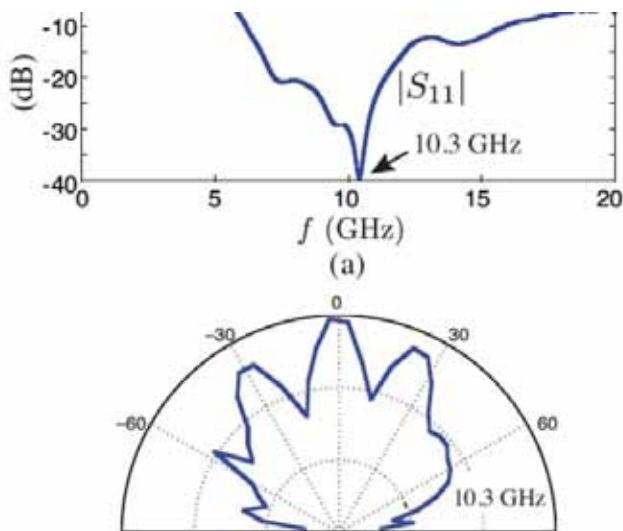

Figure 2

Figure 3

Figure 3 for Kodera2t's initial results, also from his experimentation in Japan.

One of the purposes of printing this design was to confirm the ability to print, metallize, and characterize a "known good" horn antenna. Any problems inherent in the printing, metallization, connectorization, and measurement stages could be addressed with some confidence that they weren't due to the horn design itself.

Horn antennas are very popular in the microwave band. Rectangular horns provide high gain, low SWR, and relatively wide bandwidth, and rectangular horns are not difficult to make.

What About Copyright?

Being able to share 3D models like this makes experimentation with objects much easier. Kodera2t speaks more English than I speak Japanese, but if we weren't able to simply share the 3D model, collaboration would be much more difficult. Freely sharing 3D (and 2D) models on sites such as Thingiverse directly supports the open source movement, where work output is given away to the public domain, and others are encouraged to use, modify, and republish the work for their own applications and needs. This is not mandatory. Many 3D models are unpublished or controlled, for all sorts of reasons. This brings up the question of where 3D printed objects fall in the universe of patents, trademarks, and copyrights. A good starting point for understanding these issues is the white paper "What's the Deal with Copyright and 3D Printing?" by Michael Weinberg (https://www.publicknowledge.org/files/What's%20the%20Deal%20with%20Copyright_%20Final%20version2.pdf).

There are multiple patents on a wide variety of horn antennas. Almost any creative image of a horn antenna has a copyright. A horn antenna as part of a logo of a specific manufacturer or seller would be a trademarked image. All parts of the process of 3D printing largely fall into the existing framework of intellectual property, but there are new challenges and novel legal questions that will have to be addressed in the coming years as 3D printing becomes more and more widely available. Being able to make 3D scans of objects, and then recreate them with a high degree of precision, means that the market for some useful manufactured objects might decrease, whenever a 3D model is made available. This is similar to the challenges the music industry believes they are facing with people being able to easily copy and share music files instead of being forced to buy their own copy of every song or album. One specific example is wargaming models such as ones from

Games Workshop (http://www.games-workshop.com). These small gaming models are expensive and only available from one manufacturer. If one could scan a completed model and then print out an entire army, it would save hundreds or thousands of dollars. I will not be revealing how much money I have invested in Games Workshop models!

The counterargument is that 3D printers are not yet, and may never be, a good solution for mass manufacture. They are (still) very expensive. High-resolution printers can cost thousands of dollars. The filament is expensive at about $40 a kilogram. Many prints fail for a variety of reasons. Home 3D printing is not in any way as cheap and easy as making a copy of a CD or DVD or MP3. Injection molding is still superior in terms of resolution. For mass manufacture, even a very expensive mold for an injection machine is the most profitable way to create objects for sale. In Games Workshop tabletop wargaming, it has always been acceptable to use scratch-built models instead of the purchased ones. The community standard is that if you have a proxy or a scratch-built model of the proper size it is a legitimate model and it can be used in a game. It would be considered poor form to show up with a 3D printed model that was an exact copy of the models offered by the company that makes the game because supporting the company means more versions and updates to the game. However, conversions and scratch building and now 3D modeling and printing are an accepted part of the gaming landscape. I've used 3D printing to make very successful custom characters and terrain for wargaming. It's quite enjoyable to field a model of your own design on the tiny battlefields of tabletop wargames such as Warhammer 40k. This is the same type of satisfaction that we feel when we put a custom-designed or homebrew rig on the air.

Elliptical Taper Horn Design

The next step in the project was to attempt to create a 3D model in software of a more complex horn.

There are many different types of tapers to choose from. The horn shape that gives minimum reflected power is an exponential taper (Bakshi, K.A.; A.V. Bakshi, U.A. Bakshi (2009). Antennas And Wave Propagation. Technical Publications. pp. 6.1–6.3. ISBN 81-8431-278-4). This means that this taper is the most efficient way to get the signal from the wire or waveguide into the air. Tapers also affect phase error. The waves are leaving the antenna as spherical waves. If the waves encounter straight sides, then parts of the wave will be reflected at slightly different times. See Figure 4 for a drawing that shows the phase error in a rectangular horn. Tapers that make an effort to comply with the spherical wave front have less phase error.
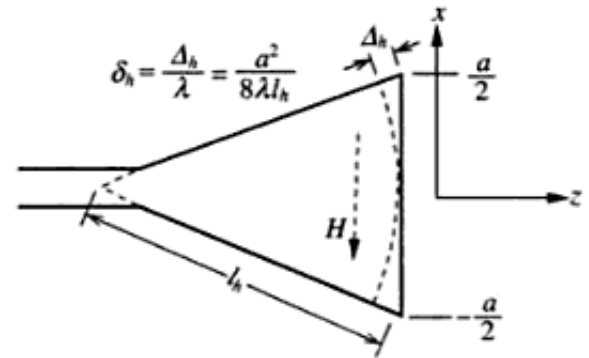

$$\delta_h = \frac{\Delta_h}{\lambda} = \frac{a^2}{8\lambda l_h}$$

Fig. 4.8 Phase Error of Pyramidal Horn Antenna Aperture (H-plane)

Figure 4

See Figure 5 for a comparison of many different tapers investigated by the audio horn community. This image was sourced from the discussion at http://www.diyaudio.com/forums/multi-way/248198-midbass-horn-35.html. Another type of taper is the elliptical taper. These horns are described in the literature as high performance. The claim is that the elliptically curved sides are more efficient, and have less phase error than an equivalent straight-sided horn.

I had recently read an essay about ellipses, so I decided to try to model an elliptically tapered horn. 3D modeling generally falls into one of two classifications. One is either defining the shapes with instructions, much like writing a computer program, or one is dragging and dropping, pushing and pulling various solids or meshes. Using OpenSCAD (http://www.openscad.org) I began to describe the shapes I wanted in OpenSCAD's scripting language. See Figure 6 for an example of what the 3D modeling workspace looks like.

For the elliptical horn, I decided to create the horn using four solid ellipses. These four solid ellipses had surfaces that would be the inside, or throat, of the horn. I then used the difference function in OpenSCAD to subtract a slightly smaller ellipse to turn the solid ellipses into a set of curved walls. This process is somewhat similar to using one layer of an onion, instead of the
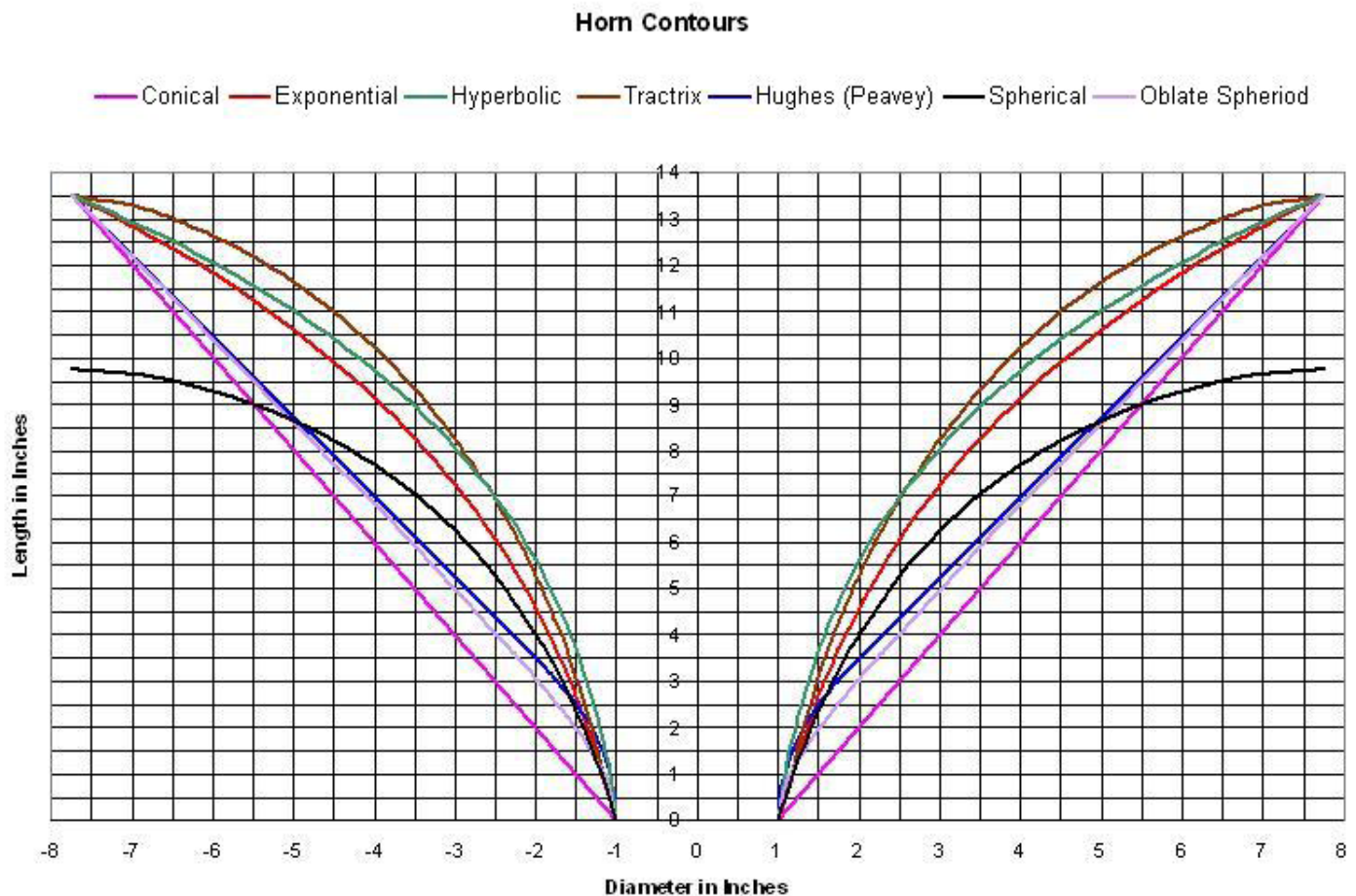
Horn Contours

Figure 5

entire onion.

It was then that I encountered one of many interesting problems with 3D modeling a complex shape. Simply scaling down the ellipse I wanted to subtract meant that the wall thickness was not constant. I had to scale the major and minor axes differently in order to have constant wall thickness. After that was fixed, the horn wall thickness was consistent, and attaching the SMA connector could be done with a greater amount of confidence. If the wall where the connector is attached isn't controlled in the model, it can end up being too thin to attach the connector. Screws might protrude into the throat of the horn, or the antenna might end up being too short or too long. Part of good 3D design, especially when the model is parameterized, is controlling the repercussions of changing the parameters. Code for all of the horns can be found at https://github.com/Abraxas3d.

Printing the Elliptical Horn
Each elliptical horn was printed in two pieces.

This was necessary because the dimensions of the elliptical horn were greater than the available print dimensions on the Ultimaker2. In Figure 6, one can see the transition from the waveguide/SMA portion of the antenna, to the tapered part of the antenna leading to the aperture. Where the color changes is where I separated the model in OpenSCAD.

I wanted to print the horn with the aperture facing up in order to make the inner surface as smooth as possible. I decided not to use support material for the outside surface, which would overhang to near horizontal at the aperture. Support material is a lacework of 3D printed filament that allows the printing of overhangs. Wherever the solid object has a horizontal part projecting into the air, support material is "grown" up from the platform so that the overhanging structure somewhere up above the platform has something to sit upon. It's somewhat like scaffolding when building a construction project. The decision to skip support material was somewhat risky because there is an overhang at the top of the print.
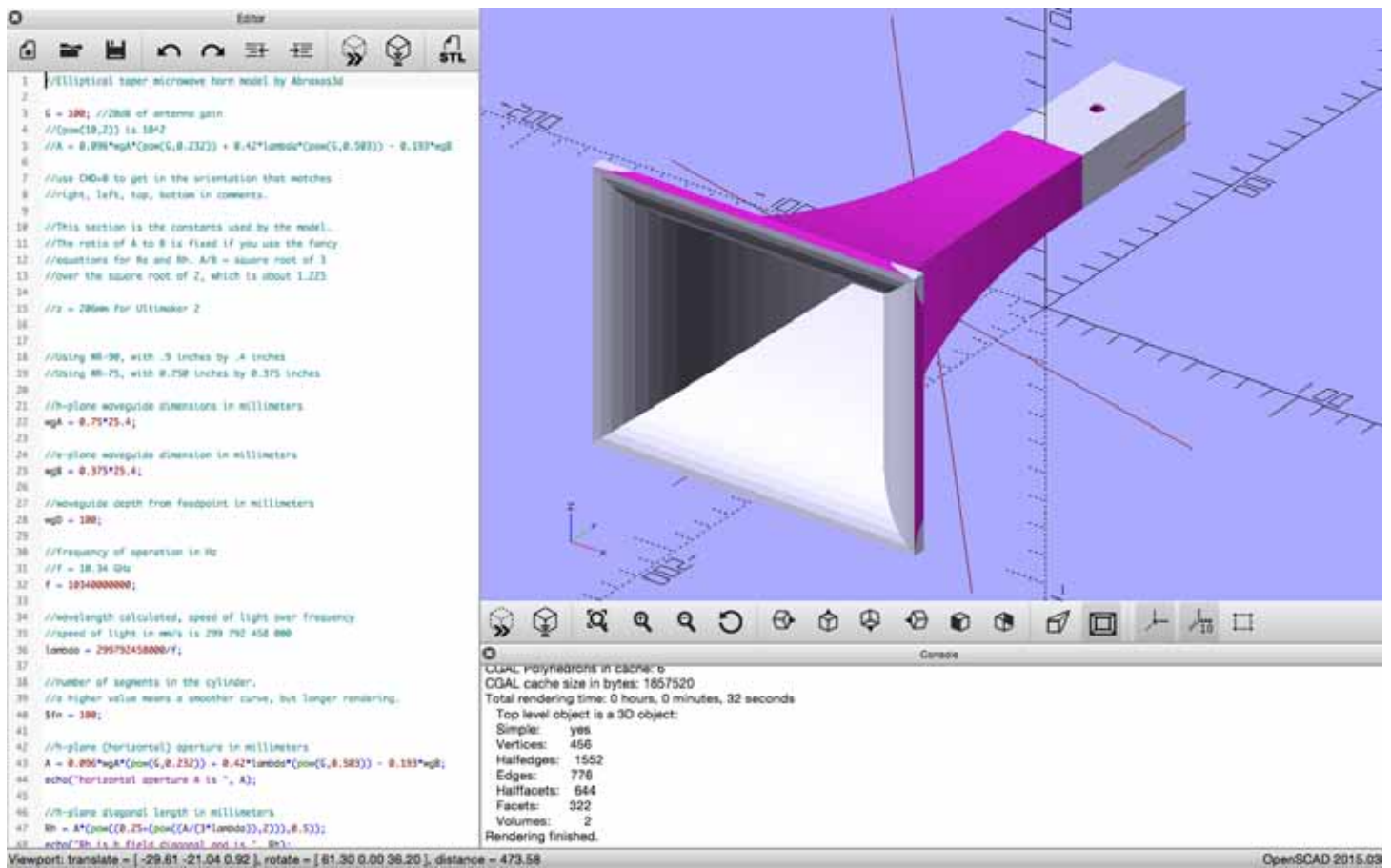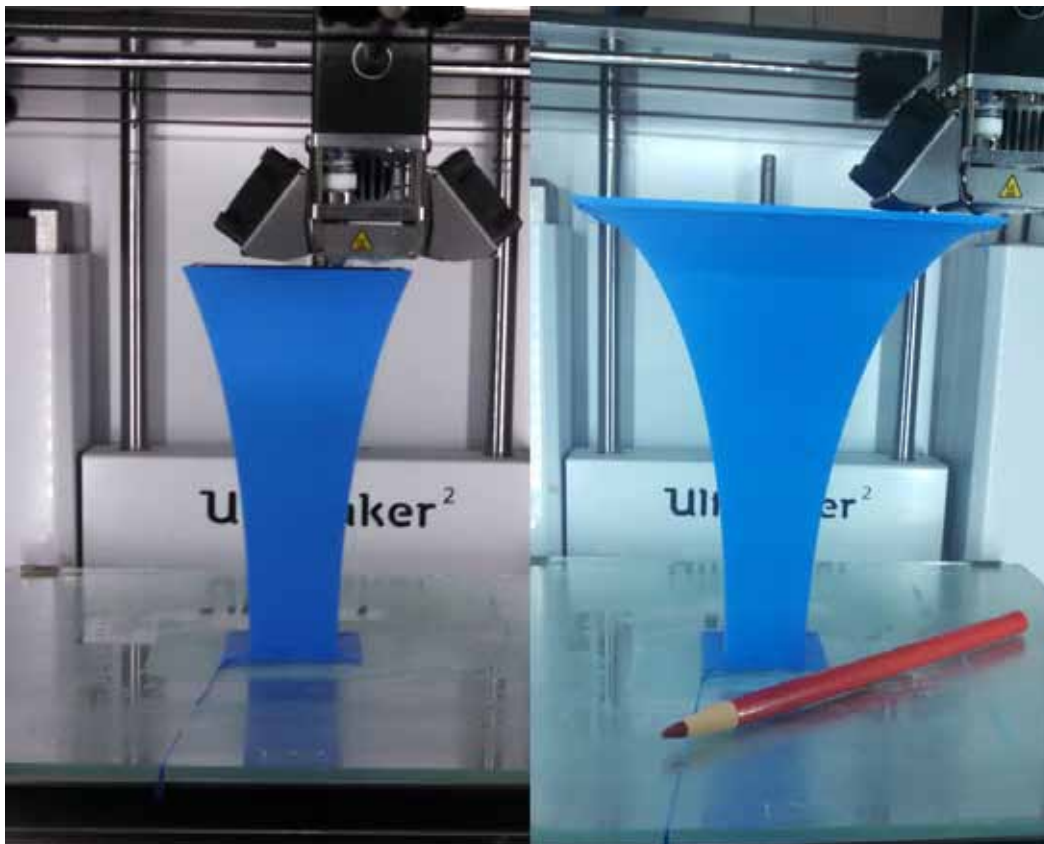
Figure 6

Figure 7

Figure 7 shows the print at two points in time. Pencil is for scale. On the left is the print at about the halfway point. On the right is the print nearly complete. Note some of the filament is loose on the overhang on the right-hand image. Support material prevents this. However, printing the amount of support material required for a tall print like this is risky as well. The lacework would have to print perfectly all the way up to meet the relatively small amount of overhang. The print took approximately 40 hours without support material. The driver software estimated 55 hours if support material had been included.

Two horns were successfully printed out of two attempts.

Figure 8

The four parts were metallized with conductive spray paint (MG Chemicals 843-340G Super Shield Silver Coated Copper Conductive Coating, 5-Ounce Aerosol, $40).

See Figure 8. Dinosaur is for scale.

The waveguide/SMA sections were then super-glued to the tapered sections.

Initial Testing of Rectangular and Elliptical Horns SMA connectors and advice were obtained from RF Parts in San Marcos, CA. Kerry Banke N6IZW assisted with installing SMA connectors for the 3D-printed rectangular horns as well as the 3D-printed elliptically tapered horns. We made initial measurements in his lab of both the rectangular and elliptically tapered horns. The first rectangular horn tested was one that didn't print well. I selected one that had voids and other problems with the print in order to test whether the conductive paint would work at all as a reflective surface at 10GHz. While confidence was high, and measured resistance was very low (1 Ohm across the horn), I didn't want to use one of the nicer prints if conductive paint would fail to properly metallize the printed shapes.

The backup plan was to apply copper foil to the surfaces of the horns. While this would be much more painstaking to apply, copper foil would definitely work. I knew this due to advice from Professor Nuno Borges Carvalho, from the Instituto de Telecomunicacoes, Universidade de Portugal. He presented extensively about 2D printed circuits and 3D printed horn antennas at the 3D printing workshop at IEEE Radio Wireless Week conference held in January 2015. He and his graduate students used copper foil to metallize their 3D printed 10GHz horn antennas. They are advocating for a two-part 3D printer that would metallize as part of the printing process.

The first thing we noticed when we tested the spray-painted rectangular horn is that I had neglected to paint the rear surface of the waveguide-shaped section of the rectangular antenna. I had painted the horn while it was sitting on its rear surface, so that part wasn't covered with the conductive paint.
A whole lot of signal was blasting out of both the front and back of the antenna. This gave us a lot of confidence that the conductive paint actually worked as a reflective surface. We added some foil to the back of the horn, and achieved 30dB front-to-back ratio. We removed the foil, painted the rear surface in the driveway with conductive paint and retested. The painted surface was now "closed" and reflected RF to the same level as the copper foil.

This particular rectangular antenna had several large voids in the layering of the print. Sniffing around with a probe revealed RF leaking through the void. Since we could literally see through this void to the other side, this result was not surprising.

The elliptical horns were painted with conductive paint only on the inside, with the SMA connector hole painted as well. This turned out to not be enough in order for them to work. I took back the horns and coated the outside of the horns as well.

N6IZW attached one horn with SMA to a network analyzer. It had a return loss of 15dB at 10GHz with large dips at 7.5GHz and 9GHz. Kerry removed the SMA connector and found that the conductive coating had not been sufficiently applied. Additional conductive material was added below the SMA and the dips were substantially reduced.

Gain was measured with comparison to a reference antenna and found to be at least 12dB.

The second elliptical horn had 0dB gain and was returned for more conductive coating.
The waveguide of the horn is designed to be WR-75, with inner dimensions of 0.750 inches by 0.375 inches. The dimensions of the waveguide affected the size of the horn, with WR-90 making the horn large enough in some dimensions to not fit as desired on the print surface. WR-75 was chosen because it was the smallest waveguide that would work on 10GHz and also allow the horn to print completely within desired printer dimensions. WR-75 works from 10.0 to 15.0 GHz. The next size up, WR-90, works from 8.20 to 12.40 GHz. WR-90 puts 10GHz much more comfortably in the middle of the range, at

the cost of making the print slightly larger. Some of the results that we were seeing could be due to choosing WR-75 over WR-90 for the prototype horns.

Range Party Results

An elliptical horn antenna was tested at the San Diego Microwave Group range party on 27 July 2015. Fourteen operators attended with gear covering 10-47GHz. The range tests include measuring output power and minimum discernible signal.

See Figure 9 for Kerry N6IZW holding up the elliptical taper 3D printed horn in operation at the range test.

This horn performed well at the range test. It was directional and had at least 12dB of gain. The second elliptical taper horn was re-painted and the SMA connecter re-seated. In late August 2015, this horn underwent further tests. Performance was not in line with the first horn, so the tapered part was separated from the waveguide and tested with a known good SMA to WR75 transition held firmly in place. The antenna worked well, achieving a gain of about 20 dB. The transition from taper to waveguide was determined to be problematic, even after rework. However, the antenna shape, surface texture and conductive coating all performed very well.

Suggested Improvements

Several improvements were suggested based on experiences with handling, printing, and testing the 3D printed 10GHz horns.

First, we should consider adding a radius to the corners in the model. The edges are all sharp. It would improve paint adherence to radius the corners without much cost in terms of gain or phase performance. This can be achieved with a relatively simple function in OpenSCAD. Second, we could print the model so that the horn is assembled around the SMA connector. The horn could be printed in pieces where the connector can be captured by the sides, instead of fitting through an SMA hole. With the current design, screws to hold the SMA connector are going into the surface of the 3D print. There is a layer of solid PLA for the outside wall of the print. However, the inside of these prints is a honeycomb. It's not solid plastic all the way through.

The amount of material used for a print is made at print time. In general, the outer walls are a few layers thick, and the interior is a honeycomb of about 20% material and 80% air. Rectangular and hexagonal honeycomb are the most popular. Printing a large object such as this horn in solid plastic would take a very large amount of additional print time and filament. I chose 25% fill for the honeycomb for these prototype horns. For an antenna with a connector, reinforcing the area where the holes for the SMA connectors go seems to be a necessary improvement. The area immediately around the SMA connector can be solid plastic all the way through without costing much additional printing time. This would improve the seating of the connector and reduce unreliability of this particular interface.

However, we came to believe that printing horn antennas that directly connect to a waveguide with a flange would be superior to attempting to incorporate an SMA connector. This leads to the next suggested improvement.

Third, we explored the idea of building in an RF choke flange into the design wherever a transition was required. This would improve the reliability of any interface, whether the transitions were due to having a multi-part print or when the horn was designed to attach to a waveguide.

Conclusion

Rectangular and elliptical taper 3D-printed 10GHz horn antennas were designed, printed, metallized, and tested. 3D printing technology can be used to create complex tapers for 10GHz horn antenna experimentation.

It is believed that the reliability of the horns can be improved by making the improvements discussed in this paper. Future work will implement these improvements.

Figure 9

Microwave Update - K6AH

AMATEUR RADIO EMERGENCY DATA NETWORK
AT THE CENTER OF EMERGENCY COMMUNICATIONS PREPAREDNESS

Andre Hansen, K6AH
The AREDN Project (aredn.org)
2113 Via Monserate
Fallbrook, CA 92028
k6ah@arrl.net

Abstract

Mesh technology has been around for ten years or more. Over the past two years a team of developers has advanced the art by porting Broadband-Hamnet's extremely popular mesh firmware to the Ubiquiti airMAX line of commercial Wireless ISP routers and expanded its utility across a wide range of microwave bands. This has literally changed the complexion of mesh technology from an experimental, hobby-oriented, novelty into a viable alternative network suitable for restoring some degree of Inter/intra-net connectivity "when all else fails."

In the midst of this work the AREDN Project was kicked off to focus development on taking this technology to the next level in EMCOMM communications.

This paper begins with an introduction to the AREDN Project and mesh networking and concludes with a roadmap for the Project's future. It dives into implementation techniques and aggressive plans to implement across broad portions of the Southwestern US.

Keywords: AREDN, EMCOMM, mesh, BBHN

The AREDN Project

Background

The ARDEN Project has its roots in the ARRL's 2001 Technology Task Force headed by John Champa, K8OCL (SK) to explore the development of High Speed Digital Mesh Networks for the Amateur Service. For many years the HSMM / Broadband Hamnet (BBHN) group carried the torch for Amateur mesh technology, making creative use of the familiar Linksys desktop WiFi routers as a means of demonstrating the utility of the technology.

It became popular quickly… but for years that is where the technology stood… being utilized perhaps for Field Day logging, support of local runs and races, personal security camera networks and extending in-home LAN services out to the shack. The home/office nature of the hardware did not lend itself to the more robust network designs required for EmComm to really embrace it.

Then in 2013, Conrad, KG6JEI, and the author, K6AH, offered to develop BBHN software for commercial routers in use within the Wireless ISP industry. These environmentally robust devices were ideally suited for towers and mountain-top deployments.

The first commercial devices to leverage the new strategy in 2013 were in the Ubiquiti AirMax 2.4 GHz line in release 1.01. Operating on channels shared with WiFi routers, the RF spectrum was crowded, but it worked… often over link-distances of 20+ miles.

This literally changed the complexion of Broadband Hamnet from an experimental, hobby-oriented, novelty into a viable alternative network suitable for restoring some degree of Inter/intra-net connectivity when "all else fails." Emcomm finally had what was needed to exploit this technology.

Since then the team has been augmented with other developers: Joe, AE6XE, Darryl, K5DLQ, and Randy, WU2S, and the technology has been extended beyond 2.4 GHz to the 900 MHz, 3 GHz, and 5 GHz bands and to a variety of bandwidths and channels, many entirely within the ham bands. As you will see, this technology works very well now and is ready for production EmComm deployment.

Due in large part to the EmComm passion Conrad and the author brought to the project, the pressures the original BBHN group was getting from their "legacy" Linksys user community, and the resultant lack of focus EmComm was getting, the development team made the tough decision to spin up a separate AREDN Project to focus strictly on supporting the EmComm implementation of this technology. The software is Open Source under the GPLv3 license, and to this point at least, BBHN continues to utilize this team's software in their own offering.

Objectives

So the AREDN Project's focus is EmComm. It seeks to provide hams a means to implement this technology in practical ways to support local and regional emergency communications needs. To that end, the project's primary focus is on:

- Refining the software to make implementation easier, more reliable, and more manageable
- Expanding the range of equipment the software runs on, particularly where it adds new utility
- Exploiting what has already been proven
- Defining standards for inter-network integration
- Exploiting the strength of the technology and championing it where it is best suited
- Supporting those in the process of designing and implementing EmComm networks
- Providing an Open Source, collaborative environment for technically qualified hams wishing to contribute

The project typically does not:

- Experiment with other techniques and technologies unless it becomes necessary to fulfill its objectives
- Support the non-EmComm mesh user community
- Support the earlier Linksys device

Team Composition

The team is currently comprised of:

- Conrad, KG6JEI, the primary architect and lead software developer
- Joe, AE6XE, software developer working primarily on the User Interface; technical strategist
- Darryl, K5DLQ, software developer working primarily of peripheral features and functionality

- Randy, WU2S, Webmaster, as well as team and technology promotion
- Gordon, W2TTT, ARRL and regulatory liaison, tactician

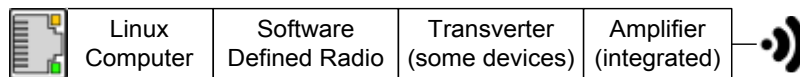- Andre, K6AH, project evangelist, project manager, and spokesperson

Mesh Technology

Brief Introduction

AREDN is an RF network mesh of radio/routers operating under the FCC rules, Part 97 in the ham microwave bands, controlled by hams with a Tech license or higher. It's a high-speed data network capable of rates of 54 Mbps and greater, designed to provide a TCP/IP medium when other network infrastructure has failed. While technically capable, it is not intended to be a general Internet access alternative.

AREDN software replaces the manufacturer's device operating system, repurposing the hardware for a new set of objectives.

The diagram illustrates the functional elements of the hardware:

| | Linux Computer | Software Defined Radio | Transverter (some devices) | Amplifier (integrated) | ·)) |

The Ethernet interface on the left provides a means of connecting to and communicating with the device locally. VLAN techniques are used in conjunction with a compatible outboard Ethernet Switch to distinguish LAN, WAN, node-to-node traffic, from local access to a Linux computer which executes the AREDN software. The AREDN code controls a Software Defined Radio, based one of several chips in Qualcomm's Atheros 802.11 wireless portfolio. In some cases a transverter is used to move the device to another band. Such is the case for Ubiquiti's 3 GHz line, which are based on their 5 GHz devices transverted 2 GHz down to 3 GHz.

In some cases the Atheros native RF power output is augmented with an integrated RF linear amplifier, giving these devices a respectable output of from 23 to 28 dBm (200mW – 630mW).

The hardware is manufactured using components with a wide environmental range (-40° to 176°F), and packaged to withstand weather extremes.

Figure 1 - Ubiquiti AirMax product line

Software Components

The software is comprised of:

- Graphical User Interface (GUI) – A web browser-based system providing access to mesh management tools and manually configurable parameters such as Ham Callsign, RF channel, bandwidth, etc.
- OpenWRT – the core routing utility which frees the project from having to deal with the unique nuances of the disparate devices on which our software runs. This core empowers us to use these devices in ways never envisioned by the manufacturer.
- An auto configuration utility – A key advantage of AREDN/BBHN software is that it automatically configures network operating parameters, so one doesn't need to know very much about the operating environment or networking in general, to deploy ad hoc nodes during an emergency.
- Optimized Link-State Routing (OLSR) – A mesh routing protocol which determines the most efficient way of sending data through the network. The quality of each link is propagated throughout the mesh giving all nodes the ability to determine these best routes.
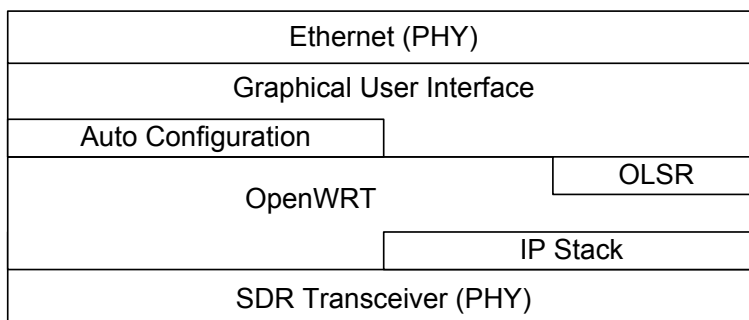
Ethernet (PHY)		
Graphical User Interface		
Auto Configuration		
OpenWRT		OLSR
		IP Stack
SDR Transceiver (PHY)		

Figure 2 - The Software stack book-ended by the physical interfaces

How it Works

Mesh routing protocols are evolving and OLSR is being used not so much because the team has done an exhaustive examination of the alternatives, but because it was inherited from the BBHN legacy system and there has been no compelling reason to revisit the choice. Should another routing protocol prove better suited for the project's purposes, then we would surely look at it. Again here, the project doesn't spend a lot of time experimenting with other techniques and technologies unless it becomes necessary to fulfill its objectives. We do keep an eye on protocol competitions such as Wireless Battlemesh (battlemesh.org).

Here's a high-level description of how the system works:

In the Standard WiFi diagram below, we see two distinct "domains." The User domain includes both wired and wireless devices. These are all in the same address space and nothing distinguishes them aside from how they connect to the WiFi router.

The second domain is for the Internet. You will note a firewall protects the User domain from unauthorized access and other threats from this external domain.
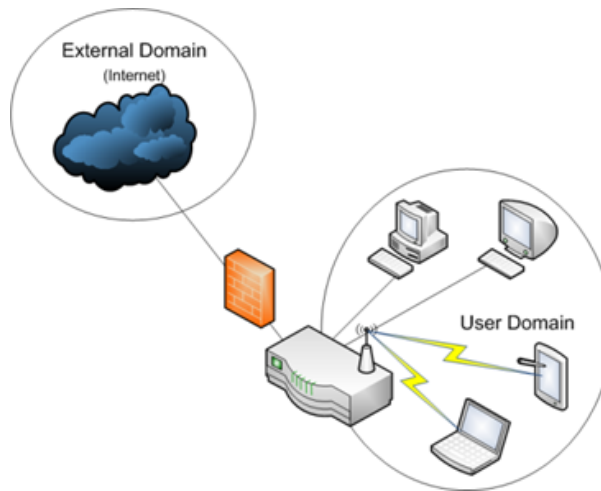

Figure 3 - Standard WiFi

In the repurposed AREDN software model illustrated below, the two domains in the Standard WIFI diagram have now become three. We see the familiar external and user domains... although the user domain now contains computers which deliver services such as email, FTP, VoIP, chat, etc.

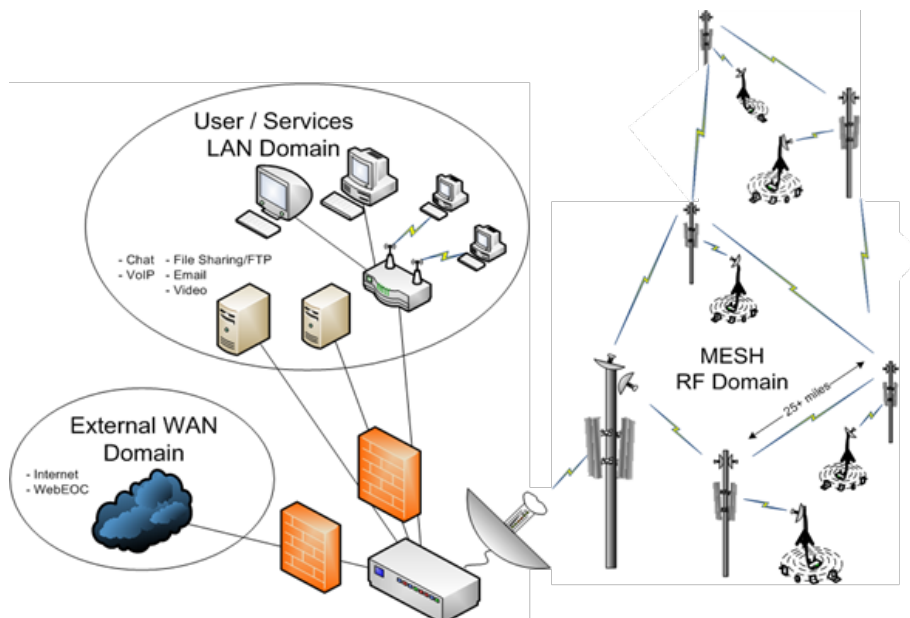The new domain here is an RF mesh network which forms the business end of the AREDN technology.

Figure 4 - Repurposed with AREDN Software

SCOPE page 45

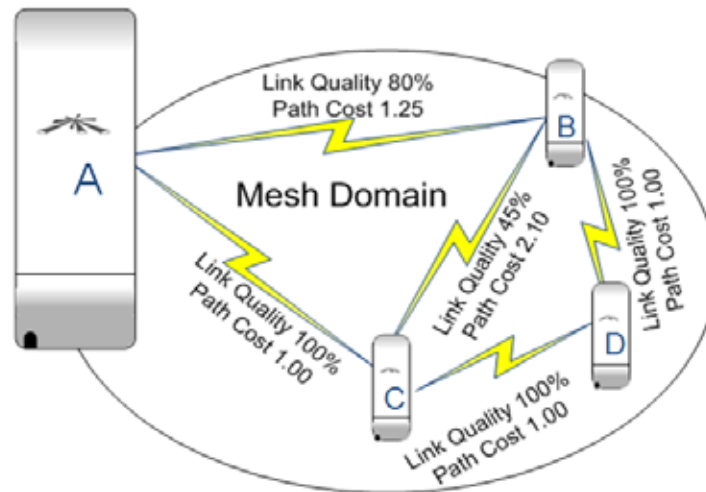The four devices, all Ubiquiti NanoStations, illustrated below have formed a "mesh."

Figure 5 - OLSR Routing

The route data will take through this network is dependent on the reliability of the links between them. Note the link between Node A and Node B. Through historical broadcast reception, Node A knows that 80% of the data from Node B is received without error… it is said to have an 80% Link Quality (LQ). Based on this, it assigns a "cost" to that link which is inversely proportional: $1.25 in this case. All traffic from A to B will take this path, because there are no less expensive routes available.

If the link between A and B where to fail, then Node A would quickly calculate an new lowest-cost path. Two are available for it to evaluate:

- Path A-C-B at a cost of $1.00 + $2.10=$3.10
- Path A-C-D-B at a cost of $1.00 + $1.00 +$1.00= $3.00

Node A's routing table is updated with the new optimal path of A-C-D-B. These updates are performed multiple times each second, with routing table propagations through the mesh taking some amount of additional time depending on the size of the mesh.

The Graphical User Interface is generated using HTTP by the AREDN software running on the embedded Linux computer. The GUI provides access to a variety of administrative and operational functions, such as:

- Checking for traffic / congestion on the channel
- Reporting the current node status and other nodes both directly or indirectly connected
- Basic node configuration settings

- More advanced administrative setting for
    - Port Forwarding / DHCP / Advertised Services
    - Network Address Translations for complex network environments
    - Updating the AREDN firmware
    - Installing useful service packages on the node

Strengths (and limitations) of the Technology

The AREDN system utilizes the CSMA/CA (Carrier Sense Multiple Access / Collision Avoidance) transmission control protocol to gain access to the air (the RF ether). I have heard this is analogous to polite people sitting around a table talking---'polite' being the operative word here. It's well suited for many nodes that can all hear each other and very well suited for accommodating newcomers to the table. These are exactly the attributes we want, because we don't know who might join the network, and we have no idea how much of the network they might demand for their traffic. Such a protocol is also good at handling random channel access, nodes coming/going and being moved around.

In contrast, the TDMA (Time Division Multiple Access) protocol, as the name suggests, assigns time slices for each neighboring node. When a new node join the network, the time gets divided among the now larger group with the effect of allocating less time for everyone. While TDMA implementations are generally proprietary to a given manufacturer, they typically have some means of manually or dynamically adjusting time slice sizes bases on link bandwidth requirements. TDMA is preferred for static networks where little change occurs in the network topology. TDMA would not be suitable for ad hoc, mesh networks.

The other major strength of the AREDN/BBHN technology is the automated configuration of the node's network parameters. A ham need know nothing about the network he/she wants to connect other than the channel to use and the bandwidth which are established in advance or conveyed over radio in a deployment. The nodes IP address, net mask, gateway, etc. are determined by the software and assured to be unique throughout the network. This significantly speeds deployment and virtually eliminates concerns over multiple devices having the same address. This is accomplished using the devices MAC address to compute a unique address in the 10.X.X.X address space.

Network Design

Choosing Devices

Ubiquiti airMAX M-series wireless routers obtain their operating power from the CAT5 cabling (PoE or Power over Ethernet). They have a broad DC input voltage specification to accommodate the voltage drop over a wide range of cable lengths which may be required for tower applications: 10.5 to 24VDC at the CAT5 connector.

Many utilize a combination of horizontal and vertically polarized antenna to minimize unwanted interference from on-channel or adjacent channel WiFi noise. When conditions allow, they also support the combining of these polarizations for increased data throughput—called MIMO (Multi-In, Multi-Out).

Here are a few representative devices and characteristic selection criteria:

- o Rocket – A two RF port MIMO node (500mW) that is "plug and play" with a variety of Ubiquiti antenna systems: 90° and 120° Sector antenna, Dual-polarization Verticals, and 30-34dBi Dish antenna. Note that MIMO nodes split the power between the vertical and horizontal domains.
- o Bullet – A single RF port high-power (600mW), non-MIMO node with an N-Type female connector suitable for direct connection to many 3rd party antennas. With the right antenna this could achieve link distances of 50+ km.
- o NanoStation – A fully contained node with an internal 11dBi patch antenna and a 45° coverage pattern.
- o airGrid – A larger node available in several size/gain grid-reflector antenna configurations. Designed to be a highly directive, it performs at a range of from 10 to 30 km

In planning to deploy the core nodes it is advisable to use propagation prediction software such as Radio Mobile to avoid the hassle and expense of experimentation.

I will diverge for a bit for the benefit of those unfamiliar with this type or software.

Radio Mobile is a free propagation simulation system. It utilizes data from the Space Shuttle Radar Terrain Mapping Mission (SRTM) resulting in elevation contours which have then been overlaid with satellite imaging and road maps. It further utilizes the Longley-Rice radio propagation prediction method, which computes the attenuation of radio signals using an "irregular terrain model"… a technique that has been successfully used in commercial radio coverage planning since the 1960's.

It is available both as a software download and a Web-based tool. While the download results in a more flexible tool, its installation is not for the faint-of-heart. I would advise that, if you do not consider yourself a computer expert, then the Web-based tool will more than adequately meet your needs. The English language portal is at: http://www.cplus.org/rmw/english1.html

Sufficient use of this tool to explore the variables of band, node-model receiver sensitivity, and node-model power output, will result in the required antenna gain in either point-to-point (PtP) or point-to-multi-point (PtMP) topologies.

Conceptual Network Design

One conceptual model, currently being implemented in San Diego and Imperial Counties, incorporates both mesh and traditional backbone elements.

Taking a layered look at it, the top level I will refer to as the backbone.
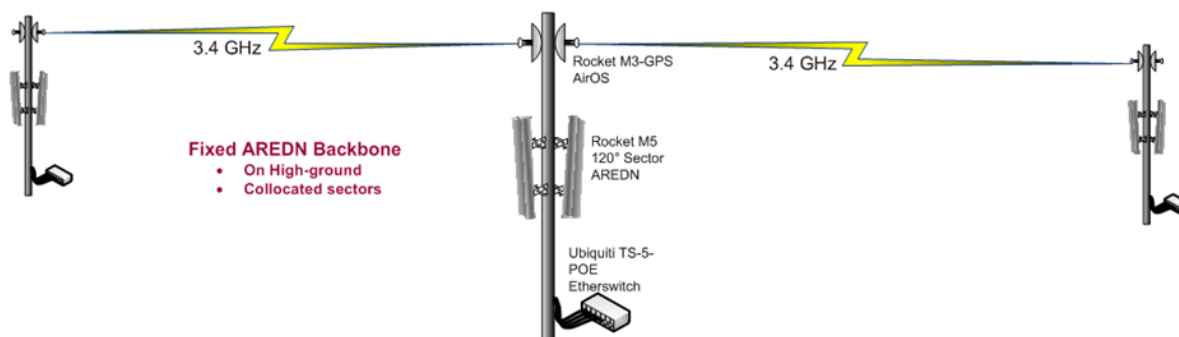
It's comprised of Ubiquiti 3 GHz "Rocket" nodes coupled to a 2' diameter, RocketDish (26dBi). They are loaded with Ubiquiti's factory software and are configured to use TDMA for their transmission control protocol. Under typical conditions they will use 20 MHZ of bandwidth, but under ideal conditions, will double their throughput by establishing independent data paths on the vertical and horizontal polarization axes.

Figure 6 - Ubiquiti RocketDish and Sector antennas

These devices comfortably span links of 50 miles and beyond, supporting multi-megabit to fractional gigabit data rates. Note that these are fixed installations with care taken to align their narrow beamwidths. 3 GHz is chosen to avoid competition and interference from commercial installations generally found on the same towers/mountaintops. This band has no commercial allocations within the US and, when coordinated with other ham users, can be an outstanding medium for long-haul links.

	Channel	76	77	78	79	80	81	82	83	84	85	86	87
3.4 GHz	Status	Ham Band											
	Freq	3.380	3.385	3.390	3.395	3.400	3.405	3.410	3.415	3.420	3.425	3.430	3.435

	88	89	90	91	92	93	94	95	96	97	98	99
Status	Ham Band											
Freq	3.440	3.445	3.450	3.455	3.460	3.465	3.470	3.475	3.480	3.485	3.490	3.495

Figure 7 - AREDN supported channels in the 3 GHz ham band

The objective of this backbone layer is to deliver the network to the next layer down which they typically do using sector antennas and again, Rocket nodes. This configuration covers a 120° "swatch" from the horizon to 7 degree below the horizon making them ideally suited for mountain top installations.
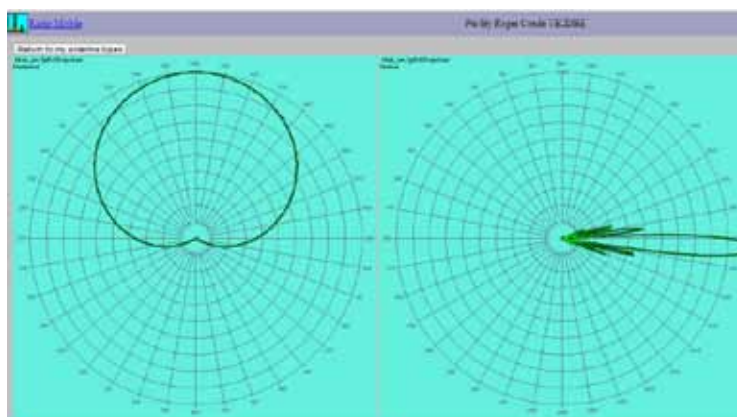
The sector antenna can be tilted to optimize a particular coverage area. Here's an example of one such San Diego installation plotted in Radio Mobile to predict its coverage.
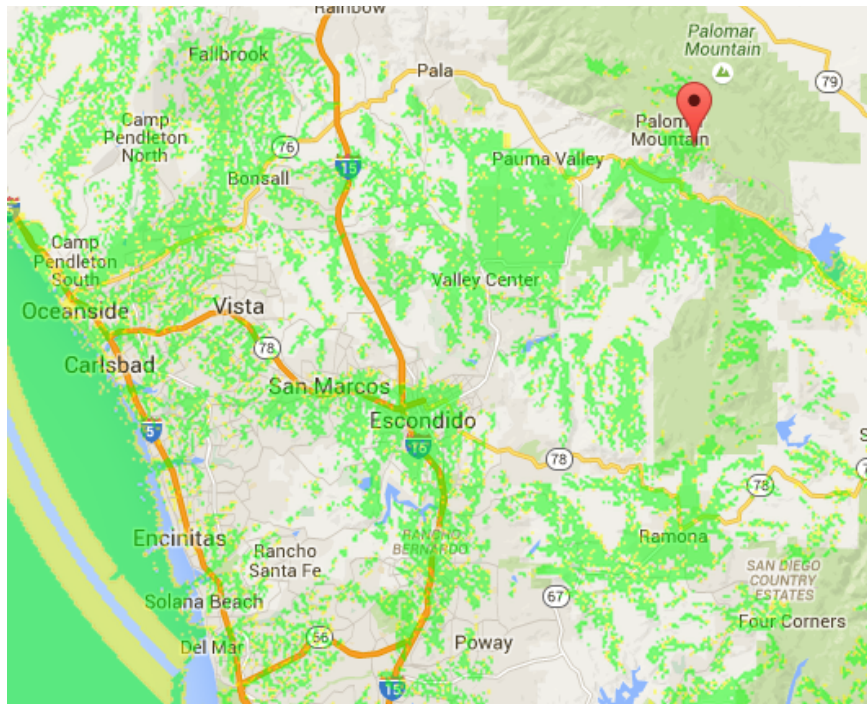
The green shade identifies locations suitable for the next layer of the network, the Mid-Mile nodes:
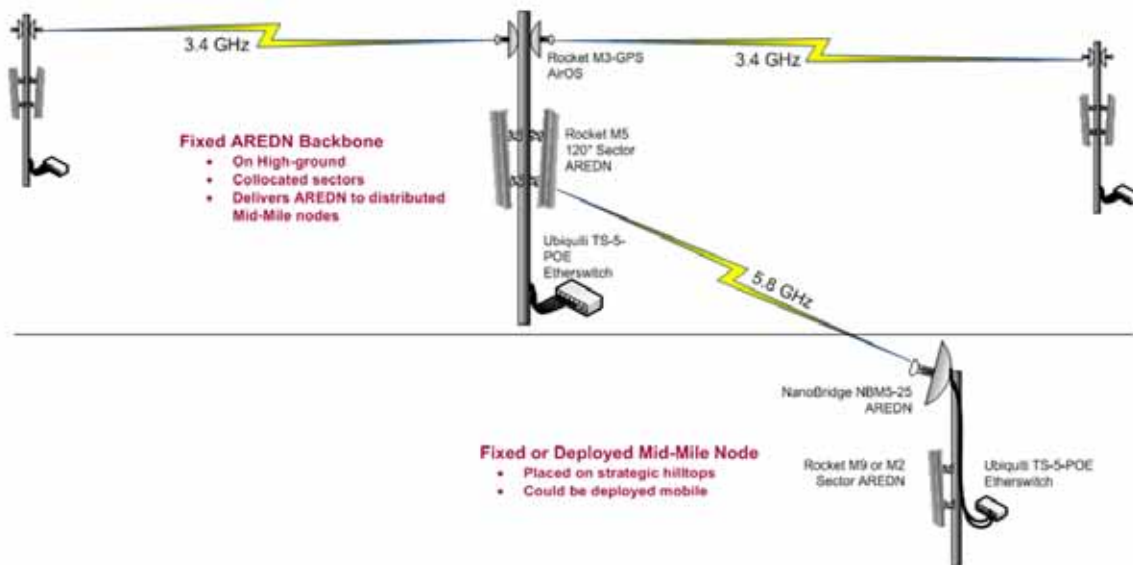
These nodes serve as relays connecting the backbone to the served agency and deployed hams in the next layer, down. They can be either fixed or deployed based on an agency's needs and ham communications plan. They typically have a high-gain antenna pointed up to the backbone layer and again utilize a sector antenna to distribute the AREDN-developed mesh network to the lowest layer. The 5 GHz band is chosen due to the availability of a relatively large ham-only sub-band and the lower cost of these devices.

<table>
<tr><td rowspan="13">5.8 GHz</td><td>Channel</td><td>133</td><td>134</td><td>135</td><td>136</td><td>137</td><td>138</td><td>139</td><td>140</td><td>141</td><td>142</td><td>143</td><td>144</td><td>145</td></tr>
<tr><td>Status</td><td colspan="13">Shared Ham and ISM/WiFi Band</td></tr>
<tr><td>Freq</td><td>5.665</td><td>5.670</td><td>5.675</td><td>5.680</td><td>5.685</td><td>5.690</td><td>5.695</td><td>5.700</td><td>5.705</td><td>5.710</td><td>5.715</td><td>5.720</td><td>5.725</td></tr>
<tr><td></td><td>146</td><td>147</td><td>148</td><td>149</td><td>150</td><td>151</td><td>152</td><td>153</td><td>154</td><td>155</td><td>156</td><td>157</td><td>158</td></tr>
<tr><td></td><td colspan="13">Shared Ham and ISM/WiFi Band</td></tr>
<tr><td></td><td>5.730</td><td>5.735</td><td>5.740</td><td>5.745</td><td>5.750</td><td>5.755</td><td>5.760</td><td>5.765</td><td>5.770</td><td>5.775</td><td>5.780</td><td>5.785</td><td>5.790</td></tr>
<tr><td></td><td>159</td><td>160</td><td>161</td><td>162</td><td>163</td><td>164</td><td>165</td><td>166</td><td>167</td><td>168</td><td>169</td><td>170</td><td>171</td></tr>
<tr><td></td><td colspan="13">Shared Ham and ISM/WiFi Band</td></tr>
<tr><td></td><td>5.795</td><td>5.800</td><td>5.805</td><td>5.810</td><td>5.815</td><td>5.820</td><td>5.825</td><td>5.830</td><td>5.835</td><td>5.840</td><td>5.845</td><td>5.850</td><td>5.855</td></tr>
<tr><td></td><td>172</td><td>173</td><td>174</td><td>175</td><td>176</td><td>177</td><td>178</td><td>179</td><td>180</td><td>181</td><td>182</td><td>183</td><td>184</td></tr>
<tr><td></td><td colspan="13">Ham Band</td></tr>
<tr><td></td><td>5.860</td><td>5.865</td><td>5.870</td><td>5.875</td><td>5.880</td><td>5.885</td><td>5.890</td><td>5.895</td><td>5.900</td><td>5.905</td><td>5.910</td><td>5.915</td><td>5.920</td></tr>
</table>

Figure 8 - AREDN supported channels in the 5 GHz ham band

The lowest layer is comprised of users connected to the network via deployed ham resources. These devices also use AREDN-developed mesh software and auto-configure the node is configured to the prearranged channel and bandwidth… which is typically channel -2 with a bandwidth of 5 MHz. These are chosen due to the lack of congestion found in the shared sub-band. This gives users between 1-1.5 Mbps of data bandwidth based on last-mile link quality.

<table>
<tr><td rowspan="3">2.4 GHz</td><td>Channel</td><td>-2</td><td>-1</td><td>0*</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Status</td><td colspan="2">Ham Band</td><td></td><td colspan="6">Shared Ham and ISM/WiFi Band</td></tr>
<tr><td>Freq</td><td>2.397</td><td>2.402</td><td>2.407</td><td>2.412</td><td>2.417</td><td>2.422</td><td>2.427</td><td>2.432</td><td>2.437</td></tr>
</table>

*Not available for use

Figure 9 - AREDN supported channels in the 2 GHz ham band

One last comment on the conceptual network design…
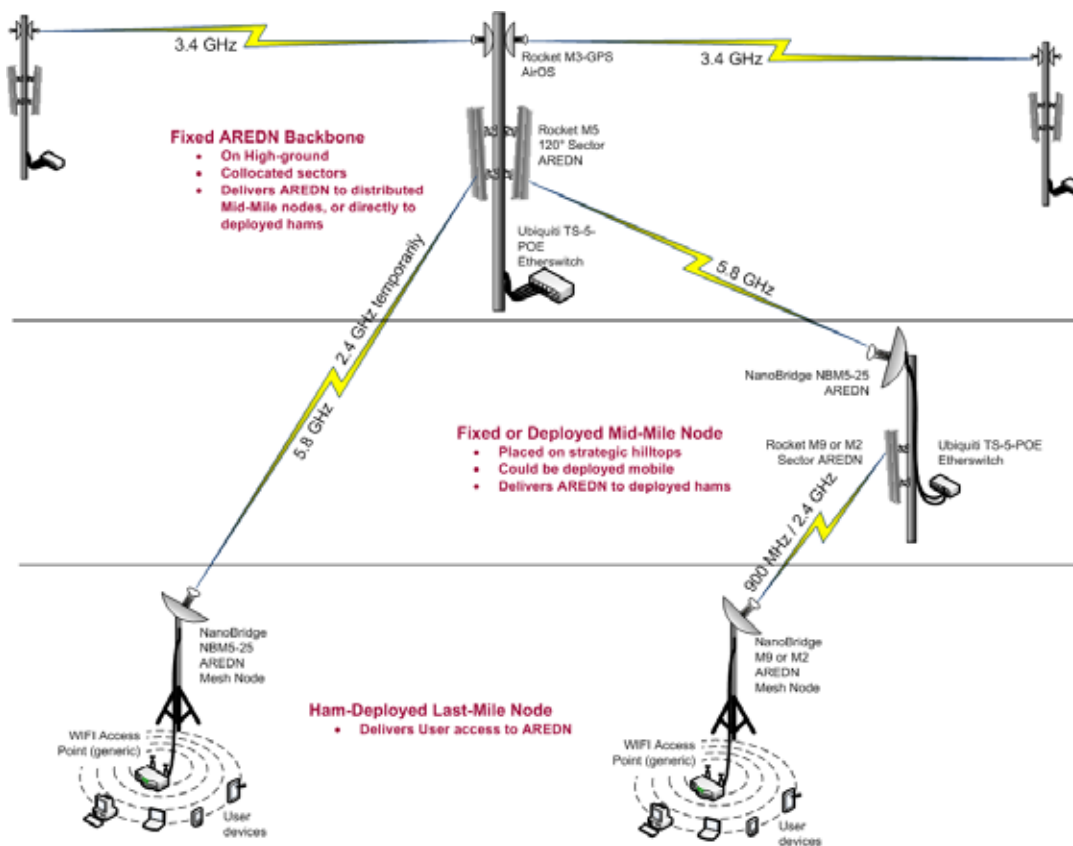
Deployed hams may also elect to connected directly to the backbone should that link prove possible. The San Diego implementation supports this through backbone sectors nodes on each of 5 GHz and 2 GHz. This also tends to allow more hams to connect to the network while mid-mile nodes are being deployed---which can take time considering the many property arrangements and the considerable equipment expense.

Practical EmComm Uses

Restoration of email is the single biggest benefit of the network. There are several other less-obvious applications users will find useful.

For users who have brought their own PC:

- Pre-defined Client (EOC, Red Cross, etc.) Services
- Skype-like video conferencing (when cost/benefit justified)
- Voice over IP calling to similarly configured PCs within the network

Users who have brought their own smartphone:

- SIP-based direct-dial calling to similarly configured smartphones within the network
- Gateway to PSTN when Internet is available to a node
- Chat, video (when cost/benefit justified)
- Pre-defined Client (EOC, Red Cross, etc.) Services

Implementation

Here is a collection of photos and diagrams illustrating AREDN Implementations
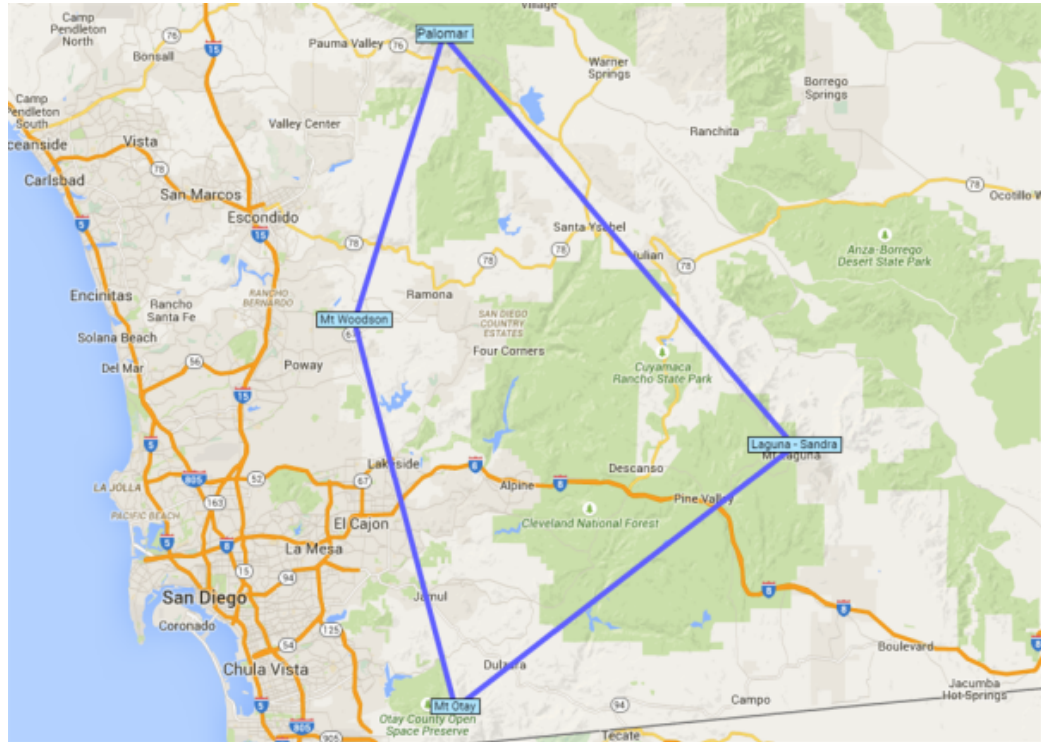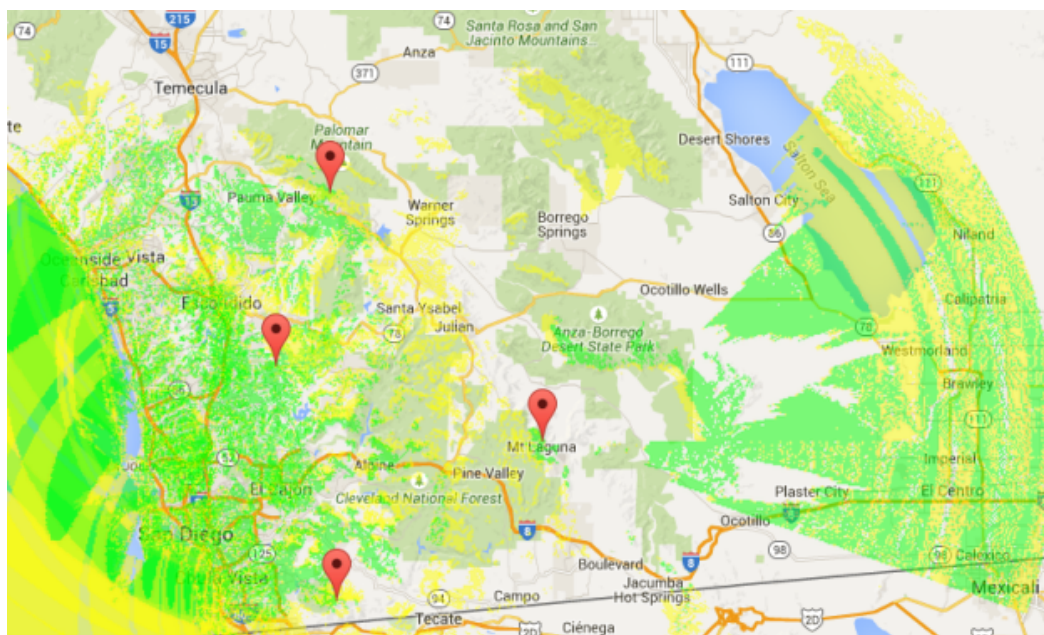

Figure 10 - San Diego Backbone links

Figure 7 – San Diego 5 GHz Backbone Downlinks

Figure 11 - Mid-mile node "in the wild"

Figure 12 - Another mid-mile node "in the wild"

Figure 13 - Pleasant Peak backbone site

Figure 14 - Mid-mile sites need not be complicated

Figure 15 - Qualcomm mid-mile site

Figure 17 - Security is a consideration when deploying nodes "in the wild"

Figure 16 - Bonsall mid-mile node

Figure 18 - Deployable network access

Looking Forward

Regional implementations

Regional implementations are now in process in many western California counties, with planned coverages into all or significant parts of San Diego, Imperial, Riverside, San Bernardino, Kern, Orange, Los Angeles, Ventura, Santa Barbara, San Luis Obispo, Monterey, Santa Cruz, Santa Clara, San Mateo, and Alameda.

Regional Integration

Representatives from these initiatives have begun to discuss network integration standards with the objective of building one seamless network throughout the Southwest US where deployed hams with AREDN mesh nodes can provide EmComm services to disaster agencies.
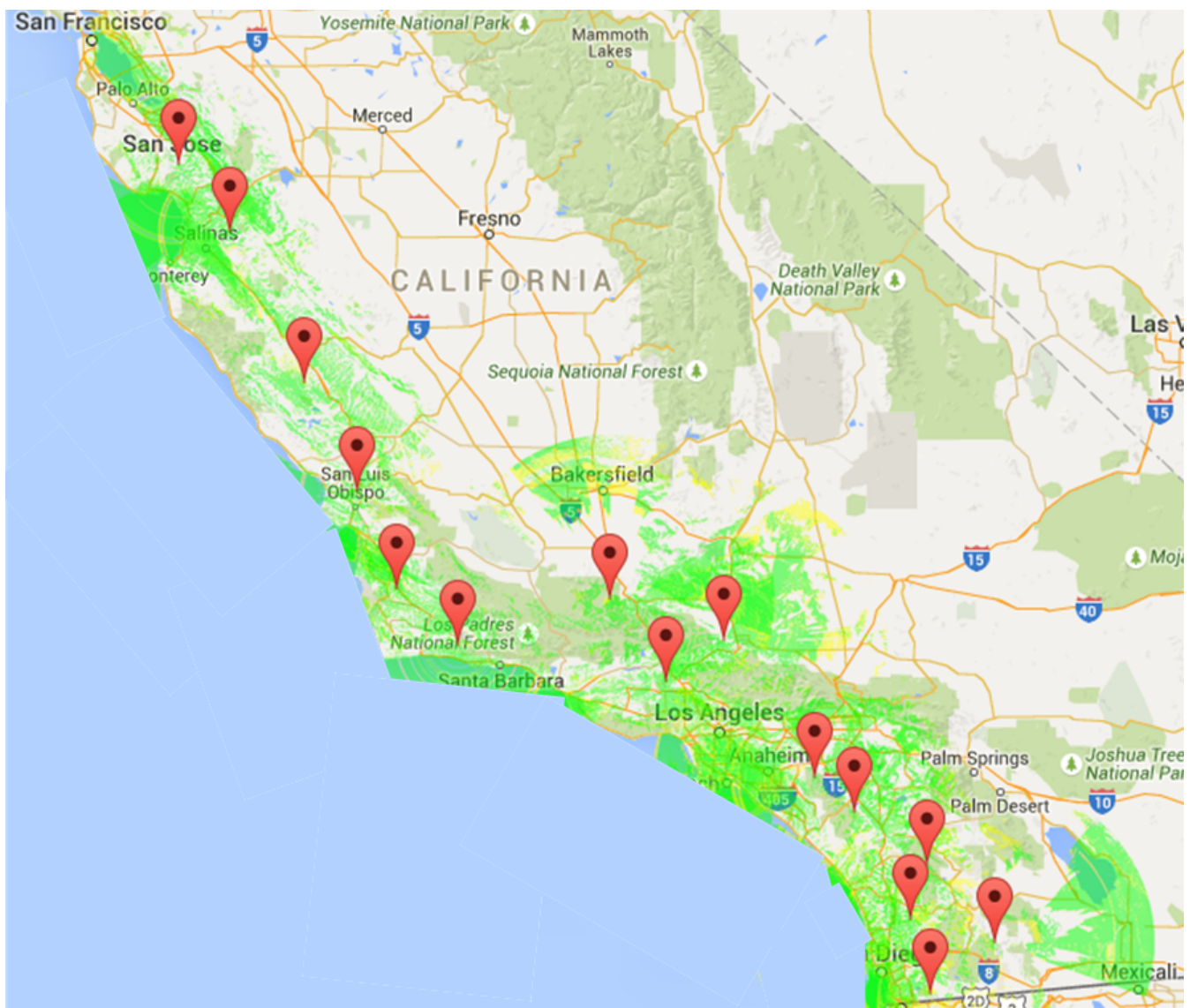
Figure 19 – Initial estimate of the potential West Coast mid-mile node coverage

Development Priorities

The AREDN Project continues work on improving its product with the following priorities:

- Network Monitoring/Management – The current beta release, 3.15.1.0b02 includes support for Simple Network Management Protocol (SNMP) providing operational metrics to most commercially available Network Management System (NMS). While usable in this fashion, this priority adds a custom Management Information Base (MIB) for parameters unique to AREDN nodes.
- Quality of Service (QoS) – This priority recognizes the need to differentiate and prioritize critical traffic. Real EmComm traffic is more important than general ham traffic, thus should be provided a higher-level of service through the network. As it exists today, all traffic receives the same treatment.
- Support for a broader collection of Ubiquiti hardware – This manufacturer made a major change to their physical hardware last year which is not yet supported by AREDN (or any other mesh system for that matter).
- A more advanced, flexible, Graphical User Interface – The great majority of our users won't require more than what is already provided in the AREDN GUI. However, there is a group of sophisticated users who deserve the ability to configure the more advanced operational parameters.

Challenges

- Software Configuration Control – It would appear the FCC doesn't want the OpenSource community installing code on commercial routers. This proposed rulemaking requires manufacturers to lock down their devices to prevent the software from being replaced. This could have a dramatic effect on the AREDN / BBHN projects, essentially forcing us to design and build our own hardware.
- Citizens Broadband Radio Service (CBRS) – this is a shared spectrum allocation recently announced that carves out 3550-3700 MHz for mobile broadband and commercial use. How this might impact the AREDN Project is not yet clear.
- Impact on other ham operations – Due to the low power densities involved in mesh technology, interference sounds a lot like low-level noise. The team recognizes that broad acceptance of this technology will tend to raise the overall noise floor for all hams that utilize the microwave bands. While we seek to be good stewards of these resources, inevitably there will be conflicts which will need to been discussed, addressed, and overcome.

Conclusion

There are a variety of mesh network systems today. AREDN is unique in that it operates in Part 97 under the authorizations inherent in our Amateur license grant. It is easy to configure and is deployable by hams to served agencies without any knowledge of data networking or the design of the mesh to which their node is being connected. It can be used to provide a variety of IP-based services or to restore failed intranet-based agency services.

The AREDN Project team provides support via its website at www.aredn.org to Emcomm groups wishing to deploy this technology. There is a fabulous getting-started primer entitled "Wireless Networking in the Developing World" which I encourage anyone interested in this technology to read. It is available for free as a PDF download at: www.wndw.net.

The AREDN logo is a copyright of Randy Smith, WU2S, and is used with permission.
Broadband-Hamnet is a trademark of the Broadband-Hamnet, Inc.
airMAX, NanoStation, airGrid, Bullet, and Rocket are trademarks of Ubiquiti Networks, Inc.

The AREDN software is distributed and licensed for use under the Free Software Foundation's General Public License, GPLv3 license. A copy of that license and source is available at the project's web site: http://www.aredn.org.

AREDN Team Receives ARRL 2014 Microwave Development Award

by Andre N6AH

Two PARC members, Conrad Lara, KG6JEI, and Andre Hansen, K6AH, were recently honored by the ARRL as recipients of their 2014 Microwave Development Award.

Members of the AREDN (Amateur Radio Emergency Data Network) Project accept the 2014 ARRL Microwave Development Award for the microwave mesh networking advancements they achieved as the development arm of Broadband-Hamnet™ in 2014. Dick Norton, N6AA, Director-ARRL Southwestern Division, presented the award at the ARRL 2015 Southwest Division Convention's evening banquet.

Andre, K6AH, presented a paper on this project at Microwave Update, October 15-18, at the Crowne Plaza Hotel in Mission Valley (http://ham-radio.com/sbms/mud2015/mud_index.html).
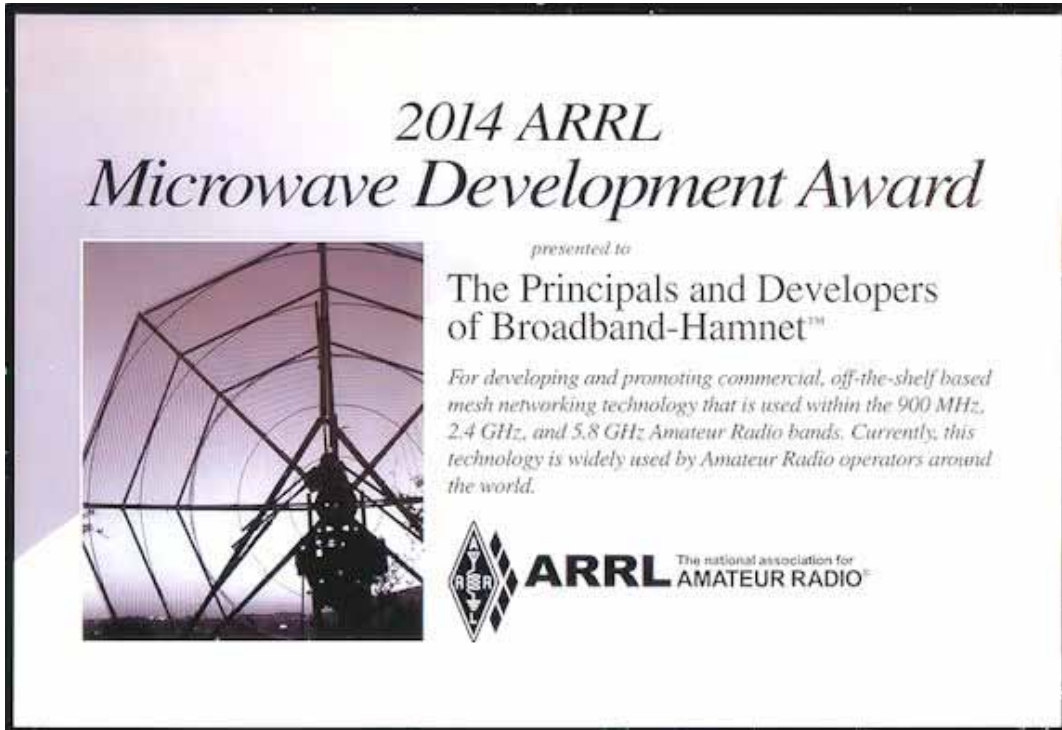
From left to right: Randy Smith, WU2S; Conrad Lara, KG6JEI; Andre Hansen, K6AH; and Joe Ayers, AE6XE (not pictured: Darryl Quinn, K5DLQ and Gordon Beattie, W2TTT).

Repeater Status as of 26 October 2015

Echolink

447.000
107.2

146.730
107.2
System Fusion - Auto

147.075
107.2
System Fusion - FM

52.680
107.2

147.130
107.2

PARC
Voice
Repeaters

PARC
Digital
Repeaters

145.050
packet node
linked to Metro 9600 Net

146.700
packet duplex repeater
Duplex

operational
non-operational

Circle Diameters Scaled to
Show Relative Wavelengths
Between the PARC Repeaters
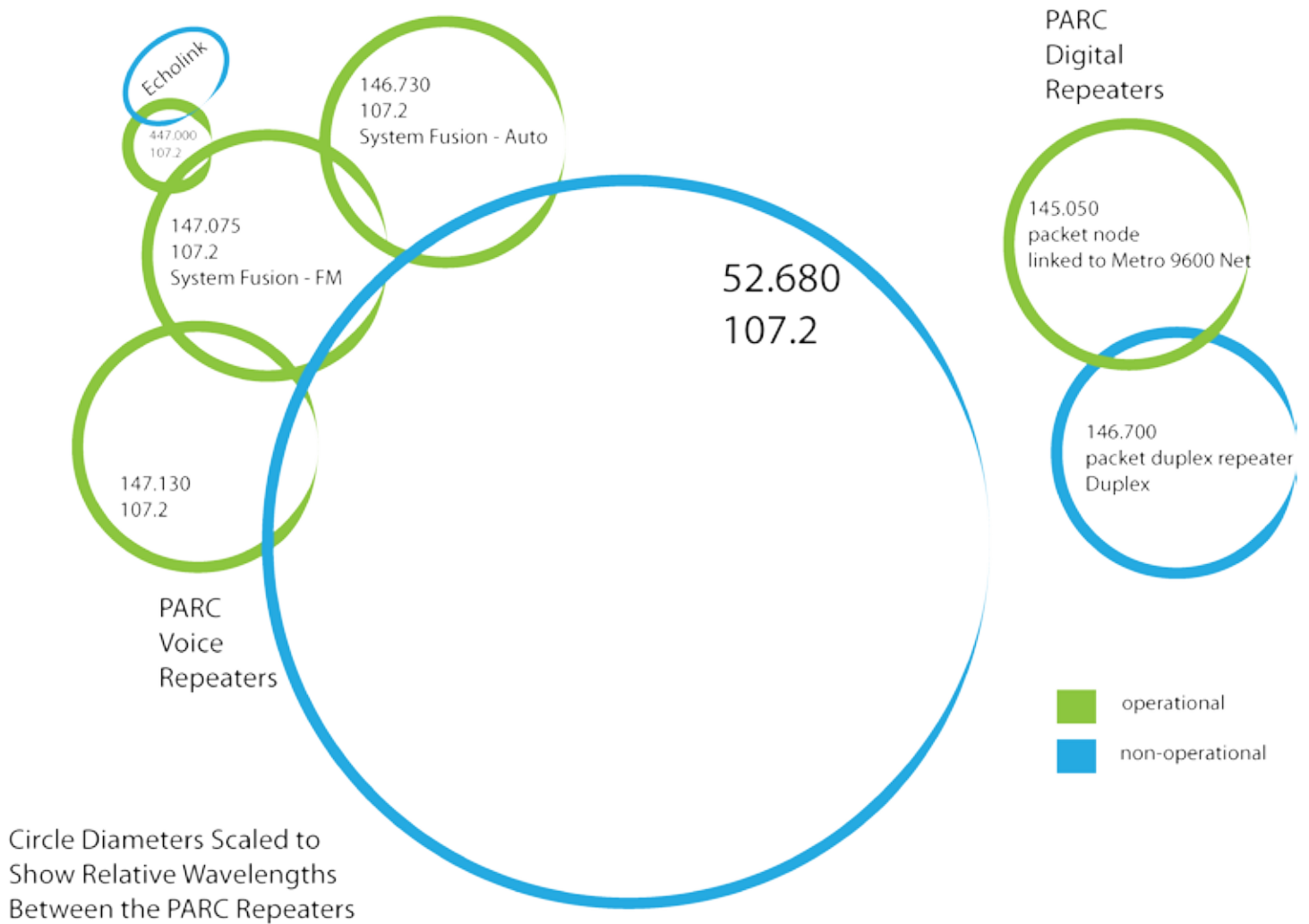
OPERATING DAY
Saturday, November 7, 2015
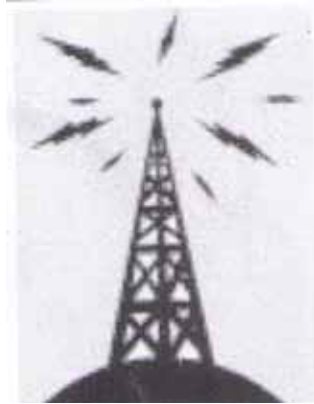
FRY'S ELECTRONICS
150 South Bent Street
SAN MARCOS, CALIFORNIA 92069
9:00 AM to 4:30 PM
HOSTED BY PALOMAR AMATEUR RADIO CLUB
www.palomararc.org
contact Tom K6RCW (619) 778-3866
Come operate on the ham bands at Fry's
70cm, 2m, 6m, 10m, 15m, 20m

PARC Demo 24 October - Fire Days!

by Dennis KD6TUJ

Oceanside Fire Day occurred Saturday October 24 at Oceanside Fire Station 7. Set up was scheduled for 7:30 AM. Equipment was set up in advance on Friday evening as a result of a logistics meeting Jo N6JO asked me to attend on Wednesday with Ron and Linda of the Fire Department. Unexpected help was provided by Greg and Conrad.

On Saturday, Glen KJ6ZQH arrived at 7:30. Greg KI6RXX arrived shortly after. We all helped set up the trash/recycle receivers and tables. After "Big Mike", the historical engine operated by the Fire Department members, was moved to it's display posistion, CERT and PARC set up the tables and displays. Open hours were listed from 9 AM to 2 PM. Quite a few came by and asked questions including a Brownie Girl Scout Troop. Other members who stopped by were John AC7GK, Don WD6FWE, and Conrad KG6JEI.

As noted earlier in the process of coordination, I was working from the event and was called to work for a CHP request for service at 1:10 PM. It was fortunate that Greg managed to get away from work to staff the table. I also want to thank Conrad for staying and providing transport to storage when the event was over. The other choice was for me to come back Sunday, interrupting my wife's schedule.

Thanks to all who lent support letting the public understand more about Amateur Radio and how it can help in emergencies.

Photo by Lauren Bushey , City of Oceanside Emergency Coordinator

PARC at Fire Days - photos by Don WD6FWE

SCOPE   PERIODICALS
P.O. Box 73
Vista, CA 92085-0073

Return service requested

Featured Program:

At 7:30pm on 4 November 2015, Palomar Amateur Radio Club will present a Program about PARC's
involvement in AMSAT Phase 4. What have we gotten ourselves into?! Come at 7pm to socialize and for
advanced demonstrations. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way,
Carlsbad, CA.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo

Current Board of Directors

Charlie NN3V President
Joe K6JPE Vice President
Jim NE6O Director
Greg KI6RXX Director
Gary W6GDK Secretary
Richard KJ6WUY Treasurer
Dennis Baca KD6TUJ Repeater Site Chair
Glen KJ6ZQH Membership
Mark KF6WTN Repeater Technical Chair

Nominations for the 2016 Board were announced at the November membership meeting and are as follows.

Charlie NN3V President
Joe K6JPE Vice President
Kevin KK6FRK Director
John AC7GK Director
Sandy KK6EED Secretary
Tom W0NI Treasurer

There are three additional directors. These directors are selected from four appointed positions, which include Repeater Site Chair, Repeater Technical Chair, Membership Chair, and Newsletter Chair.

Elections for 2016 Board will be held at the December membership meeting.

In addition to the board of directors election, a ballot of YES or NO for "Shall Palomar Amateur Radio Club grant life membership to Mike Pennington K6MRP?" will be held at the December membership meeting.

Save the Date

Club Meeting	Board Meeting	Club Events
2 December 2015	**9 December 2015**	**5-7 December 2015**
PARC board elections for 2016 and our annual Holiday Potluck Party!	Palomar Amateur Radio Club board meeting at 7:00pm at Poway Fire Station on Community Road	Ft. Rosecrans Goes To War - special event station, vintage radios, and living history at Cabrillo National Monument.

Contents

Advertisements are free for members

Have items that need to find a new home? Advertise here! Send your ads to scope@palomararc.org

President's Corner

A joyous Merry Christmas and Happy New year to all! May Santa's sleigh come loaded with ham candy for you, and may you and all your loved ones have a healthy and wealthy New Year!

As we near the holiday season, and beginning of a new year, there are many thoughts upon which to reflect and plan.

The December club meeting will feature our traditional Christmas special social event, as well as the elections for the PARC 2016 Board of Directors. Bring some goodies to share with your fellow club members. It will also be the time for election of the 2016 PARC Board of directors, as announced at last month's meeting.

At the meeting you will also have the opportunity of voting for whether or not PARC should award an honorary life membership for Mike Pennington K6MRP, a PARC member now living far from San Diego (Montana…BRRR), who devoted a tremendous effort in technical work for PARC for many years while he lived here. The honorary life membership award is offered to Club members who have distinguished themselves in service to the ham radio community. I hope you will support the award.

As a preview of exciting things to come, in January we hope to host a unique club program. Gene Spinelli KG5S was a leader of the TX3X DXpedition to Chesterfield Island this year. Chesterfield Island is located 6600 miles West/Southwest from San Diego, midway between New Caledonia and Australia. The name "island" is somewhat of an aggrandizement. It is more specifically a rock reef in the middle of nowhere, but if you are a DX hound, it represents one of the most cherished DX entities in the world. Gene will describe the work that went into planning the DXpedition to Chesterfield, and talk about the fun of facing the pile ups on the receiving end of "CQ TX3X".

I hope many of you have the opportunity to participate in the Ft. Rosecrans Goes to War special event on December 5-7 at Cabrillo National Monument at Pt. Loma. This event, organized by PARC Club members Gayle K6GO and Mike NA6MB is likely to be an exceptional and fun filled event with ham radio and vintage WW-II radios on exhibit. You may contact Gayle and Mike at K6GO@rrl.net and NA6M@arrl.net. They are looking for voluntary assistance to operate some radio equipment (SSB, CW, and digital) on the 5th. and 6th. I will be thinking of the event while I commemorate the Pearl Harbor anniversary at Arlington National Cemetery in DC.

Ft. Rosecrans Goes To War Event Information

The Cabrillo National Monument Foundation in San Diego, CA is sponsoring an event called "Fort Rosecrans Goes to War" and the local amateur radio community is participating by operating a special event station, W6W, from Fort Rosecrans on December 5 and 6.

The amateur radio operators are setting up radios and antennas on Saturday December 5 and Sunday December 6 from 9:00 AM to 4:00 PM. The hams will commemorate the event by making as many radio contacts as possible and exchanging an event postcard with stations reached locality, nationality and internationally.

A special event call sign had been obtained from the FCC and the station will use W6W.

There will be vintage WWII radios on display and operating at the event!
Those visiting will see a hands on demonstration of amateur radio in action.
Please come by and visit, either in person or on the air. We will be on the circular drive just outside of the Cabrillo National Monument visitor center and operating on HF, VHF and UHF bands.
For more information or to volunteer for an operating time.

K6GO@arrl.net
NA6MB@arrl.net
(619) 494-1204

New Committee Chair

It's been a while since PARC had an active committee system. In the October 2005 Scope, the list included ARES Info, ARES Net, Attendance, ATV, Auction, Badges (New), Batteries, BBS Monitor, Billing Ads/etc, Contest Info, Control Ops, Del Mar Fair, EmComm, Field Day Tech, Inventory, New Member, Nets, Newsletter, Patch Info, Patch Electronics, Picnic, Power AC/DC, Programs, Publicity, QSL Cards, RACES Info, RED Flag, Repeater Site, Repeater Tech, SANDARC, Seller Table, Testing, VE, Trustee, and Web.

The club is reviving the committee system and will be welcoming new chairs. If you are willing to serve, or have an idea for a particular chair that you believe the club needs, please contact the board at board@palomararc.org.

Some of these positions are no longer relevant. For example, since we don't have a phone patch, we don't currently need a committee chair for that position.
It's our pleasure to announce a new Committee Chair for PARC. This chair reports to our club president, Charlie NN3V.

New Chair for Operating Day
An Operating Day Chair has been established for Palomar Amateur Radio Club. Tom Martin K6RCW has been organizing Operating Day for several years. He has generously agreed to be listed as PARC's Operating Day Chair. Tom welcomes volunteers to help make Operating Day bigger and better each time.

Operating Day is twice a year, once in the fall and once in the spring. Our most recent Operating Day was 7 November 2015, and was held from 9:00am to 4:00pm at both Fry's Electronics in San Diego and Fry's Electronics in San Marcos.

Committee	Chair	Contact
EchoLink	Bernie Lafreniere N6FN	n6fn@niftyaccessories.com
mesh	Phil Karn KA9Q	karn@ka9q.net
Operating Day	Tom Martin K6RCW	k6rcw@amsat.org

Tech Tip from Dennis N6KI
FYI - Besides an Emergency Car Starter, also great for a nice Phone or Laptop emergency charger and can power your 12 VDC devices like a 5 Watt QRP Ham Radio Transceiver or SDR etc.
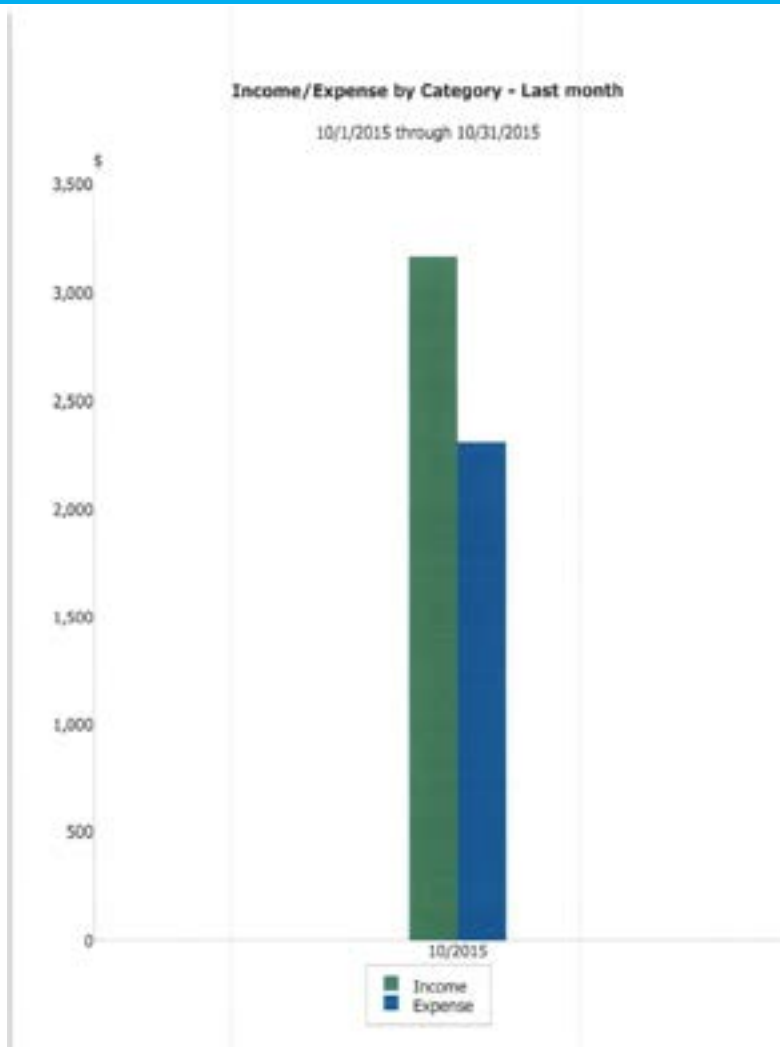
Also has a fairly good flashlight in it that can stobe and also send SOS for hours. I am testing right now to see how long it can send SOS with the fairly bright light.

I'll report back in a few days I imagine as it's been sending SOS for 5 hours and the #5 of 5 Blue LED battery charge indicator lamps has not extinguished!
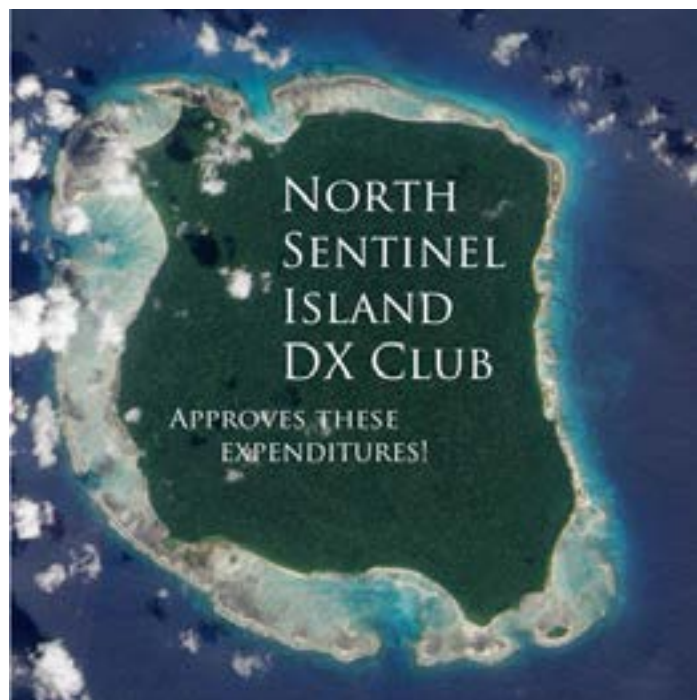
http://www.tooltopia.com/rockford-8005.aspx

$50 with free ship from ToolTopia. Amazon wants $20 more for same device!

Club Financial Update

Income/Expense by Category - Last month
10/1/2015 through 10/31/2015

	Income	Expense

Income/Expense by Category - Last month
10/1/2015 through 10/31/2015

Category Description	10/1/2015-10/31/2015
INCOME	
501(C) (3)	729.17
Auction Incom	1,779.00
Dues	656.00
TOTAL INCOME	3,164.17
EXPENSES	
Auction Expns	1,337.40
Bank Chrg	47.00
Office Supplies	289.17
Operating Day	230.20
Rptr Electric	88.72
Rptr Phone	42.89
Taxes	272.38
TOTAL EXPENSES	2,307.76
OVERALL TOTAL	856.41

NORTH SENTINEL ISLAND DX CLUB

APPROVES THESE EXPENDITURES!

SCOPE page 5

Please support our advertisers. Their support of the club is vital.

(special) **THANKS** to our sponsors

Club HF Remote Station? Proposal Time!

Current status: PARC has obtained 501(c)(3) status, and we have begun putting our HF remote station proposal in writing. This is an exciting time! We expect to complete our proposal by January 2016.

If you would be interested in helping write a club remote HF station proposal for Palomar Mountain, then please join up by writing me at scope@palomararc.org and I'll add you to the mailing list!

Mailing list archive located at
http://palomararc.org/pipermail/hfremote/

This special interest group for HF remote will write a proposal for the Palomar Amateur Radio Club board of directors to vote on. If the vote is successful, then fundraising will begin immediately.

Michelle Thompson asked a question.
October 31 at 12:20pm

For the digital version of the Scope, how do you prefer it to look?

- [ ] But with landscape pages as needed (e.g., for diagrams).   +3
- [ ] portrait (the way it is now in PDF form)   +4
- [ ] landscape (wider than it is tall)
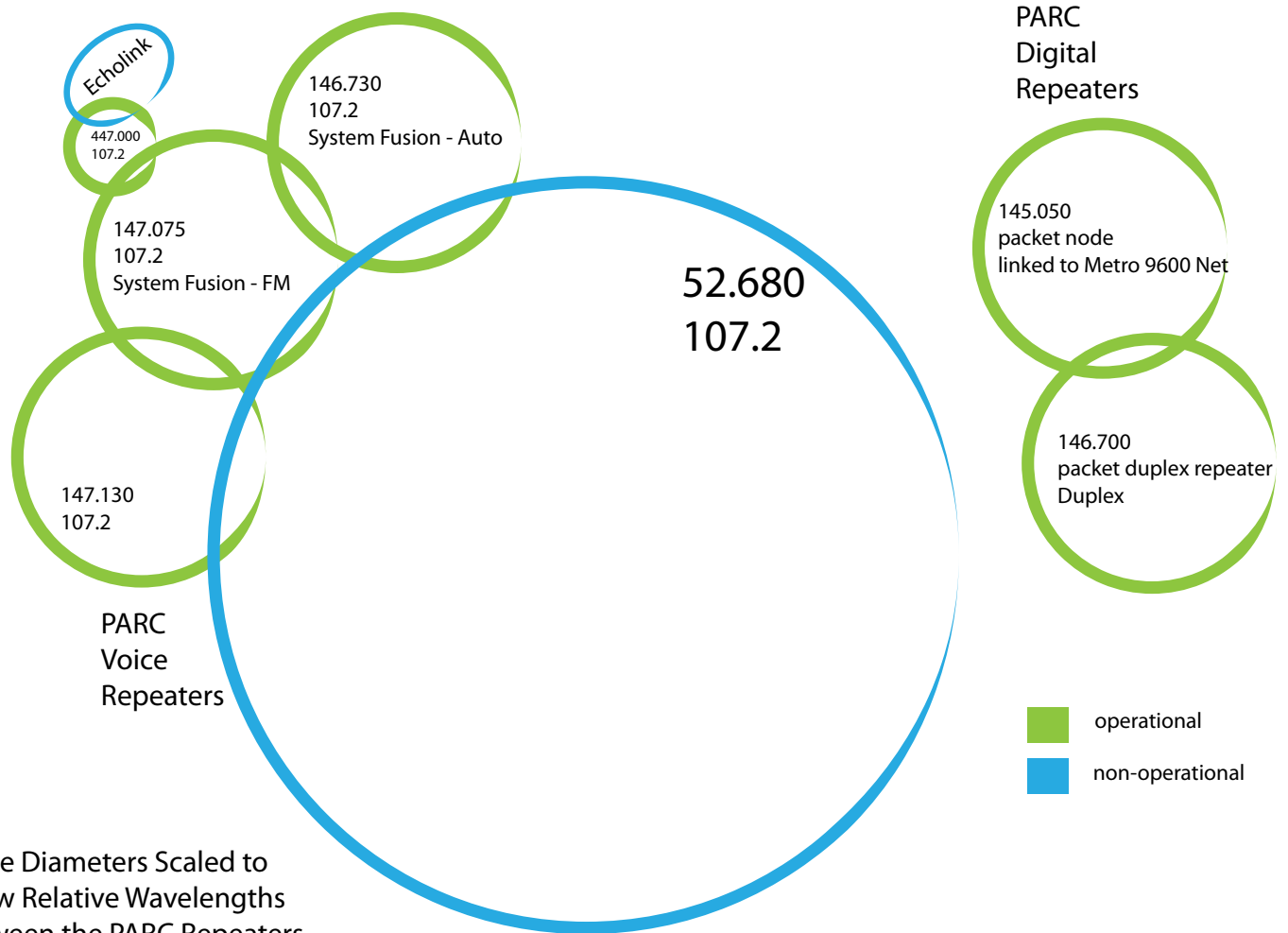
What's your opinion?

Portrait or landscape (or other option) for the digital version of the Scope?

Let us know at scope@palomararc.org

Portrait has taken a commanding lead!

Suggestion to make each page single-column for easier mobile reading has been implemented.

Reported Repeater Status as of 27 Nov

Echolink

447.000
107.2

146.730
107.2
System Fusion - Auto

PARC
Digital
Repeaters

147.075
107.2
System Fusion - FM

145.050
packet node
linked to Metro 9600 Net

52.680
107.2

147.130
107.2

146.700
packet duplex repeater
Duplex

PARC
Voice
Repeaters

operational

non-operational

Circle Diameters Scaled to
Show Relative Wavelengths
Between the PARC Repeaters

Across

1 Economical (4)

3 Ocean of Guinness (5,3)

9 ____ Park (7)

10 Broadcasting (2,3)

11 Japanese-American (5)

12 Monopoly property (6)

14 often filled with lavender (6)

16 Siberian Lake (6)

19 View from Jidda (3,3)

21 Swiss capital (5)

24 Reddish brown (5)

25 Soft leather (7)

26 Not South Sea (5,3)

27 Greek cheese (4)

Down

1 Mysterious sea monster (4,4)

2 "Bye" (5)

4 Plural of impractically large antenna (6)

5 Ribbon holder (5)

6 What you might suffer from on the ocean (7)

7 Breezy (4)

8 Kind of case (6)
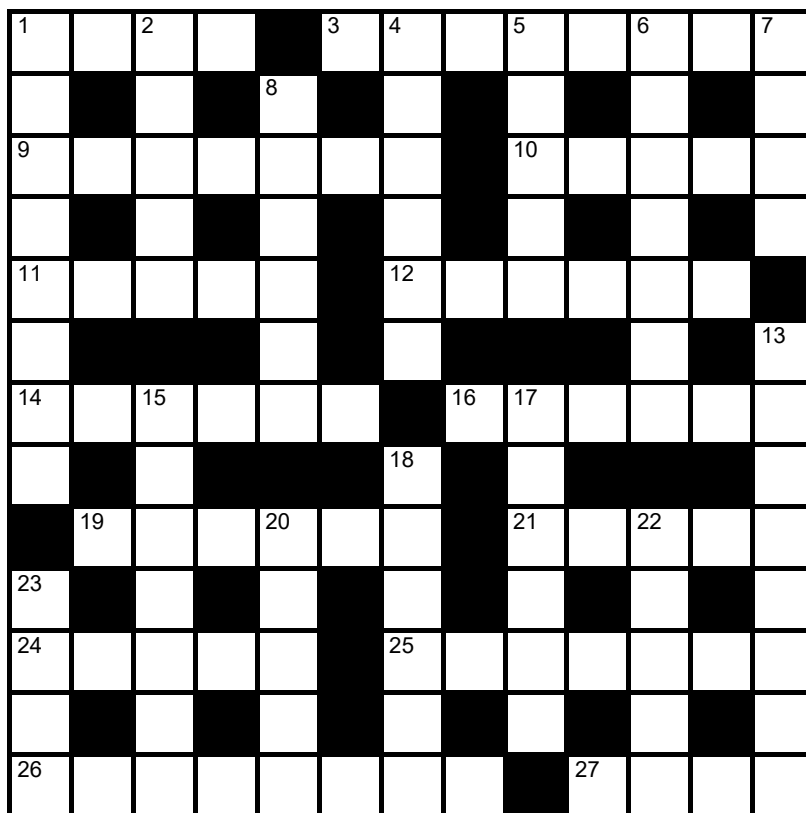
13 Not White Sea (5,3)

15 Janitor (7)

17 Brawl (6)

18 Not smooth (6)

20 #1 song (5)

22 Building block (5)

23 Top Tatar (4)

Decode the secret phrase in this logo above and win a patch. Answers to scope@palomararc.org

Callsign Confusion

Being new to the club and amateur radio, I knew enough about operating to know that you need to give your call sign every 10 minutes and at the end of a transmission. Imagine my outrage when I heard a regular contributor to 146.730 thumbing his nose at this rule! He'd always sign off with "Remember, remember, the fifth of November". The first time it was funny, but after a half-dozen of these flippant sign-offs I complained, straight to the trustee!

Then I went to my first in-person club meeting at the EOC. Now imagine my discomfort at realizing I was simply hearing the phonetic pronunciation of NN3V in his distinctive voice.

I wanted to slide under the table. I told the trustee "Never mind about that complaint. I figured it out."

-Totally Anonymous Forever
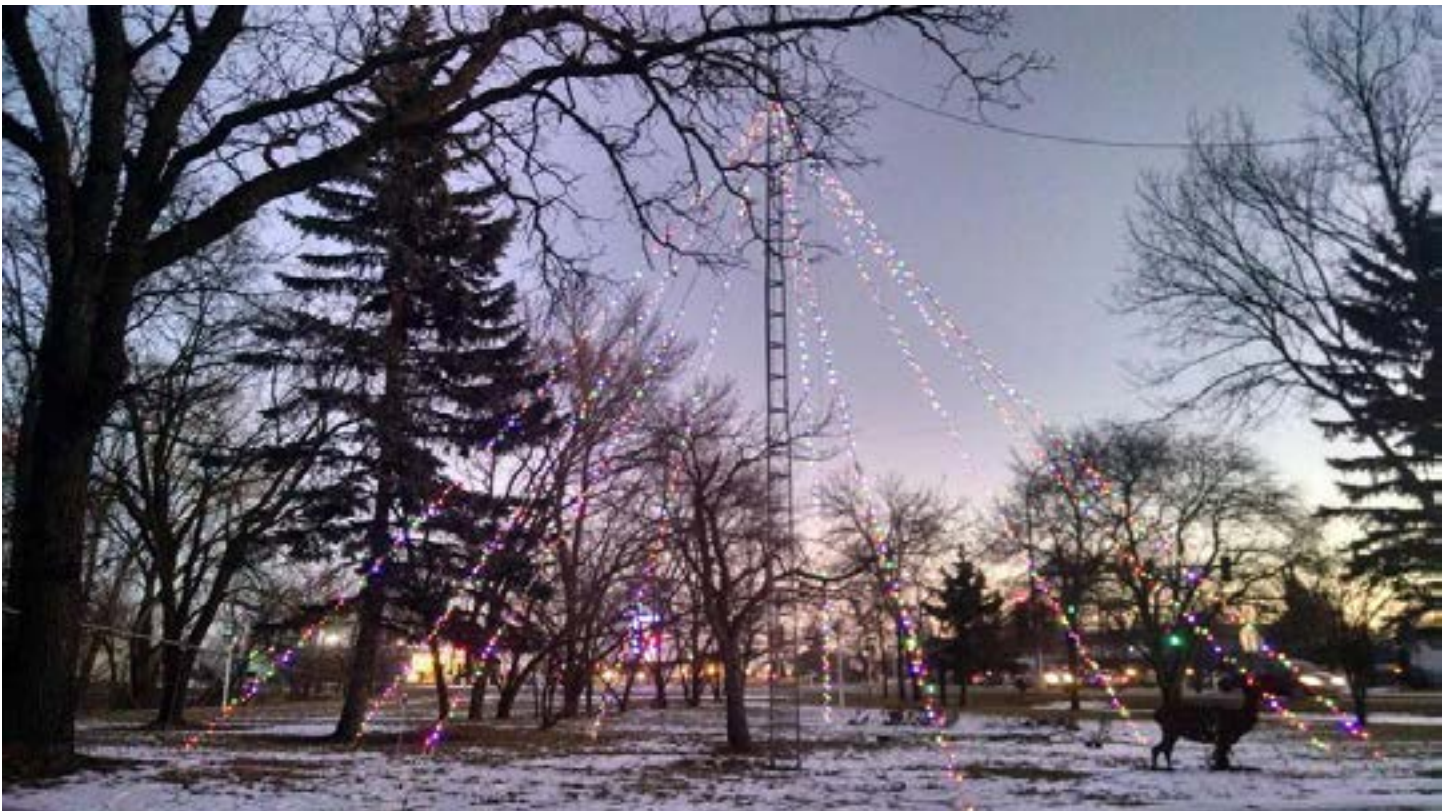
Do you decorate your tower or ham shack? Share your photos! scope@palomararc.org

PARC Members Support Education

by Glen KJ6ZQH

In September, 2015, the instructor of the Engineering Technician program at MiraCosta College, Kris Rolfson, contacted the Palomar Amateur Radio Club via email. He explained that because he is a Ham radio operator himself, he was using the ARRL Technician License Manual as the basis for introducing RF concepts to his students. His course covers a broad spectrum of subject matter; electronics, mechanics, pneumatics, automation, robotics, etc. His goal was to have his students take the Technician license test at the end of this part of the class.

Kris invited us to tour the facility and to speak to the class (for about 30 minutes) about Ham Radio. Charlie (NN3V) and I (KJ6ZQH) visited the school on September 28th. Charlie had created a slide set that covered what Ham radio is, some history, the requirements to obtain an operator license, hardware & antennas, what you can do as a Ham (including assisting in emergencies), etc. I think we spent well over a hour with the class as the students engaged us with questions. PARC gained a new member that day as Kris used the online application facility to join the club that afternoon.

Charlie NN3V and Glen KJ6ZQH in front of the class.

A few days later Kris asked if we would come back and talk about repeaters. Specifically those for VHF and UHF. Charlie and I returned on October 15th. We had a discussion with the entire class on line-of-sight propagation and repeater offsets and PL codes. Because it was the day of the California Great Shakeout practice drill, we took the class out to Charlie's car and made contact with Brian (AG6GF) in his role as net controller on the 145.180 MHz repeater. It was very helpful in demonstrating repeater offsets and operation in that I had a handheld radio and could explain that what I was receiving was NOT directly from Charlie's radio, but was what the repeater was transmitting from the top of Mr. Woodson.

After that we used Charlie's antenna analyzer on a antenna which one of the students had built and had been installed onto the roof of the school building. I believe the meter showed it was less than 1.4:1 over the entire 2 meter band. We broke the class up into two groups and Charlie and I each took a group for some hands on with radios. The students already had printouts of lists of SoCal repeaters. I made sure that each student got to input a repeater frequency, set the appropriate PL code and to verify the automatic offset matched the

picture of Charlie at this car during demonstration
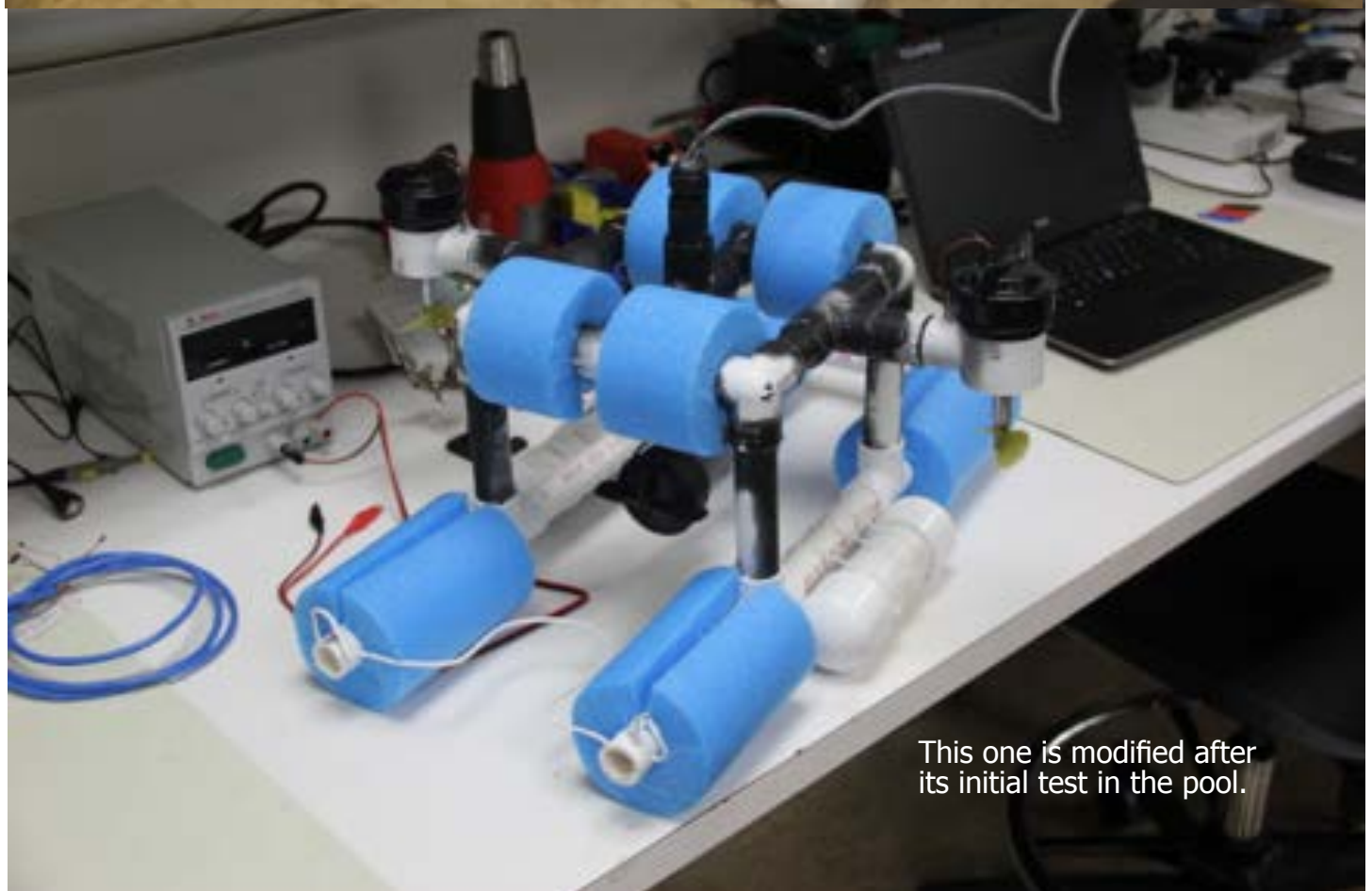
published listing for that repeater.

Jo Ashley (KB6NMK) coordinated getting herself, Charlie and five other volunteer examiners to the school on November 17th to administer Ham license tests. Six of the seven students earned their Technician Class licenses that day! Harry (W6YOO) spoke to the group about Ham Radio after the tests were completed.

While the VE's were administering the test, I spent time with Kris on a cruise thru the lab area to get pictures of the equipment used by the class; a couple of robots, a number of automated manufacturing training stations (with PLC controllers), work areas with power supplies, meters, oscilloscopes, soldering stations, hot-air surface mount solder and desolder units. They also have four 3D printers.

The students are wrapping up their 15 week course by constructing their final project. One is using a Rasberry Pi to create a monitoring system for a nearby facility the sends email alerts if the temperature in a process refrigerator falls out of range. The other students are working in teams of two to build aquatic remotely controlled vehicles. Here is a short video of the initial testing of a couple the units. Detail photographs can be found on the next page.
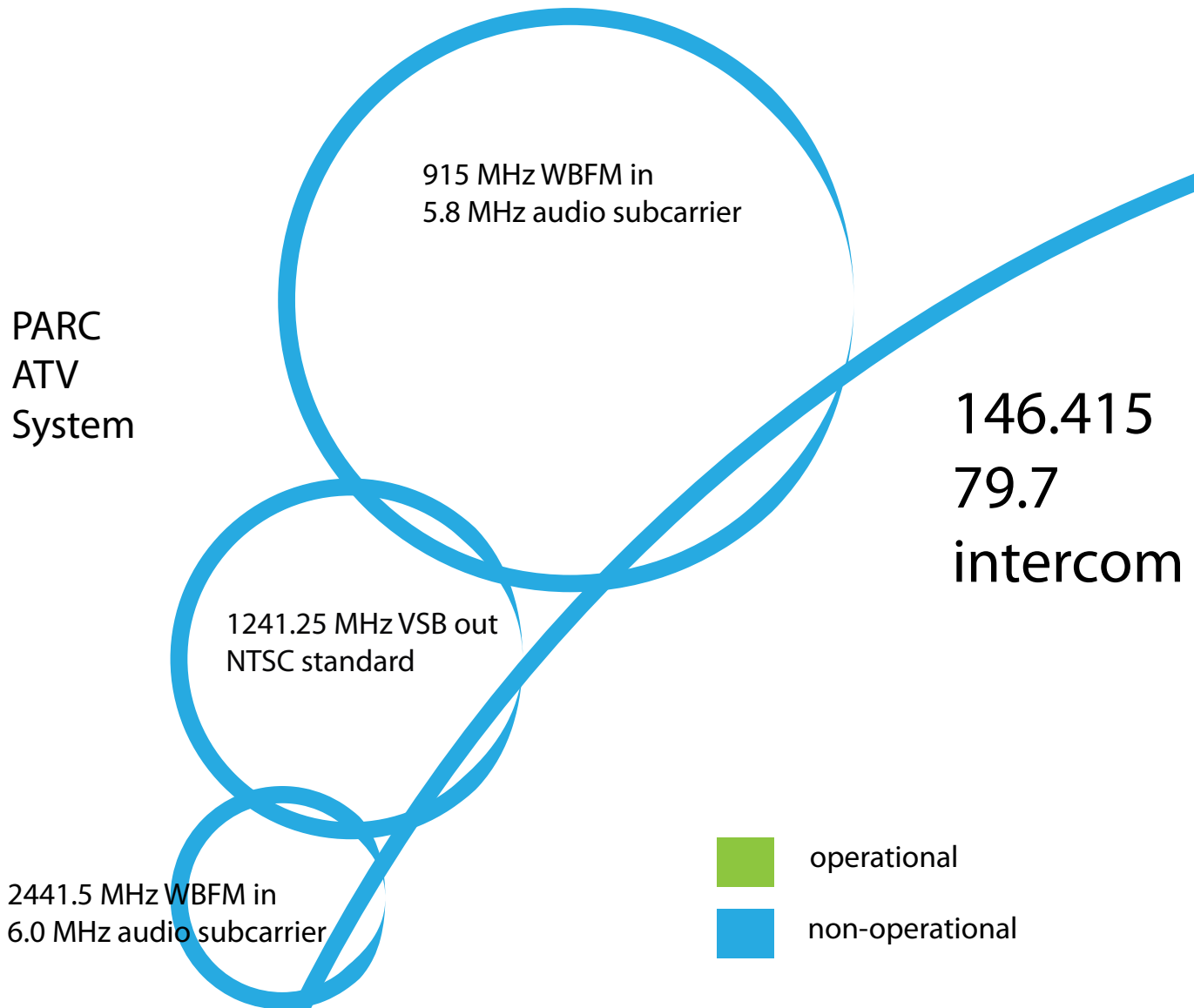
https://youtu.be/ik3Qo7pGDZ8

It was a great experience to visit the school and to interact with these very motivated students. I came away enthused by their engagement in the course material in their pursuit of a broad hands-on technical education. You can learn more about this course by writing to TCI@miracosta.edu to attend one of their weekly tours of the facility.

Here is an aquatic remotely controlled vehicle still under construction. The four propulsion motors are mounted on independent axles for directional control. The propellers were created in class using the 3D printers.

This is a camera!

This one is modified after its initial test in the pool.

Reported ATV Status as of 27 Nov

Would you like to help us revitalize our ATV system? We could use your help. Contact board@palomararc.org to volunteer.

PARC
ATV
System

915 MHz WBFM in
5.8 MHz audio subcarrier

146.415
79.7
intercom

1241.25 MHz VSB out
NTSC standard

2441.5 MHz WBFM in
6.0 MHz audio subcarrier

operational

non-operational

Circle Diameters Scaled to
Show Relative Wavelengths
Between Equipment

2016 SW Division Convention

Yuma Hamfest
Yuma, Arizona
Feb. 19 & 20, 2016

Yuma County Fairgrounds
2520 East 32nd Street, Yuma, Arizona

www.yumahamfest.org

Check the Website for Additional Information

Gates Open for Camping Thursday, 2 pm Vendor Setup Friday, 7 am - Noon	Event Hours Friday, Noon - 5 pm Saturday, 8 am - 5 pm	Hamfest Dinner & Grand Prize Drawing Saturday Night 6:00 - 8:00 pm

Vendors & Exhibitors	**Tailgating (Swap Meet)**
Consignment Sales	**Full Seminar Schedule**
License Testing	**DXCC Card Checking**
Hourly Door Prizes	**Incredible Grand Prizes**
On-site RV Camping	**Emergency Preparedness**
Hamfest Dinner	**Admission Prize**
ARRL Speaker	**Hospitality Area**
Transmitter Hunt	**Near Space Balloon Launch**
$5.00 Admission	**Antenna Clinic**

Hamfest Talk-In Frequency: 146.840 (–) PL 88.5 Hz

Email Contact: *info@yumahamfest.org*

We are proud to have the Amateur Radio Council of Arizona (ARCA) as a sponsor of our event.

The Yuma Hamfest is an American Radio Relay League (ARRL) sanctioned event.

Presented by the Yuma Amateur Radio Hamfest Organization

W6NWG Awarded Worked All States

PARC recently submitted a number of Field Day logs to the ARRL's Logbook of the World, which automates the process of QSLing contacts and qualifying for awards. It's routine for the club's Field Day operation to contact all the states, but getting all the QSL cards and sorting them out for an award submission has been a bit harder. Not anymore! Here are the club's Worked All States certificates earned so far.

The Mixed mode certificate certifies that the club worked and confirmed contacts with all 50 states, using some combination of all bands and all modes. The 20 Meters endorsement sticker on that certificate shows that we worked all states on just the 20 meter band. Likewise, the Phone mode certificate shows that we worked all states using just the phone mode.

The club must be close to qualifying for a CW mode certificate, and for other band endorsements, from Field Day activity alone. We'll continue to submit logs to Logbook of the World. If you have any W6NWG logs (written or online) please send them to the trustee (w5nyv@yahoo.com) for submission.

ARRL put the trustee's name on the certificates instead of the club's name. We'll see if we can get that fixed.

Operating Day at Fry's San Marcos

Jo KB6NMK suffering from a staff infection.

Skywarn booth did a brisk business in conversations about the gorgeous weather.

Michelle W5NYV and Harry W6YOO talk DX.

Glen KJ6ZQH toured and talked.

Don WD6FWE models the System Fusion hats that were given away at the Red Cross booth at Operating Day

Henry and Rose check out SLEEP system, by Robert Todd KJ6RET. This is one of their favorites! They each got a System Fusion hat from Red Cross.

Not just System Fusion hats from Red Cross, but also donuts! Rose hears that they are actually ham vitimin pills.

Yaesu MH-85A11U Teardown

Camera Microphone used with FT1D, FT2D, and FTM-400 System Fusion Radios

Michelle Thompson W5NYV
Paul Williamson KB5MU

Introduction

Yaesu offers an optional camera-equipped microphone (MH-85A11U) for use with the company's newly introduced System Fusion radio line. Currently, the line includes the FT1D and FT2D handhelds and the FTM-400 mobile rig.

Taking photos with the camera microphone requires a properly formatted microSD card to be inserted into the radio. The photos and the files that manage the photos are stored on the SD card.[1]

The question that motivated this teardown was the nature of the interface between the camera microphone and the radio. The camera is referred to as USB Camera in the configuration menus. Could the interface simply be USB?

Inspecting the socket revealed what appeared to be a proprietary connector. See Figure 1 and Figure 11. No information about the pinout was included in any of the various manuals. No information about the pinout was available from Yaesu's USA sales staff.

Figure 1: Camera Microphone Cable

Figures 1 through 16 can be found following the text.

---

[1]   See Palomar Amateur Radio Club's April 2015 newsletter, Scope, for an introduction to the file system and basic photography functions. http://www.palomararc.org/Scope/apr15scope.pdf

Investigation

A camera microphone was purchased and tested. The microphone was connected to an FTM-400. Proper microphone function was observed, but the speaker function does not seem to be supported on the FTM-400. Photographs were taken and saved to the SD card. These photographs were successfully sent over the air. The camera microphone has three buttons. The usual push-to-talk (PTT) button is located in the traditional place on the side of the handheld microphone. A button with an image of a camera on the front serves as the shutter button for the camera. A data transmission start button (marked D-TX) on the front sends the most recently taken photograph over the air. See Figure 2. The back plate of the microphone is held in place with four screws. These were removed. See Figure 3. Once removed, shielding on the inside of the back plate and the main board of the microphone were revealed. See Figure 4.

The back plate was set aside and the main board examined. See Figure 5.

We immediately marveled that there was an ARM processor onboard. It was marked "ARM STM32F207 ICH6", which identified the chip as a ARM Cortex-M3 based microcontroller manufactured by STMicroelectronics. ST describes this chip as featuring a "120 MHz CPU/150 DMIPS, up to 1 Mbyte of Flash with advanced connectivity and encryption, adding Ethernet MAC and camera interface to the STM32F205/215, and more GPIOs and features on larger packages." [2]

That's a lot of compute horsepower for a microphone! We speculated that the microcontroller was simply the cheapest solution for integrating a very small package camera via USB to a host device. There are two USB ports on the microcontroller.

To the left and slightly above the microcontroller was a chip marked CY62138EV30LL-45BVXI. That makes it a 256kB by 8 bit 45ns static RAM device from Cypress Semiconductor.

We believe the 8-pin package below the memory to be an audio amplifier.

The 5-pin device below and to the right of the microcontroller is a voltage regulator. It appeared to take in 5 volts (supplied by the radio, just as it would be supplied by the host in a standard USB device) and produce 3.3 volts (which is within the 1.8 to 3.6 volt range required by the microcontroller).

This board was marked "1489-04880(3)-10 PCB)AAJ40X main". We called it the main board.

Next, we examined the board where the camera was mounted. This board was mounted perpendicular to the main board. It was marked "1489-04870131-5 PCB)AAJ40X sensor", so we called it the sensor board.

The sensor board lifts out from a niche in the top of the opened microphone. It is attached to the main board by a copper foil ground strap (soldered to the main board and somewhat fragile) and a ribbon cable with 10-pin connector. See Figure 7. The front housing of the camera can be removed by removing the two screws visible in Figure 7. After the housing is removed, the camera body can be inspected. See Figure 8. It's a common webcam form factor. For example, it is visually very similar to, but not identical to, the Raspberry Pi camera. The length and width of the square body are the same, but the Raspberry Pi camera body is taller.

No useful part numbers were found on the camera board or body.sWe speculated that the camera lens focus distance might be adjusted by turning the lens, but we didn't attempt this.

---

2   This microcontroller family is discussed at http://www.st.com/web/en/catalog/mmc/FM141/SC1169/SS1575?sc=stm32f2

This camera doesn't seem to have autofocus. Since its focus is fixed, there is an ideal depth of field where photos will look sharpest. The camera was refitted to its housing and reinstalled in the niche at the top of the microphone.

Continuing with disassembly, the three screws that held down the main board to the front housing of the microphone were removed and the board lifted up and to the side. The microphone and speaker wires remained attached. See Figure 9.

Visible in this view was the back side of the D-TX and shutter buttons. The microphone was friction fit into a cylindrical housing. The speaker was installed in the front housing. Aside from the two pushbutton switches, no components were observed on the back side of the main board, so ws reinstalled it into the front housing.

The next area of investigation was identifying the signals on the pins corresponding to the microphone cable. We were looking for evidence that this interface was simply USB, or USB plus a few other signals. Having a standard interface available from the microphone would be desirable, as one could interface another camera or photo-serving device to the radio, or possibly improve or expand the performance and capabilities of the Yaesu MH-85A11U. Being able to use the Yaesu MH-85A11U with other devices was also raised as a possibility. These objectives could be more easily enabled if the interface could be defined.

The cable enters the bottom of the handheld microphone. The individual wires then go to an 11-pin connector with reference designator CN1. We called this connector 1. See Figure 10

Not all of the pins of the connector were populated in the cable. During the first pass, the following pins were identified and the cable wiring color code noted.

Table 1: Pins Identified with Multimeter

Pin	Cable Wire Color	Apparent Function
1	Green	5V
2	White	
3	Red	
4	No connection	
5	Black	Ground
6	Brown	
7	No connection	
8	No connection	
9	Yellow	
10	White	PTT
11	Black	Ground

With power provided to the radio, and the radio switched off, no signals appeared at connector 1. With the power switched on, signals appeared at the connector.

When the PTT button was pressed on the side of the microphone, the 3.3 volts normally observed at pin 10 (PTT) was pulled about halfway down. Obviously, this is not a standard USB pin. This signal is also connected to the microphone element itself.

Next, an oscilloscope was used to more closely examine the pins.

Pin	Function
1	5V
2	data burst every 1ms
3	data burst every 1ms, very close to differential of pin 2
4	nothing
5	Ground
6	8.2 volts DC
7	3.3 volts DC
8	3.3 volts DC
9	nothing
10	PTT normally 3.3 volts high pulled about halfway down by pressing PTT button
11	Ground

On the oscilloscope, busts of data at 1ms intervals were observed on pin 2. An image was made of the data burst. See Figure 12. Pin 3 also had bursts of data at 1ms intervals. This is very encouraging, since an idle USB Full Speed interface should always have Start of Frame (SOF) packets at regular 1ms intervals. A second oscilloscope probe was connected, so we could see the timing relationship between the signals on pins 2 and 3. See Figure 13.

Looking at the waveforms, the data rate was estimated at approximately 12Mbps, which corresponds to the Full Speed Data Rate of the USB standard. The signals on pins 2 and 3 wereymostly differential, meaning the same signal appears on two different wires, but with one wire going high when the other goes low, and vice versa. At the end of each burst, as shown in Figure 13, both signals go low together for about two bit-times. This is called a Single-Ended Zero (SE0), and is exactly what you'd expect to see as an End Of Packet (EOP) marker on a standard USB signal.

If this is indeed a SOF packet, it should consist of an 8-bit Sync pattern (constant), followed by 8 bits of Packet Identifier (PID, also constant), 11 bits of Frame Number (varying), 5 bits of CRC (varying) for error detection, and the EOP. That should take 34 bit times, plus overhead for NRZI encoding, for a duration of about 2.8 microseconds. That is completely consistent with our observations. We saw the first part of each packet remaining constant, and the later portion varying, followed by a consistent SE0.

With differential signaling, The receiving circuit responds to the voltage difference between the two signals, rather than the difference between a single wire and ground. This makes it more immune to common-mode noise induced on both wires, which can be a big advantage. Often differential signaling is used with positive and negative voltages, which maximizes this advantage, but requires a negative supply. Like standard USB, this interface uses only low (near zero volts) and high (about 3.3 volts) states.

When PTT was pressed, the data burst did not appear to grow in size. The part that stayed the same continued to stay the same, and the part that was rapidly changing continued to rapidly change. When a photograph was transmitted, no change in size or nature of the data burst was observed. Apparently no data is transmitted between the microphone and the radio for these two activities, which makes sense.

An additional amount of signaling was observed to follow the periodic (SOF) data burst. This second packet wasn't always transmitted, but when it was transmitted, it always followed the first burst and always occurred after the same amount of delay. See3Figure 14 for an image of both bursts. We have not decoded the second

packet, but it also appears to have the standard structure of a USB packet, including the sync pattern and SE0 EOP marker.

The FT1D handheld operated in a similar manner. The only difference discovered was that the speaker in the camera microphone worked as a speaker. When attached to the FTM-400, the speaker in the camera microphone was silent. With the FT1D connected, we probed the connector looking for the speaker audio, without finding anything. Since the audio doesn't come in as an analog voltage, We assumd that the audio was coming in through data on pins 2 and 3, but we have not verified that assumption

We decided that we would need a logic analyzer, or a USB protocol analyzer, to better study these signals. We had a basic logic analyzer on hand. This particular model is an FPGA-based open hardware design called the Open Bench Logic Sniffer. Of the several host programs designed to control and interface with that kind of logic analyzer hardware, we ran the recommended Java client "Logic Sniffer" on a Mac.

We attempted to solder some wire wrap wire to the connector in order to more easily connect the leads. The solder on the connector turned out to be very high temperature solder, and we were reluctant to risk damaging the connector by applying enough heat to melt the solder. Instead, we connected a ground wire on the large ground pad on the main board, and held the Logic Sniffer test leads to pins 2 and 3 manually to capture the data. Data was captured, and the SOF data bursts seen on the oscilloscope were also seen on the Logic Sniffer. The next experiment was to take a picture and see if image data could be captured by the logic sniffer. This was successful. When the shutter button is pressed, a large amount of data is transmitted over pins 2 and 3 to the radio. See Figure 14. When the review screen was zoomed out, it was observed that the data came in batches about 50 microseconds (about 600 bits) long. See Figure 15.

The Open Bench Logic Sniffer doesn't have a very large memory, so even with the camera ses to capture at the smallest size and lowest quality the entire transmission of data from camera to the phone could not be captured in full detail. We were able to confirm that the amount of data transmitted was about the same as the file size as stored on the microSD card, so presumably the JPEG encoding is being done in the microphone. The analyzer also has relatively primitive triggering features, so we weren't able to capture the beginning of the transfer, where the standard JPEG file signature would be readily identifiable. Ideally we'd like to capture the entire exchange, to confirm how the file is being transferred.

Next steps in this direction would require a more capable logic analyzer or, preferably, a dedicated USB protocol analyzer.

Software-based USB protocol analyzers are available, including some for free. It's possible we could learn more by using one, but they are really intended for use when a device is connected to a standard computer. In this case, where we have a proprietary device connected to a proprietary host, we really need to use a hardware based analyzer.

There are several USB hardware analyzers on the market. One relatively low cost unit is the Beagle USB 12 from Total Phase. It can handle the 12 MHz "Full Speed" interface used here, but no faster. It costs $400, and comes with software that is artificially limited in its ability to decode USB transactions. Most hardware analyzers are much more expensive. Purchase was put on hold pending the results of some inquiries about borrowing time on an existing USB protocol analyzer or logic analyzer.

There are also software-based USB protocol analyzers, including some for free. Of course, they are intended for the case where the device is connected to a standard host computer. They would not be directly useful for the case of the camera microphone connected to the transceiver, but they might be useful if the camera microphone's interface is close enough to standard USB to be recognized by a computer.

We had seen enough evidence to support our guess that the data interface on pins 2 and 3 might be standard USB. To put this theory to the test, we decided to try hooking up that interface to a computer's USB port and see if it would be recognized.

A standard USB cable was partially disassembled, and pins 2 and 3 and power and ground from the camera mic were connected to the corresponding pins of the USB cable. The USB cable was connected to a MacBook Air running Mac OS X 10.10.3 Yosemite. Nothing visible happened. The wires for pin 2 and pin 3 were reversed. A USB message was then captured from the console.

```
4/18/15 8:33:00.000 PM   kernel[0] USBF:    15721.218    The IOUSBFamily is
having trouble enumerating a USB device that has been plugged in.  It will
keep retrying.  (Port 2 of Hub at 0x6000000)

4/18/15 8:33:02.000 PM   kernel[0] USBF:    15723.357    The IOUSBFamily
was not able to enumerate a device.
```

These messages speak of difficulty "enumerating" the device. That refers to an essential step in the USB protocol that enables plug-and-play operation with many USB devices. Normally, a newly connected USB device will respond in a particular way that enables the host computer to recognize exactly what type of device it is, so that the right device driver software can be activated to use the device.

The error is a fairly generic one. It suggests that the computer was able to tell that something had been connected, but that it could not complete the basic handshake to find out what had been connected. This kind of error can be caused by cable problems (our pin-probing arrangement wasn't exactly according to USB standards) or it could be a software issue on either end. The next step here would be to make solid connections to the data pins and try to capture the attempted enumeration on a logic analyzer.

Despite the failure to enumerate the camera mic as a standard USB device, we think the chances that the interface is basically USB and can be made compatible with other devices are still pretty good.

Summary

The interface between the radio and the microphone does appear to rely on USB or USB-like signaling. Signals were identified, and data captured that does appear to be USB packets. USB allows for a variety of potential experiments and applications with System Fusion radios.

Figure 2: Front View of Camera Microphone
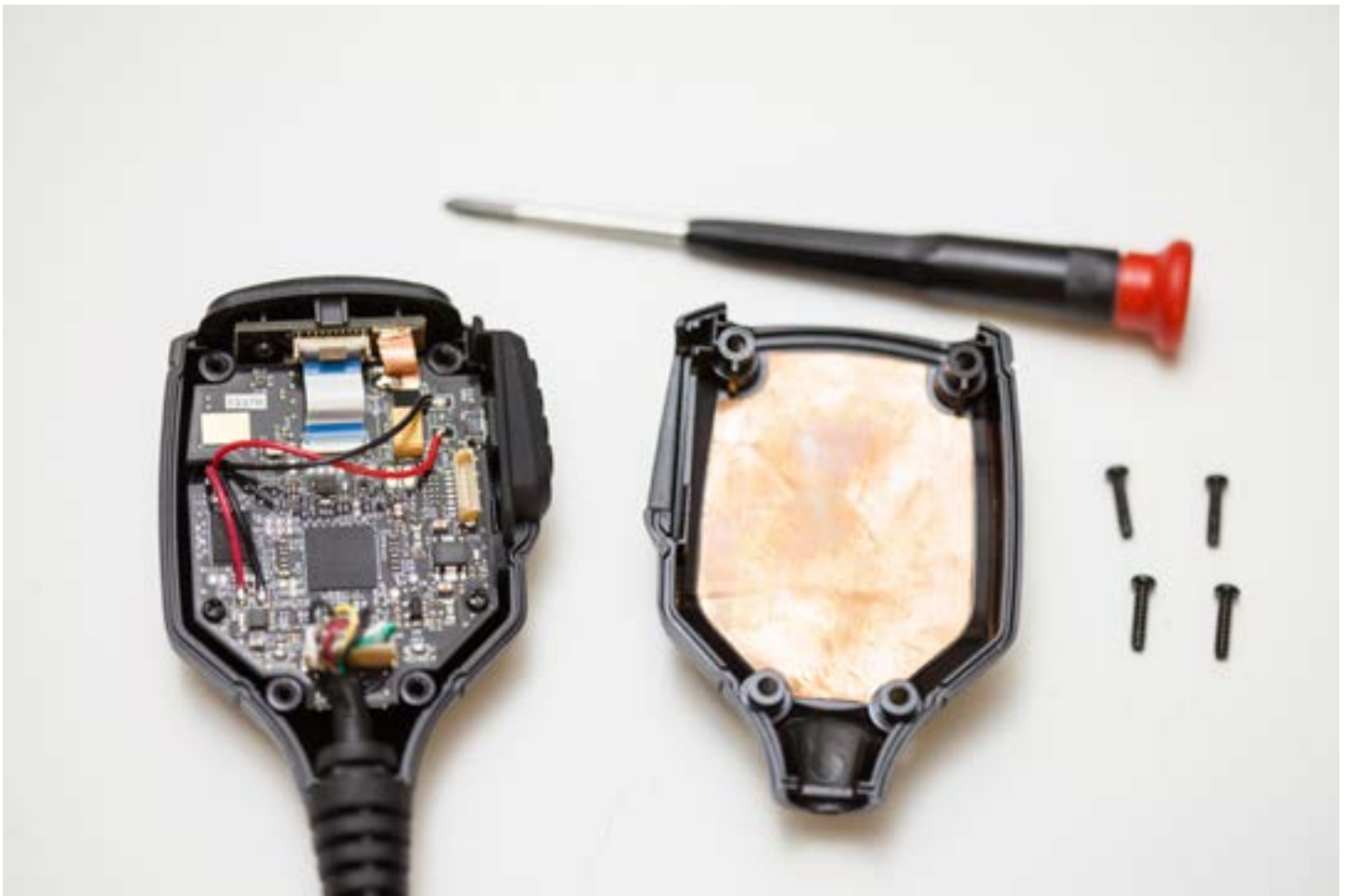
Figure 3: Removing the Back Plate

Figure 4: Back Plate Removed

Figure 5: Main Board

Figure 6: ARM STM32F207 ICH6

Figure 7: Sensor Board Lifted Out

Figure 8: Camera Exposed

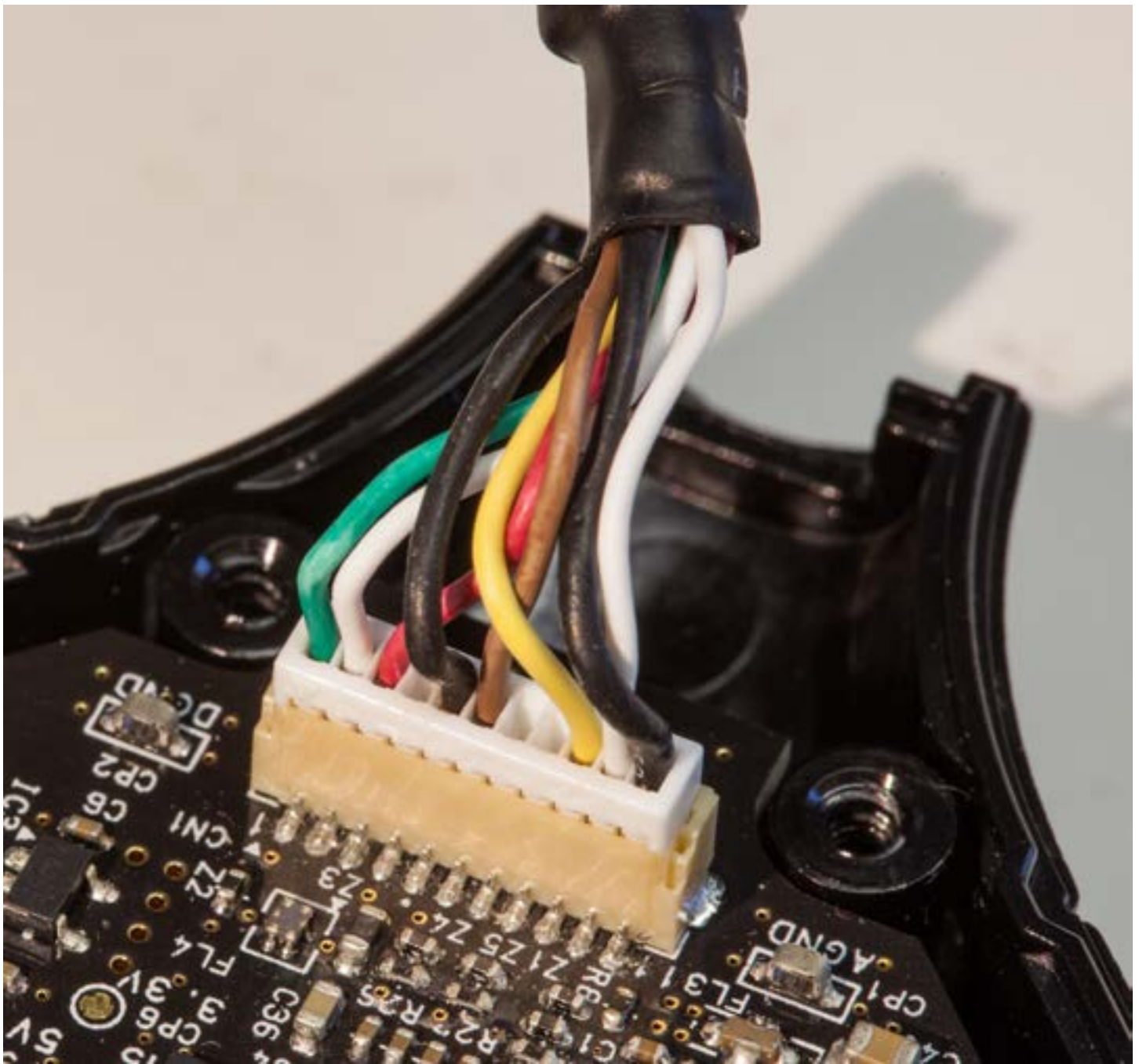Figure 9: Back of Main Board and Speaker

Figure 10: Connector CN1
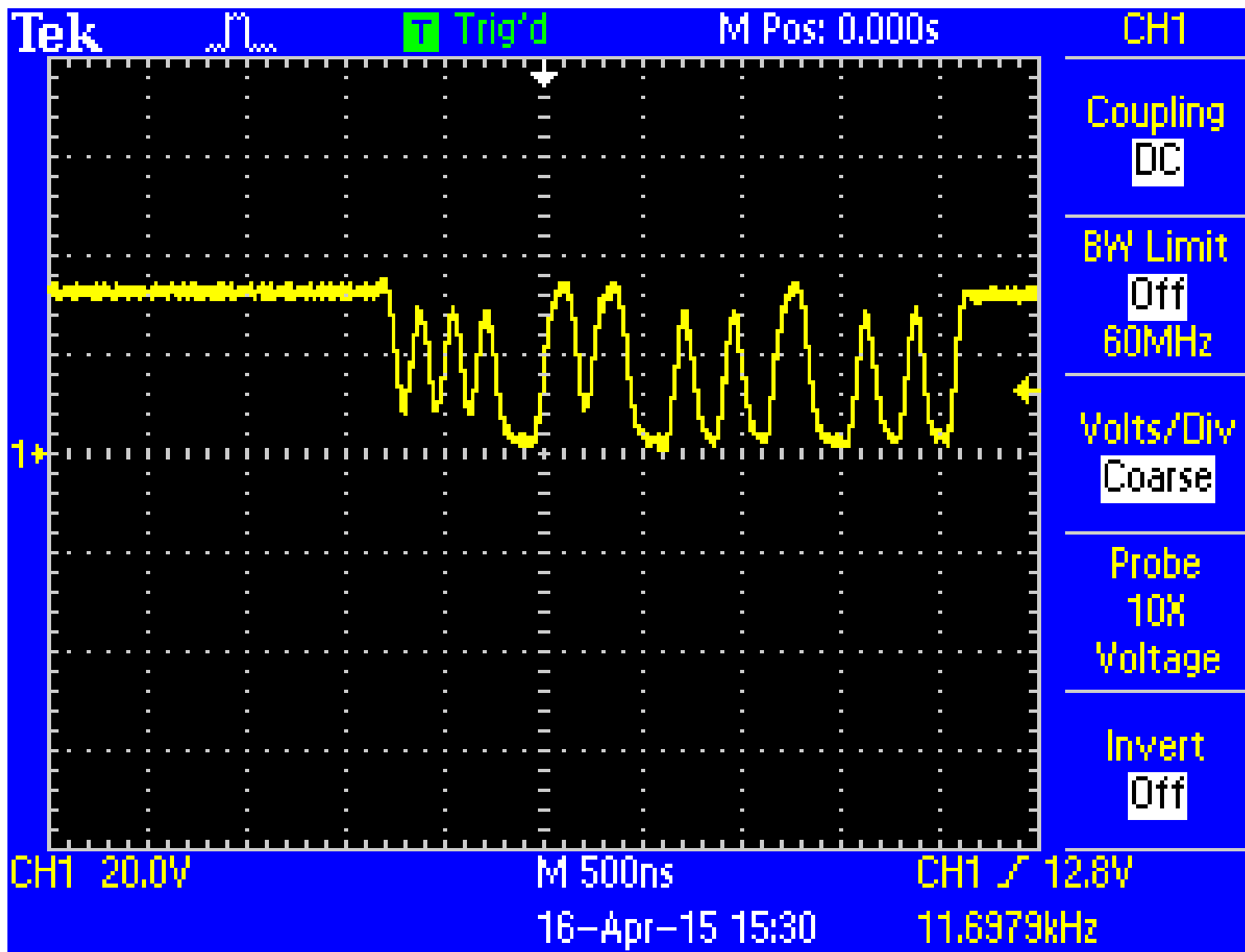
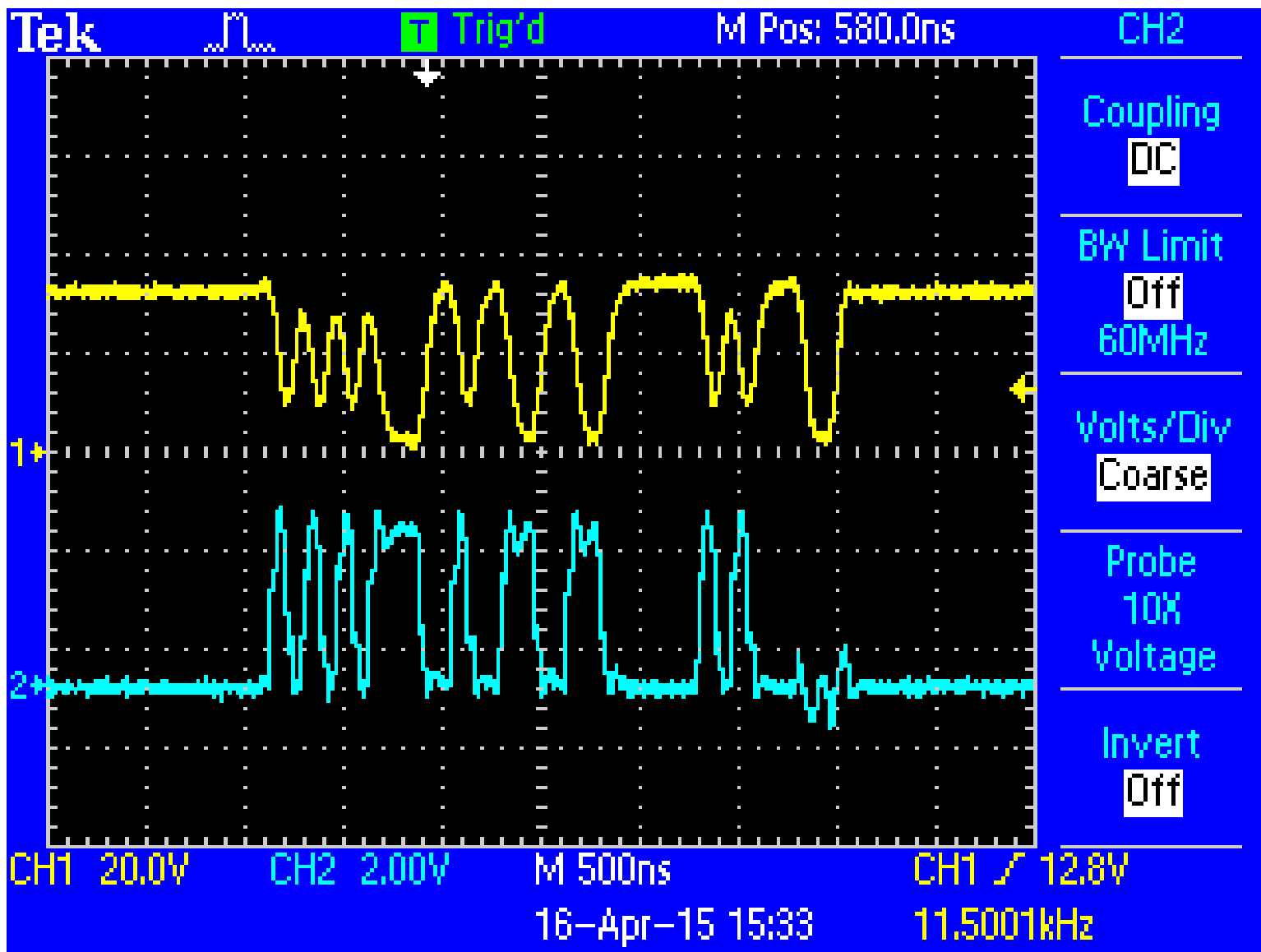Figure 11: Camera Microphone Plug Detail

Figure 12: Pin 2

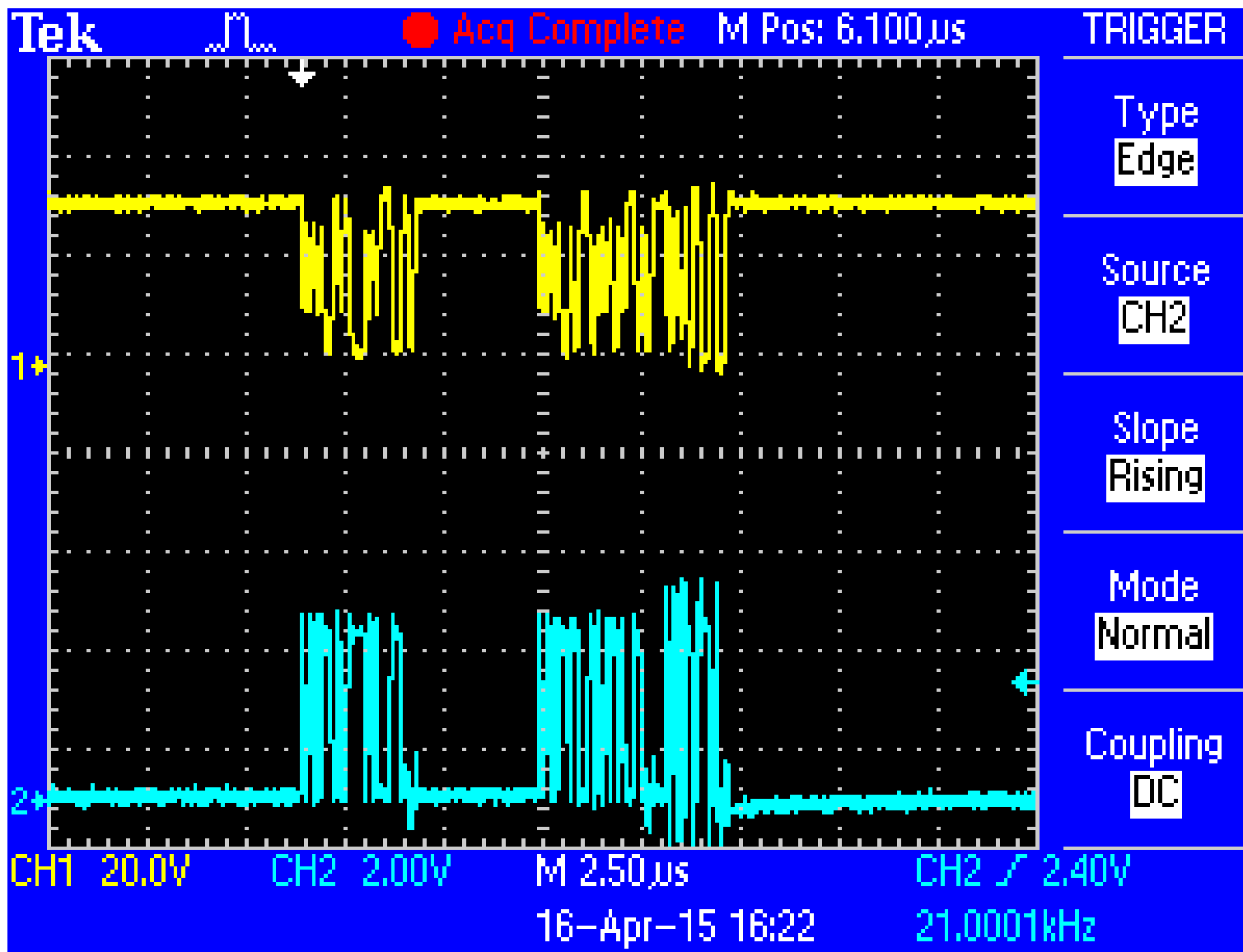Figure 13: Pin 2 and 3 Comparison of Initial Data Burst Signals

Figure 14: Pin 2 and 3 Initial Data Burst and Burst That Sometimes Follows Initial Data Burst

Figure 15: Data from Pin 2 and 3 During Shutter Press
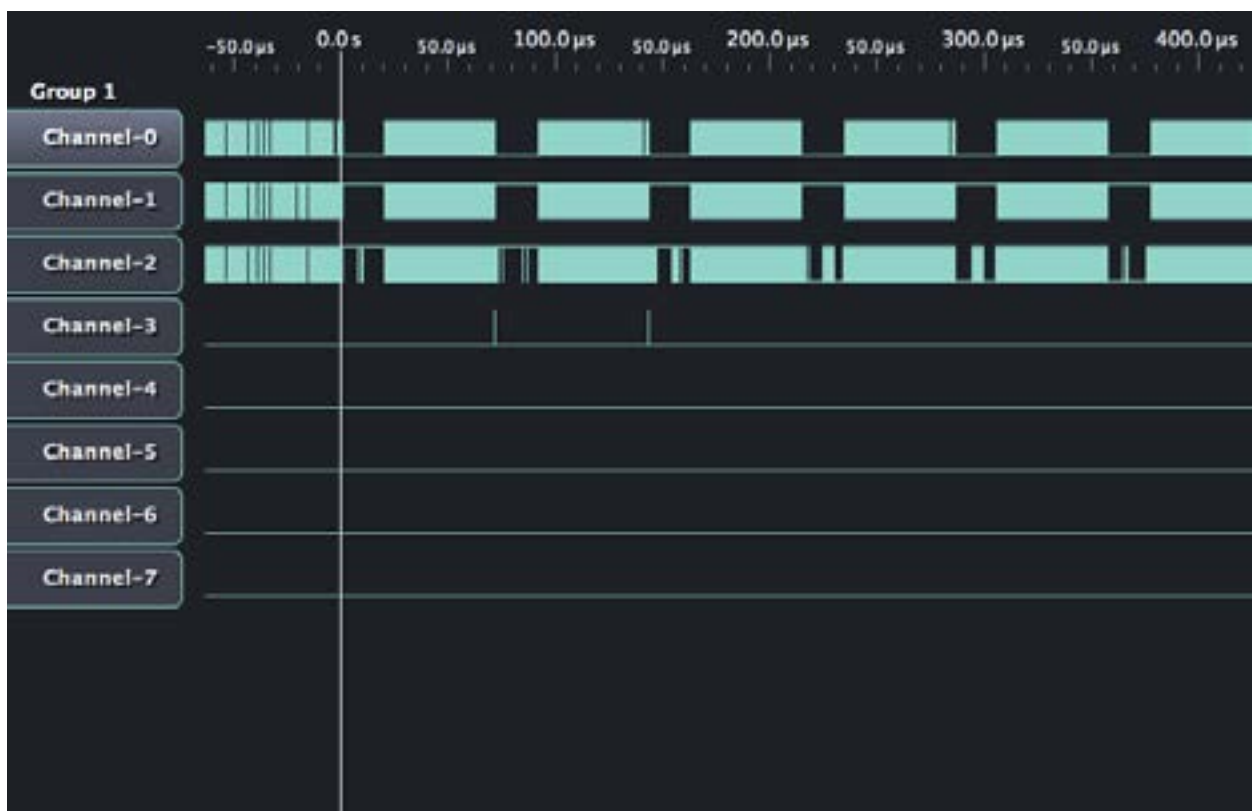
Figure 16: Data from Pin 2 and 3 During Shutter Press Zoomed Out

Signal Adventures: SigGens from China

Article and photos by Paul KB5MU

At the November meeting of the San Diego Microwave Group, Kerry N6IZW showed a recent eBay purchase: a little black box described variously as something like "138MHz-4.4GHz USB SMA Source/Signal Generator/Simple Spectrum Analyzer". It looked like a good deal, so I ordered one too. It cost $63.69 including free shipping from Shenzhen, China, and comes with a USB cable, two 12-inch SMA cables, and a mini CD of related software. There are other configurations available, including one with a wider frequency range (35 MHz to 4.4 GHz) for a bit more money, one without a box for a bit less money, and even one with a built-in ARM-based microcontroller (STM32F103) with a color LCD display programmed as a user interface for the device.

The BG7TBL signal generator and spectrum analyzer device.

The 3" mini-CD was the first challenge. These don't work in slot-loading drives, much less in modern computers that have no optical drive at all. I tend to keep old computers, so I didn't have much trouble finding one with a tray-loading drive that could read the disc. See the screen shot. The filenames are in both Chinese and English, and clearly some of the files on the disc refer to some other product (a GPS disciplined oscillator). I decided to set the disc aside and look for software on the internet instead. There's a callsign visible in the disc's directory listing (BG7TBL) so I decided to search for that.

The search was fruitful. I found out that BG7TBL was the original designer of the device, and that it is based on an Analog Devices ADF4350 wideband synthesizer with integrated VCO. It contains an FTDI USB-to-serial chip to provide the computer interface, which doesn't require a unique driver because it looks like a standard USB serial port. There was also a link to http://www.dl4jal.eu for software. The good news is that DL4JAL's LinNWT software runs on Windows, Macintosh, or Linux. The bad news (for me) is that it's in German. There's a manual that's "in English" but it appears to be a machine translation.

◢ Files Currently on the Disc (8)

📁 BG7TBL GPS驯服钟资料 BG7TBL GPS disciplined clock

📁 NWT系列扫频仪资料 nwt serial sweep analyzer

📁 华为GPS驯服板资料 HW(HUAWEI) GPSDO board

📁 简易频谱,简易信号源资料 simple spectrum analyzer,simple signal generator

📄 NWT系列扫频仪资料 nwt serial sweep analyzer.rar

📄 华为GPS驯服板资料 HW(HUAWEI) GPSDO board.rar

📄 天宝驯服板相关资料 TRIMBLE GPSDO board.rar

📄 简易频谱,简易信号源资料 simple spectrum analyzer,simple signal generator.rar
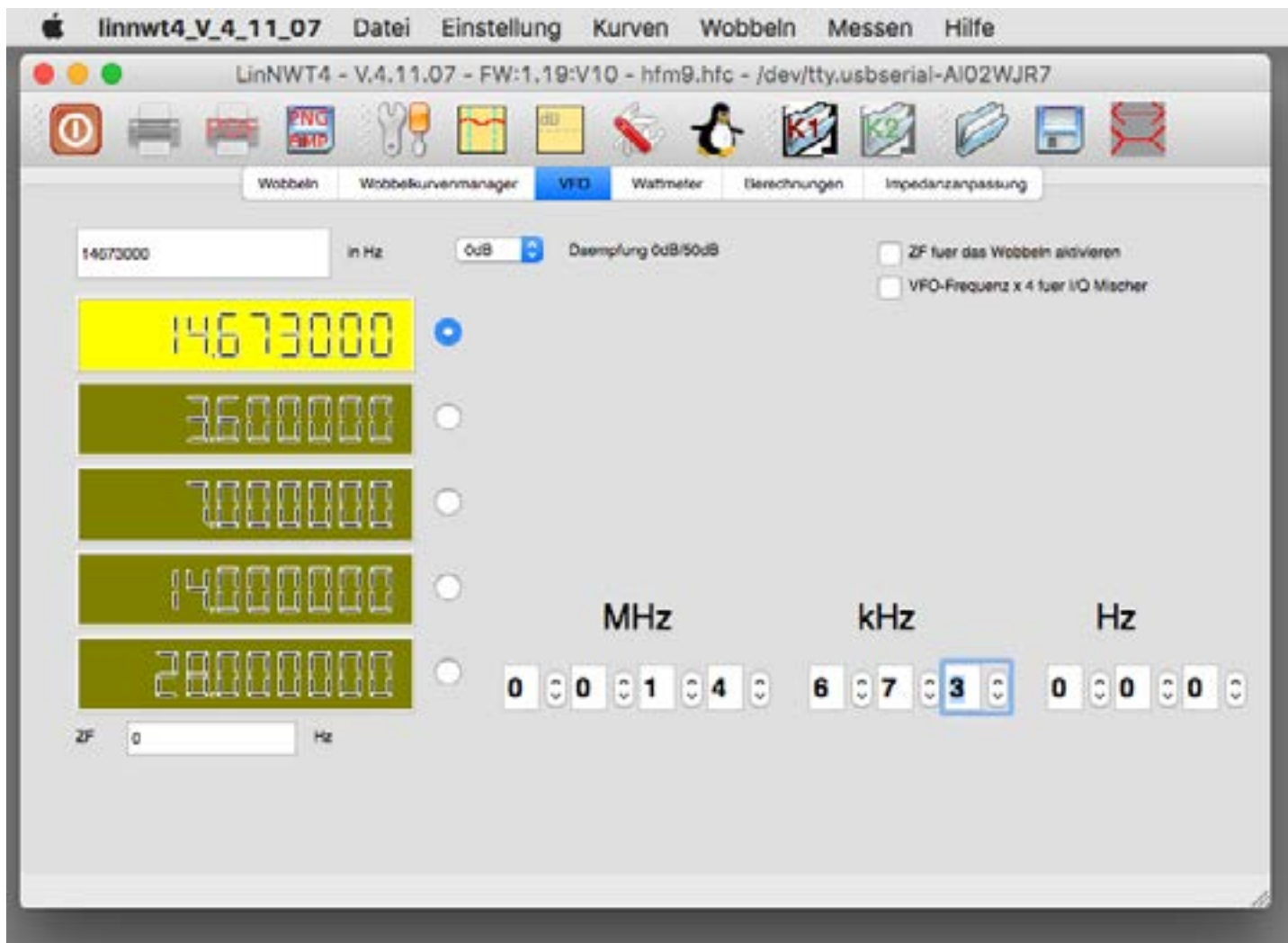
VFO screen of LinNWT running on the Mac, generating 146.730 MHz after the 10X multiplier.

OK, German is almost like English, right? I decided to try using the software first (though I usually prefer to read the manual). I loaded the Mac OS X version of the LinNWT software, found the "VFO" tab, configured it to generate a 1GHz signal, and hooked it up to W5NYV's Tektronix 492 spectrum analyzer. Setting up the spectrum analyzer to look in the vicinity of 1 GHz, I saw nothing. Tuned around, and still saw nothing. Did I get a bad unit?

Back to the web. I found an article on the device at http://dalbert.net/?p=219, which confirmed that the LinNWT software is only available in German with minimal English documentation. It reports that the signal source is pretty clean except for the third and higher order harmonics, which are not filtered, and that his unit showed about 7ppm of frequency error. Not bad for such inexpensive test equipment. The author compiled his own version of the software to run on Linux. The configuration settings he mentions appear to be in English. In particular, I noticed mention of a "frequency multiply" setting of 10. I couldn't find any such setting in the German OS X program, but I wondered if I was missing a factor of 10 in frequency. So, I tried setting the program to 100 MHz instead of 1 GHz. Sure enough, with the program set to one-tenth the desired frequency, I could see the signal on the spectrum analyzer.

I then wanted to see for myself just how bad the harmonics were, so I configured the unit to generate a frequency near its lower limit. Just for fun, I chose 146.730 MHz. Then I configured the spectrum analyzer to sweep from DC to 1.8 GHz, which is as far as it would go in a continuous sweep. See the photo. Sure enough, there are strong harmonics all the way up. For comparison, I hooked up a Yaesu VX-7R I had handy, and saw that it was very much cleaner. See photo.
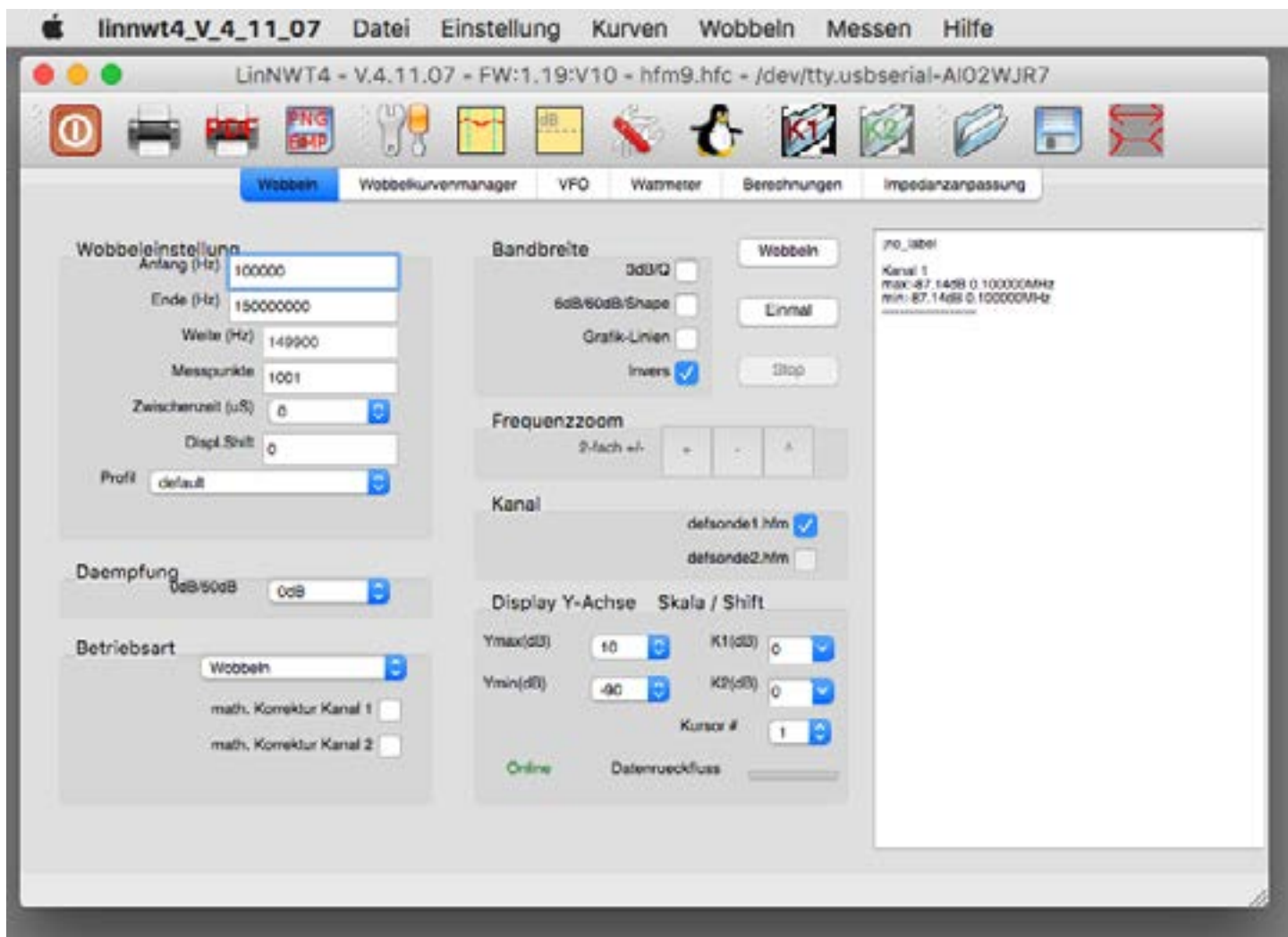
*Spectrum analyzer screen of LinNWT running on the Mac.*

I also spent some time looking for higher harmonics. In the popular microwave ham band at 10 GHz, the harmonics were strong and easy to find, so this device will be useful as a marker generator in that range. With some fiddling, I was able to find harmonics up to 18 GHz, near the top of the spectrum analyzer's range.

I was originally interested in this device as a signal generator, but it also claims to work as a spectrum analyzer, though it doesn't have any resolution bandwidth filters. I wondered if it would be of any use. I connected a 2m whip antenna for an HT to the device's input connector, set it to scan from 140 to 150 MHz, and used the VX-7R to transmit a test signal, again at 146.730 MHz. See photo. Sure enough, there's a big signal from the nearby transmitter. You can also see a smaller signal, which appears to be around 148.5 MHz. That signal doesn't depend on the signal from the VX-7R; it's really there. See photo. I tuned the VX-7R to 148.5 MHZ and heard the signal on the HT as well. Searching around the room foxhunt-style, the signal seemed to be coming from the Mac. So the spectrum analyzer function has already proven its worth, by spotting a spurious emission from equipment in the shack. Once I knew the signal was there, I could find it on the Tek 492 as well. See photo.

I wanted the English user interface, so I decided to compile LinNWT under Raspbian Linux on the Raspberry Pi. Following the instructions from the article, it built with no hassle, and ran with a mostly-English user interface when run as specified (using a command line argument of app_en.wm, which refers to the English localization file). The only catch was that the device wouldn't power up when connected directly to the Raspberry Pi's USB port, probably because there wasn't enough current available. Moving the device to a powered USB hub solved that problem. In the English user interface, I found where the frequency multiplier is set, and the same location in the German version

on the Mac did the same thing. Apparently it has to be set to 10 to make the frequency displays match reality.

Back on the Mac, I found I could get the same partially-English UI by copying the app_en.wm file out of the Linux distribution and starting the Mac program with the same command line argument as on Linux. I couldn't find a way to make that automatic, though, short of writing an Applescript. Windows users, you get the localized user interface automatically by choosing English when you install the program.
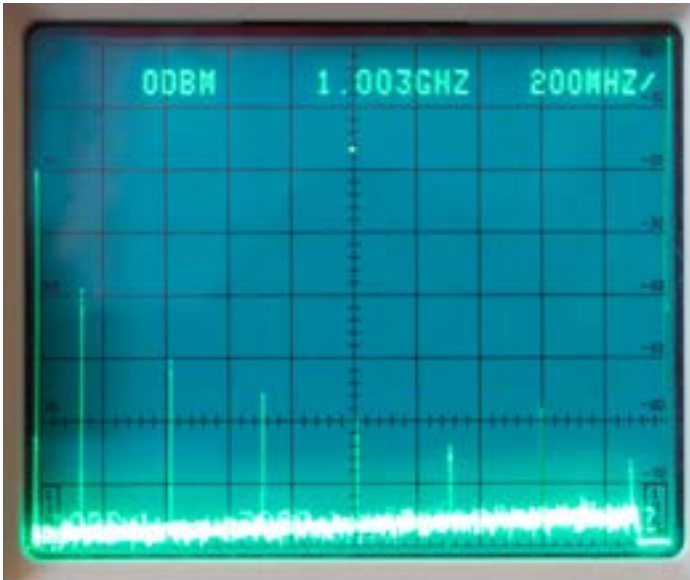
Tek 492 spectrum analyzer screen showing extensive harmonics generated by the device.
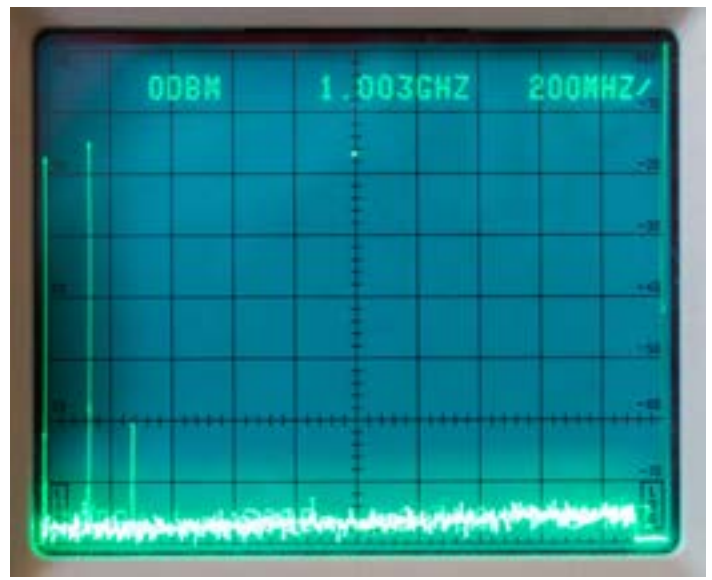
Tek 492 spectrum analyzer screen showing a clean carrier on 146.730 MHz from the VX-7R.

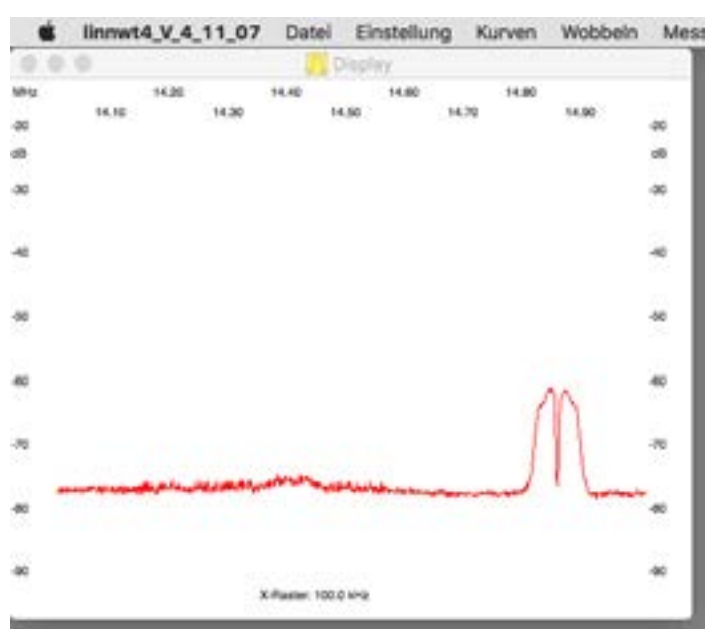*The BG7TBL signal generator and spectrum analyzer device, bottom of circuit board.*

The BG7TBL signal generator and spectrum analyzer device, top of circuit board.
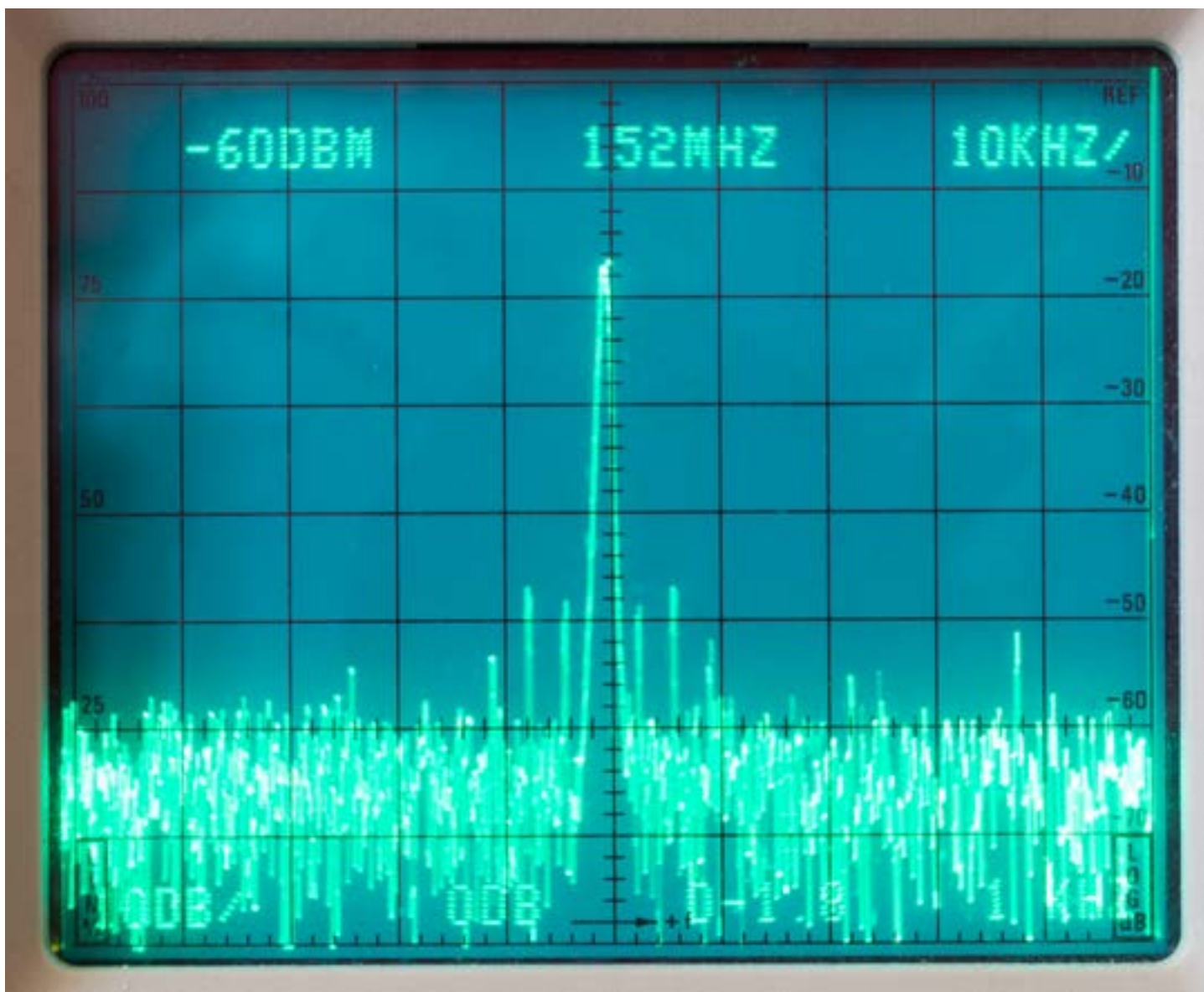
Tek 492 spectrum analyzer screen showing a close-up of the mystery signal at 148.5 MHz.
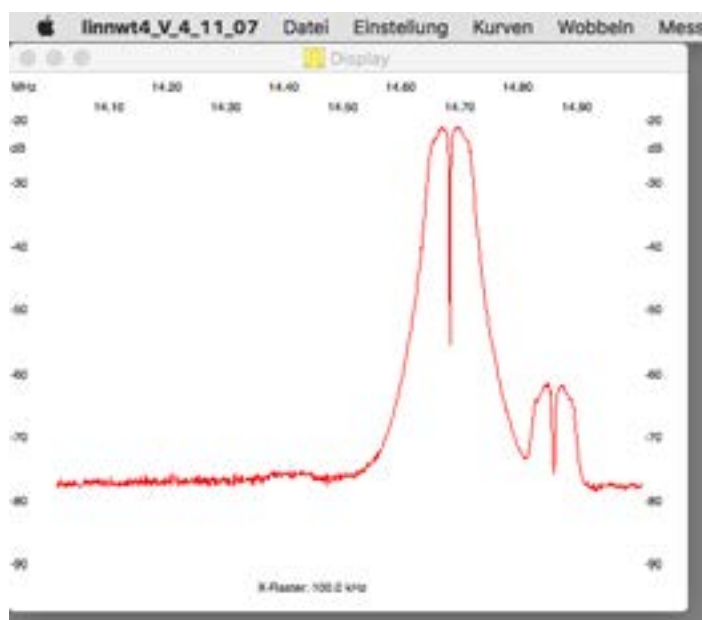
LinNWT spectrum analyzer plot showing the VX-7R transmitting on 146.730 MHz and a mystery signal around 148.5 MHz.

LinNWT spectrum analyzer plot showing just the mystery signal around 148.5 MHz.

SCOPE page 39

Repeater Site Technical Video Report

Among other tasks, Repeater Technical Chair Mark KF6WTN and PARC President Charlie NN3V investigated a complaint about the 147.130 machine squelch level. With able assistance from Joe WB6IQS, Mark was able to adjust the squelch. Reports after the adjustment were good. Here's a video of the teamwork in action.

Featured Program:

At 7:30pm on 2 December 2015, Palomar Amateur Radio Club will hold elections for the 2016 board of directors and whether or not to grant Mike Pennington K6MRP Life Membership in PARC. Come at 7pm to socialize and brng a dish to share. We look forward to seeing you at the Carlsbad Safety Center, 2560 Orion Way, Carlsbad, CA.

Sign up for the PARC Email Lists:

http://www.palomararc.org/mailman/listinfo