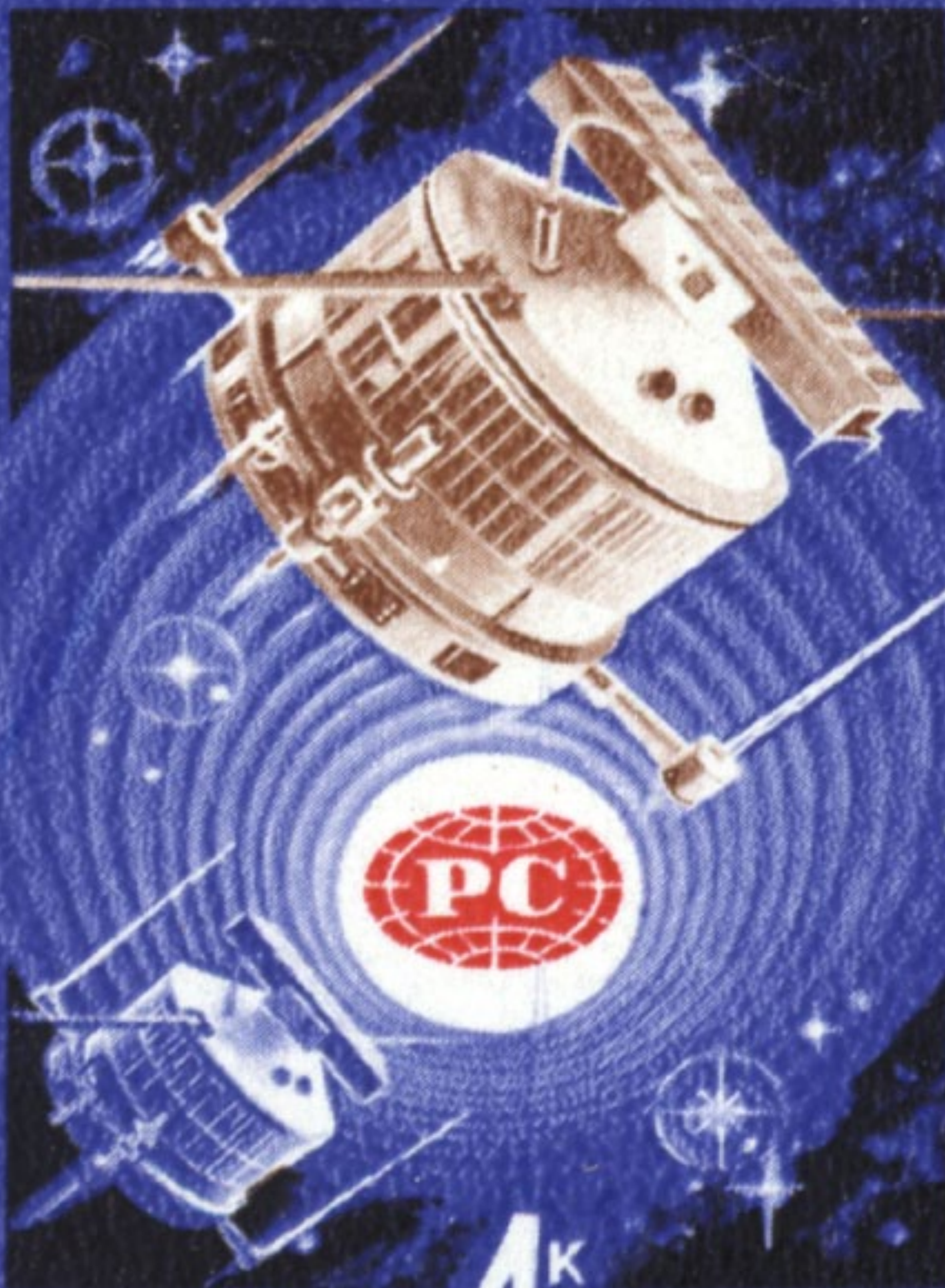РАДИОЛЮБИТЕЛЬСКИЕ

ОКТЯБРЬ 1978

СПУТНИКИ

РС

ПОЧТА 4к СССР

1979

Save The Date

Yuma Hamfest
19-20 February 2016

See page 30 for details!

Club
Meeting 7pm
3 February 2016

Carlsbad Safety Center,
2560 Orion Way, Carlsbad
KB6NXC (Kris) will
demonstrate practical Arduino
programming and 3D
printing. See page 66 for
more details!

PARC
Board of
Directors Meeting
7pm
10 February 2016

14322 Pomerado Road,
Poway, CA 92064

Contents

"Silence is golden," says the old proverb, and this even proves true in radio transmissions. Many of us have heard net roll calls in which the first letter or letters of every call sign got cut off because net control did not observe the one second of silence required after keying down to allow the squelch to open on the repeater, or the links to open up on a series of repeaters. So this same second of silence can be truly golden to everyone listening to us every time we push the PTT in our normal transmissions.

Likewise, two seconds of silence can be golden before we even key down when replying in a QSO because, in just those two seconds, another station can break in to join the conversation or make a quick comment, or even be able to pass emergency traffic.

And many seconds of silence can be golden before we key down after tuning to a new frequency to make sure that we are not interrupting a net roll call or a QSO already in progress. Yes, sometimes it seems that, in the words of another proverb, the less said, the better.
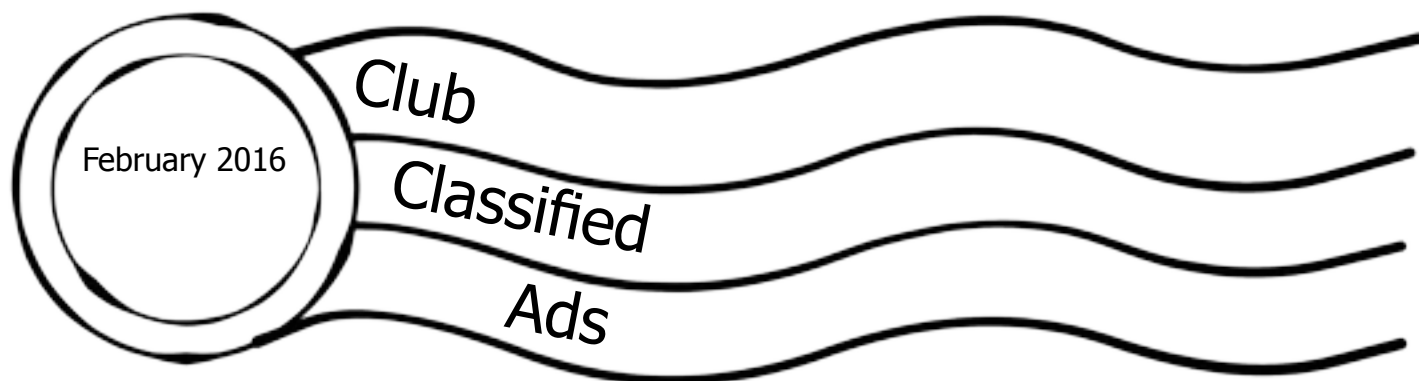
by John AC7GK

"He who does not know how to be silent will not know how to speak." - Ausonius

Q: Do they have a repeater in the Grand Canyon?

A: Echolink, but you have to yell.

AUCTION IPAD HELP NEEDED

If anyone knows the person who donated the ipad to last October's auction, please have them contact KK6EED@amsat.org. We cannot reset the defaults without your help!

FOR SALE! LAST CHANCE!

Generator for sale. Military style O.D. green color. 120 VAC output, 2 KW, 4 cycle gasoline powered. Open frame construction.

$100 or best offer.

Call John, WB6IQS, Vista, CA. WB6IQS@att.net. You pick up. No delivery.

or...

760-7 Two 7-Three Eight 76
John, Vista, CA.

FOR SALE!

SignaLink USB Sound Card Interface & Accessories

- SignaLink USB p/n SLUSB6PM

- Plug & Play Jumper Module p/n SLMODHT

- Plug & Play Jumper Module p/n SLMOD6PM

- Extra Radio Cable p/n SLCABHTY

All items brand new, all for $75.

de Bill KK6LWE@arrl.net

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

Club Financial Update

Income and Expense by Month
December 2015

| Income |
| Expense |

$ in 1's

NORTH SENTINEL ISLAND DX CLUB APPROVES THESE EXPENDITURES!
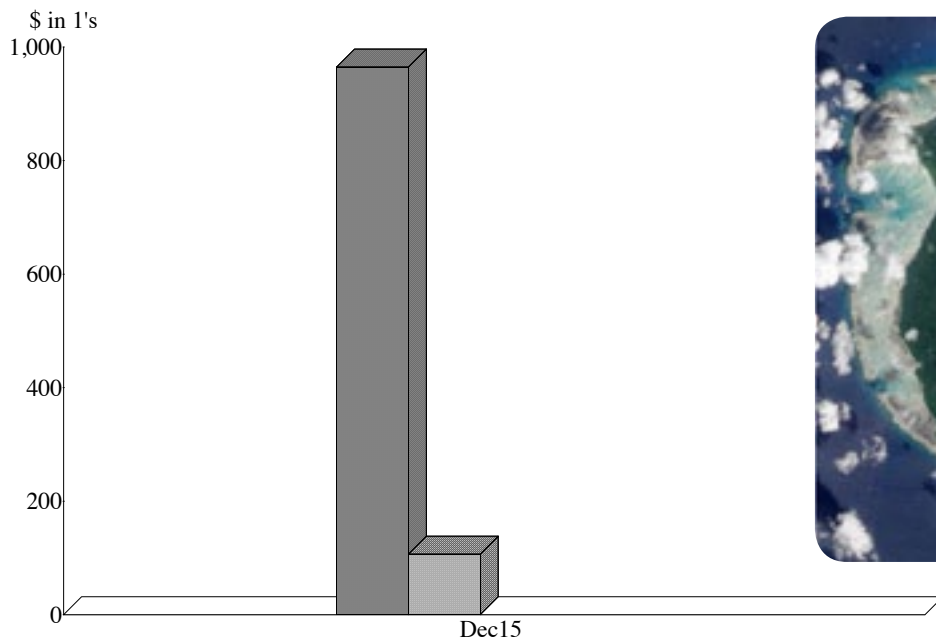
Dec15

Expense Summary
December 2015

Rptr Electric	%70.96
Rptr Phone	29.04
Total	$106.78
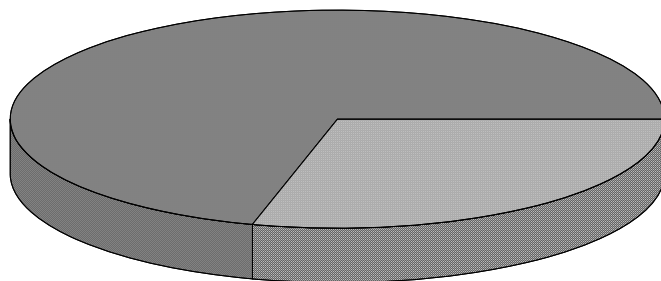
Palomar Amateur Radio Club, Inc.
Income/Expense by Category
December 2015

	Dec 15
Income	
Donations	655.00
Dues	135.00
Misc Incom	175.00
Total Income	965.00
Expense	
Rptr Electric	75.77
Rptr Phone	31.01
Total Expense	106.78
Net Income	**858.22**

By Account

February 2016

Committee Chairs
and
Board Members

Contact
Info
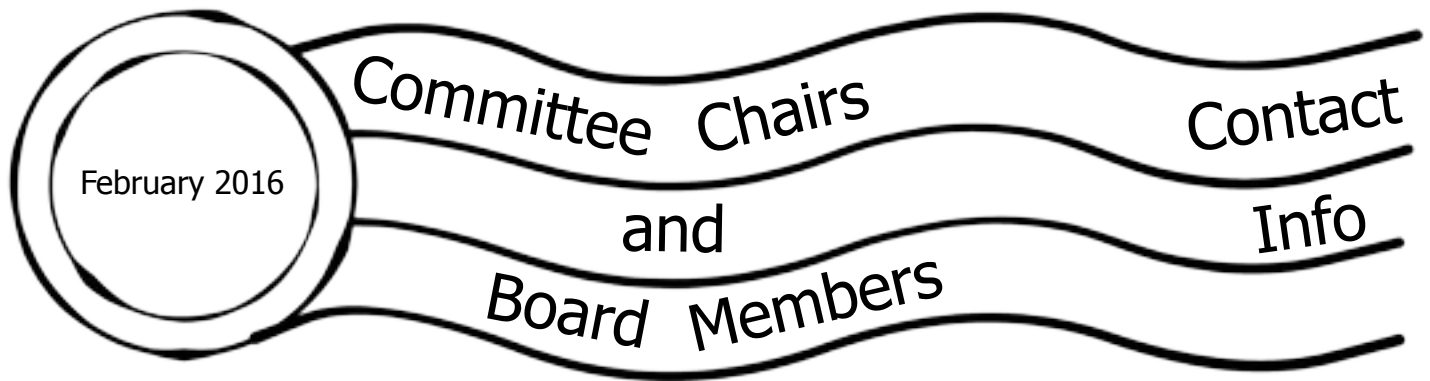
Current Board of Directors

President	Charlie Ristorcelli, NN3V	(619) 368-7617
Vice President	Joe Peterson, K6JPE	(619) 630-8283
Treasurer	Tom Ellett, W0NI	(858) 546-1148
Secretary	Sandy Pratt, KK6EED	(858) 748-2611
Director #1	Kevin Walsh, KK6FRK	(858)722-5069 (text welcome)
Director #2	John Walker, AC7GK	(949) 212-5533
Membership Chair	Glen Christensen, KJ6ZQH	(858) 735-1144
Repeater Technical Chair	Mark Raptis, KF6WTN	
Scope Editor	Michelle Thompson, W5NYV	(858) 229-3399 (text welcome)

Not on the Board

Repeater Site Chair	Mark Raptis, KF6WTN (acting)	(760) 672-0223

The board members might have callsign@amsat.org mail aliases.

Committee Chairs

EchoLink	Bernie Lafreniere N6FN	N6FN@niftyaccessories.com
mesh networking	Phil Karn KA9Q	karn@ka9q.net
Operating Day	Tom Martin	k6rcw@amsat.org
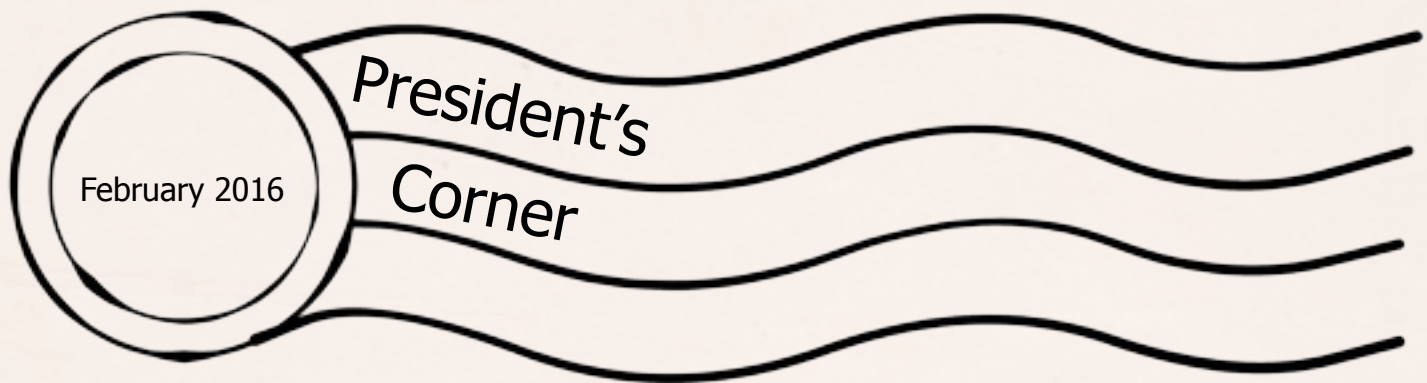
Happy Valentine's Day! And don't forget to remind your valentine that ham radio toys make excellent Valentine gifts even if not made of chocolate, or if not wrapped in red velvet hearts. Make sure they know the address of your candy store.

I hope you enjoyed last month's TX3X program. We were fortunate to have K5GS (Gene) visiting San Diego for two days, and that he was able to regale us with tales of the DXpedition.

Elsewhere in this edition of Scope you will find a summary of the results of the informal survey that was taken at last month's meeting. The Club's Board of Directors plans to use similar surveys to get further refinement of club member interests, and to orient club programs and activities to satisfy them. Needless to say, the information the Board is looking for will only be as good as you the member provides. Remember, this is your club. The Club will respond to your interests.

Survey response or not, if you are interested in a specific program, tell us! Better yet, if you already know of a program that might be presented, or are willing to present it yourself, tell us! If you have an amateur radio subject about which you are passionate, write a Scope article. Scope reflects your interests!

One conclusion from the survey is that members wish to see more "hands on" activity and programs. The Board hears you! To that extent, I believe upcoming programs, such as that planned for this month, and follow on Club activities will be of interest to all.

Last but certainly not least, the specifics of our relationship with Amazon, and how it relates to the Club's recent designation as a tax exempt non-profit is explained in this Scope. I certainly hope you will consider making use of www.smile.amazon.com when you shop on Amazon. Doing so will have absolutely no impact on your purchase price, but is a painless way to donate to the Club.

Remember that Amazon knows their smartphone app does not work for that purpose.

To make use of the donation opportunity, you must shop online at www.smile.amazon.com, and **designate Palomar Amateur Radio Club** as the charity to which you wish Amazon contribute.

73 and I hope to catch you on the air!

SANDARC Quarterly Meeting Report

29 January 2016
Paul KB5MU
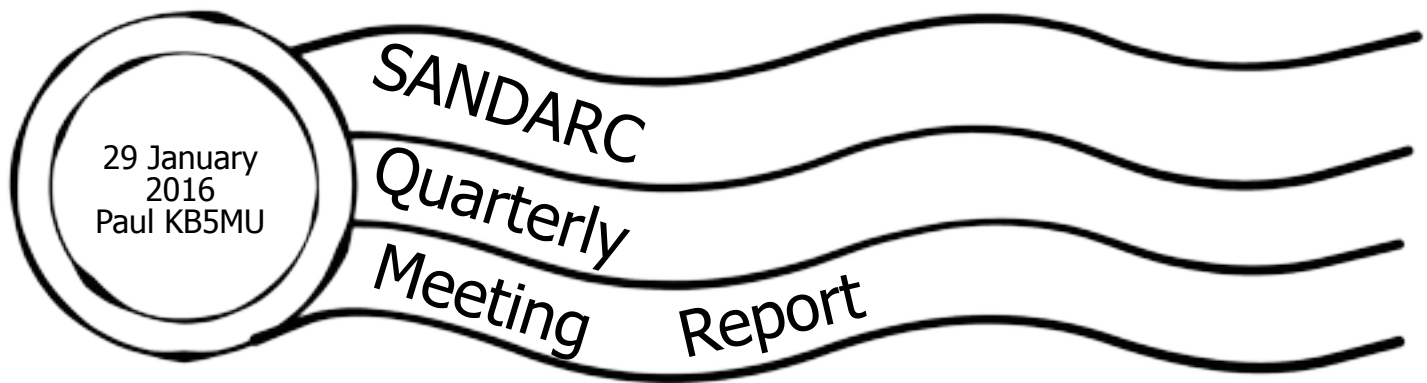
The San Diego Amateur Radio Council, SANDARC (http://sandarc.org), is a club of clubs supporting amateur radio in the county since 1958. PARC is one of the member clubs. Each club can send up to two delegates and two alternates to SANDARC's quarterly meetings. Presently PARC's delegates are Michelle Thompson W5NYV and me, Paul Williamson KB5MU.

Historically, SANDARC's primary function is to organize the ARRL Southwestern Division Convention every fourth year (2018 is next). SANDARC provides the seed money and receives any profits generated from running the convention. In 1984 when the FCC began certifying Volunteer Examiner Coordinators to give license exams, SANDARC created SANDARC-VEC to ensure the ready availability of exam sessions in our area. SANDARC-VEC administered about 35 test sessions in 2015.

At the quarterly meeting on January 28, the main order of business was the 2016 budget for SANDARC-VEC. Greg Smith N6NYX, the VEC Chairman, presented the budget proposal, as required by SANDARC's Bylaws, along with this chart comparing it to the 2015 budget. As you can see, the plan for 2016 includes increasing the exam fee from $5 to $10 per applicant. For comparison, ARRL-VEC currently charges $15. Whereas the 2015 budget showed a running deficit, the new budget proposal is theoretically break-even, despite allowing for increased expenses in most line items.

There was no controversy about the need to increase the exam fee and balance the budget. There was, however, some discussion about how expenses are to be accounted for. It turns out that the biggest expense by far is transportation: each Volunteer Examiner typically drives some miles to the exam site for each test session. Using the IRS mileage reimbursement rate for business of 57.5 cents/ mile, that works out to $388.13 per month, according to the proposed budget. These expenses are incurred by the individual VE, who is eligible to be reimbursed by the VEC. However, VEs generally do not bother to request reimbursement, so the VEC has no actual expenditures for these expenses. For 2015, this meant that the theoretical running deficit of about $150/month was actually a surplus of about the same size. If the same thing happens in 2016, the budget shows that the surplus would be more than doubled.

When a VE incurs an expense, but does not request reimbursement, SANDARC-VEC treats it as a voluntary donation to the SANDARC general fund. Some delegates at the meeting disagreed with this interpretation.

In the recent past, SANDARC has funded purchase of amateur radio license manuals for local public libraries. Since this is related to getting new hams licensed, it has been accounted for under the SANDARC-VEC budget. Greg N6NYX has reviewed the FCC rules and the guidance published by the National Conference of Volunteer Examiner Coordinators (NCVEC), and determined that license manuals for libraries is not a valid VEC expense. If SANDARC wishes to continue to fund the books (and there was some controversy about that), it will have to pay for them out of the general fund. Some delegates disagreed with this interpretation, and/or that SANDARC is bound to comply with NCVEC guidelines.

After an extensive discussion, 13 delegates voted to approve the VEC budget as proposed, for a period extended to April 2017. Only 4 delegates voted no, so the VEC budget passed by more than the two-thirds margin required by the SANDARC Bylaws.

A budgetary feasibility study for the next convention is under way. A spreadsheet of expenses has been created, but expected income is yet to be quantified. A set of questions about the convention will be published for all the member clubs to answer.

Steve Early AD6VI, the ARRL Section Manager for San Diego, reminded delegates about the Section Manager election. Pat Bunsold WA6MHZ and Dave Kaltenborn N8KBC are running, and votes are due soon. Steve AD6VI said that he prefers Dave N8KBC. Pat WA6MHZ made a very brief statement.

Bruce Kripton KG6IYN, ARRL Section Emergency Coordinator, encouraged operators to participate in the upcoming January VHF Contest and Winter Field Day events.

SANDARC-VEC 2015-2016 Budget		
VE Expense Estimates	2016 Budget	2015 Budget
Transportation	388.13	301.88
Postage	20.00	10.00
Office Supplies	30.00	10.00
Reprographics	30.00	10.00
Communications	20.00	10.00
Utilities	10.00	0.00
Site Fees	60.00	30.00
NCVEC Conference	0.00	0.00
SANDARC VEC Admin	16.87	15.00
VEC Capital Equipment	25.00	15.00
Total VEC Monthly Expenses	600.00	401.88
VEC Income		
Exam Fee	$10	$5
Exams	60	50
Retests	0	0
Admin Requests	0	0
Total Monthly Income	$600	$250
Monthly Profit (Loss)	$0.00	($151.88)
Transportation Estimate		
Mileage Rate	0.575	0.575
Miles Round-trip	15	15
Examiners per Site	9	7
# Sites per Month	5	5

19 January 2016
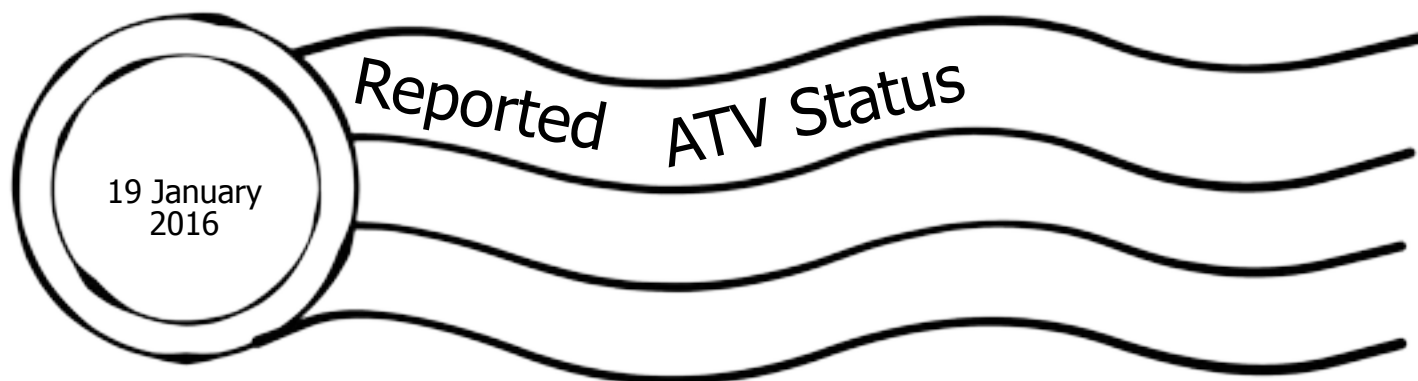
Would you like to help us revitalize our ATV system? We could use your help. Contact board@palomararc. org to volunteer.

PARC ATV System

915 MHz WBFM in 5.8 MHz audio subcarrier

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

19 January 2016

Echolink

447.000
107.2

146.730
107.2
System Fusion - Auto

147.075
107.2
System Fusion - FM

147.130
107.2

PARC
Voice
Repeaters

52.680
107.2

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
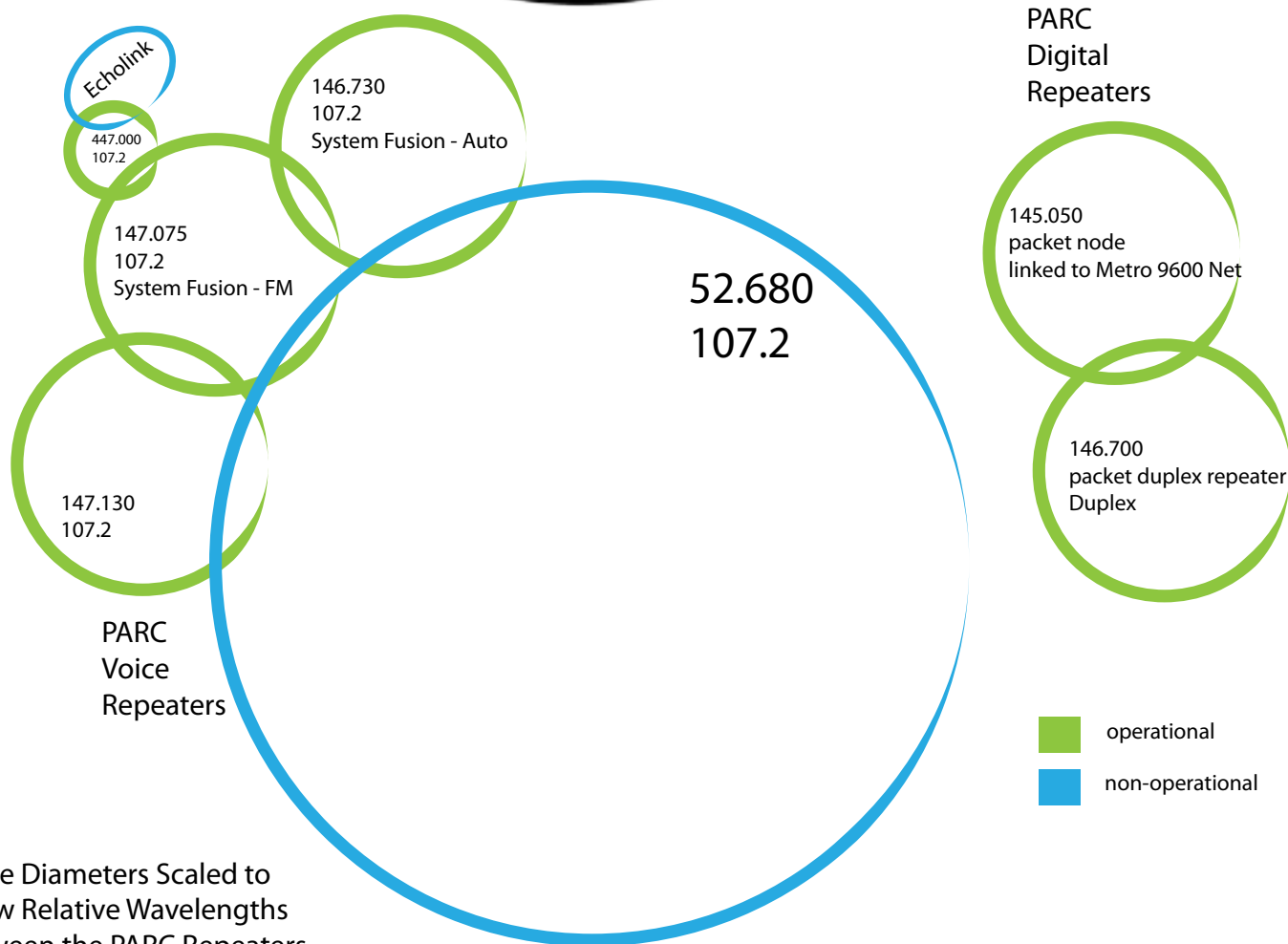
January 2016

January Membership Meeting

Photographs by KB5MU W5NYV

The January 2016 PARC meeting was held on a day that saw extreme weather across San Diego County. Multiple watches and warnings, including a rare tornado warning, were issued throughout the day. Attendance at the club meeting was slightly down from usual. The room size was adjusted using the moveable walls in order to allow the Emergency Operations Center to allow workers to have more floor space throughout the evening. Roof damage and very minor flooding were the worst things reported by members at the meeting.

Above, John AC7GK, gives remarks concerning operating. He kicked off his directorship with a strong "Say 73 on the 73" message and made it clear he was interested in collaborating with the membership in order to improve the club.

Top left, Joe K6JPE and Charlie NN3V get ready to make announcements.

Middle left, Glen Christensen KJ6ZQH and Charlie NN3V present the membership report.

Bottem left, Kevin Walsh KK6FRK gives a scouting report.

After club reports were made, the program was introduced.

Gus K5GS told us about the 2015 Chesterfield Island DXpedition, in which he was a participant. The program can be found on the club YouTube account here:

https://www.youtube.com/watch?v=FL1FTc868ro

Joe K6JPE and John WB6IQS discuss some technical issues.

Gus K5GS told us about the 2015 Chesterfield Island DXpedition, in which he was a participant.

At left, members visit with each other after the meeting.

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

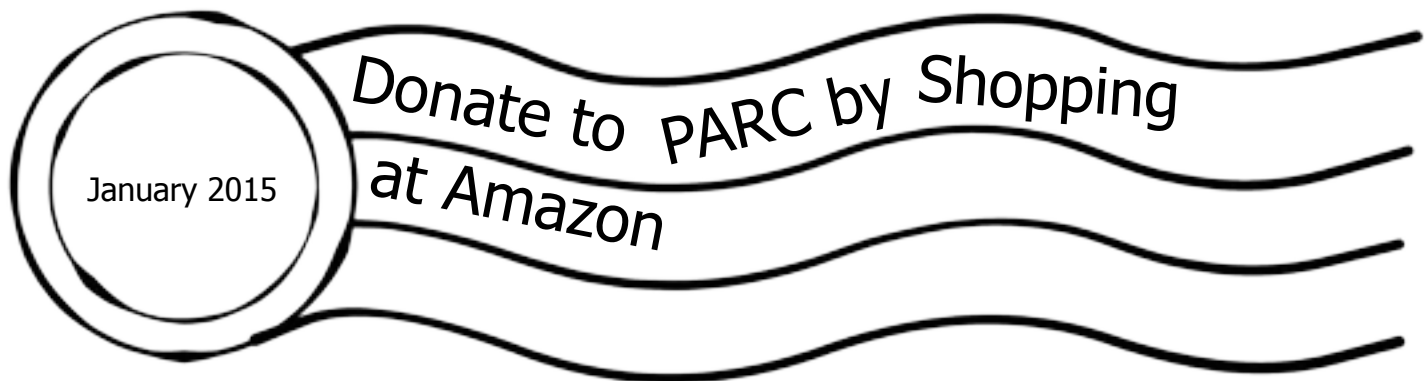{special} **THANKS** to our sponsors

Want to learn how to build this battery box that was demonstrated at the January 2016 club meeting? See page 50 for the Battery Box Build article by Tony Gawel W6TNY!

January 2016 General Meeting
photos by Paul KB5MU

There is good news about our club's non-profit status. As mentioned in December, PARC is now a tax exempt non-profit public corporation. if you choose to donate money or equipment to PARC, and if you itemize deductions, you can take a tax exemption for the value of the donation.

BUT There is even an easy way to donate to PARC! Do you shop online at Amazon?

PARC is now registered with smile.Amazon.com as a not-for-profit public corporation. If you so choose, any purchase you make on Amazon can be identified as a purchase for which you desire that Amazon donate funds to PARC!

Here is how it works.

If you wish to designate that some funds of your Amazon purchases be donated to PARC, go to www.smile.amazon.com and log on to make your regular purchases just as you always do. After logging in, you proceed to order your purchase as usual, and in the checkout procedure you are offered an opportunity to designate a portion of the purchase to be distributed by Amazon to any of thousands of charities. There we ask that you select "Palomar Amateur Radio Club" as the non-profit to which the funds will be donated by Amazon.

This will have absolutely NO EFFECT on the regular purchase price of your item.

What happens is that without any further action on your part, Amazon will forward to PARC's bank account 0.5% of the purchase price of what you bought.

You can learn all about this further by visiting the following link:
https://smile.amazon.com/ch/95-3737299

Amazon is aware of one problem with this initiative. **The Amazon smartphone shopping app DOES NOT work for charity designations. You must use the web browser.**

Your PARC Board of Directors hopes you will consider donating to PARC as you shop on Amazon. The Board of Directors is evaluating a series of projects to update the Club's infrastructure, to bring remote capability to PARC members, to upgrade our FD equipment, and to update the technologies we have available throughout our repeaters. Some of these projects are the result of your response to questionnaires, or suggestions you forwarded to the board for consideration. All these potential projects will be evaluated and announced to you so you can give us feedback about the project's desirability. To carry the projects to completion will require that club member volunteers get hands-on experience in the project. This too will be an opportunity to follow the requests expressed by members, and also an opportunity to elmer recent licensees in all aspects of ham radio.

You asked that the Club be revitalized in this manner, and here are the beginnings of the effort. So please remember, when you shop on Amazon, donate to your club! But they will all involve material purchases for which the Club will be using funds that are donated for the project accomplishment.

We hope you will be generous in donating to PARC through Amazon purchases since the donation has zero impact on what you buy.

Hamfests on Horizon
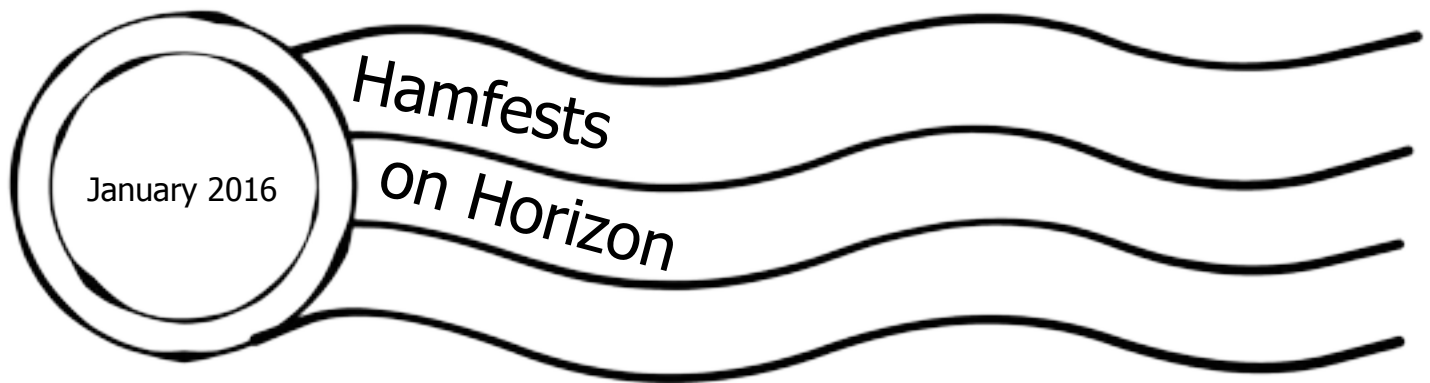
The time is near for you to be thinking about going to a hamfest. And there are three on the horizon that are really very good.

First there is the Yuma hamfest. It takes place at the Yuma Arizona County Fairgrounds which are located at 2520 E. 32nd Street, Yuma, AZ 85365

Scheduled to take place February 19 -20, this is an easy ride from San Diego, and overnight RV camping on the fairgrounds is available at an incredibly nominal fee. This hamfest has grown since 2005, and is now fun, well attended, has good tailgating and commercial vendor participation. The technical symposia are excellent. You can find all the details at:

http://www.yumahamfest.org/

Next is the Visalia International DX Convention. If you have any interest in HF communications, or if you are an avid DX chaser, this is a top notch event, and easily reachable from San Diego. There are many opportunities to ride share, and if you are interested, come up on the repeaters and mention you are looking for a ride. The hamfest / convention takes place at the Visalia California Convention Center on April 15 – 16. There you can enjoy all the traditional fun of a hamfest, and you will be treated to exceptional presentations by some of the world's top DXers. You can find out all about this at:

http://dxconvention.org/

Last, and certainly NOT least is the Dayton Hamvention. Start planning now! If you are a ham and have not been to Dayton at least once in a lifetime, then you are not yet "a real ham! Just kidding of course, but there is no question that Dayton is the largest amateur radio event in the world. Getting to and from Dayton is relatively inexpensive as Southwest and other bargain airlines offer excellent fares. And hotel accommodations in the vicinity of Hara Arena are very reasonable. Ignore the rumors you've heard about there being no Hamvention because Hara arena is falling down. Not true. It is in need of extensive renovation, but repairs have begun. And if you are looking for something about ham radio and cannot find it at Dayton, then it has not been invented or created yet! Dayton takes place at hara Arena, Dayton, Ohio, the weekend after mother's day: May 20 – 22, and you can read all about it at:

http://hamvention.org/

10GHz and RF Safety

by Wayne Overbeck N6NB
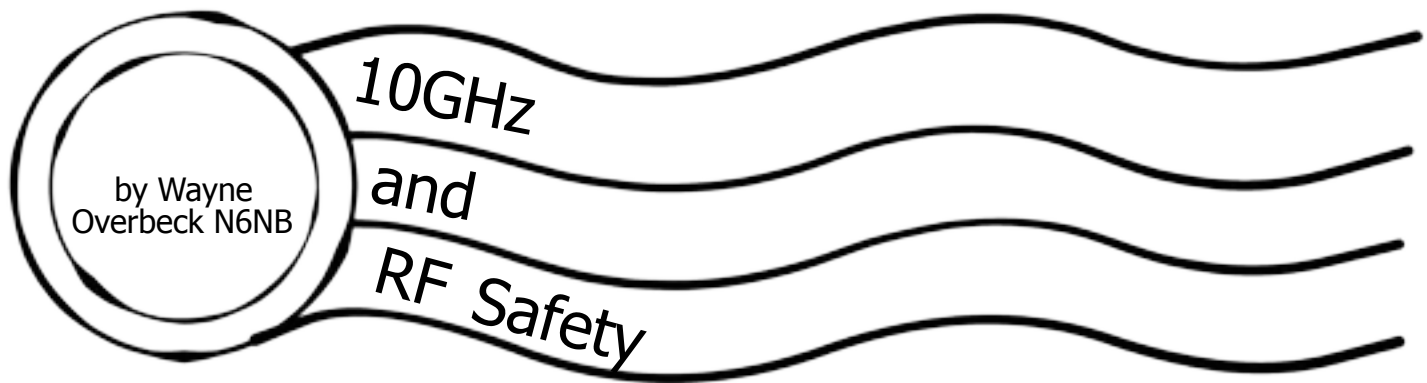
This is a long-delayed postscript to Microwave Update last October. A medical researcher, a woman who holds both M.D. and Ph.D. degrees, was scheduled to do a presentation at MUD about health hazards of low-level R.F. radiation. She had to cancel at the last minute and I had the daunting task of filling in for her. I worked with the FCC on this topic back when the current rules were adopted and the FCC's R.F. safety booklets (Bulletins 65 and 65B) were prepared. I'm acknowledged in both. However, I had not done an R.F. safety talk in about 15 years and I didn't expect some of the questions that were raised in San Diego about dish antennas. I may have given the impression that dishes pose fewer R.F. safety hazards than they actually do.

That has troubled me for months. This email is a follow up for those who might be interested.

Bulletin 65 has a section about dish antennas. It suggests using the same formula to estimate exposure from a dish in the far field as Bulletin 65 Supplement B suggests for other amateur radio antennas.[1] At 10 GHz, the far field begins surprisingly close to the antenna. For example, under the FCC's suggested formula[2] the far field of a 2-foot dish begins roughly 25 feet from the antenna. Bulletin 65 has a graph showing power density versus distance at various EIRP levels, and it's applicable to dishes as well as other antennas.[3] I had a slide in my MUD presentation saying that a 4-foot dish with 40 watts of transmitter power could have 400,000 watts of EIRP, assuming reasonable dish efficiency and 40 dBi gain at 10 GHz.[4] Using the FCC's graph, that station could exceed the FCC R.F. exposure limit at a distance of up to 300 feet in uncontrolled environments (any place that may be accessible to the public). For comparison, the hazard distance for a 2-foot dish and 18 watts (roughly 20,000 watts EIRP) would extend out 80 feet.

None of this is new. What is new since the FCC Bulletins were published is the growing use of very high EIRP in installations on tripods at human head level. During the talk I did not discuss an additional issue--dish antennas typically have sidelobes only 20 or 25 dB. down from the very narrow main lobe. Bystanders off to the side of a tripod-mounted dish may also be exposed to R.F. fields exceeding the FCC standard.

The FCC's R.F. exposure standard allows averaging over 30 minutes in uncontrolled environments. Hams rarely transmit key-down for that long, so the averaging can be used to reduce the calculated EIRP and thereby reduce the required separation distance. However, more than 200 scientists who have published peer-reviewed research on EMF hazards recently signed an appeal to the United Nations calling for much stricter standards and therefore much greater separation distances. They cited growing evidence of health hazards at far lower levels than the current time-averaged standards (which are intended only to protect from the body-heating effects of R.F. energy, not from athermal effects).

An irony in all of this is that virtually all current-day 10 GHz stations are exempt from the FCC's routine evaluations for R.F. safety compliance--but not exempt from actual compliance. That's because the exemption from routine evaluations is based only on transmitter power (under 250 watts

1   Use Google to find "OET65.pdf" (see page 29 of text) and "OET65B.pdf" (see page 17 of text).

2   See OET65.pdf (page 29 of text). Where the far field of a dish begins can be estimated by the formula 0.6*diameter^2 / wavelength.

3   See OET65.pdf Figure 2, page 25.

4   When calculating EIRP, bear in mind that antenna gain in decibels is a logarithmic function. 10 dB. of antenna gain multiplies the power 10-fold, but 40 dB. of gain multiplies the power 10,000-fold.

at 10 GHz), without regard to antenna gain. However, actual compliance estimates are based on EIRP: transmitter power times antenna gain. Given the high gain of microwave antennas, even a station with 400,000 watts EIRP can be exempt from routine evaluations. The FCC is now proposing to close that loophole by requiring routine evaluations of almost all amateur stations.

My website (www.n6nb.com) has a more detailed discussion of R.F. safety.

73, Wayne, N6NB
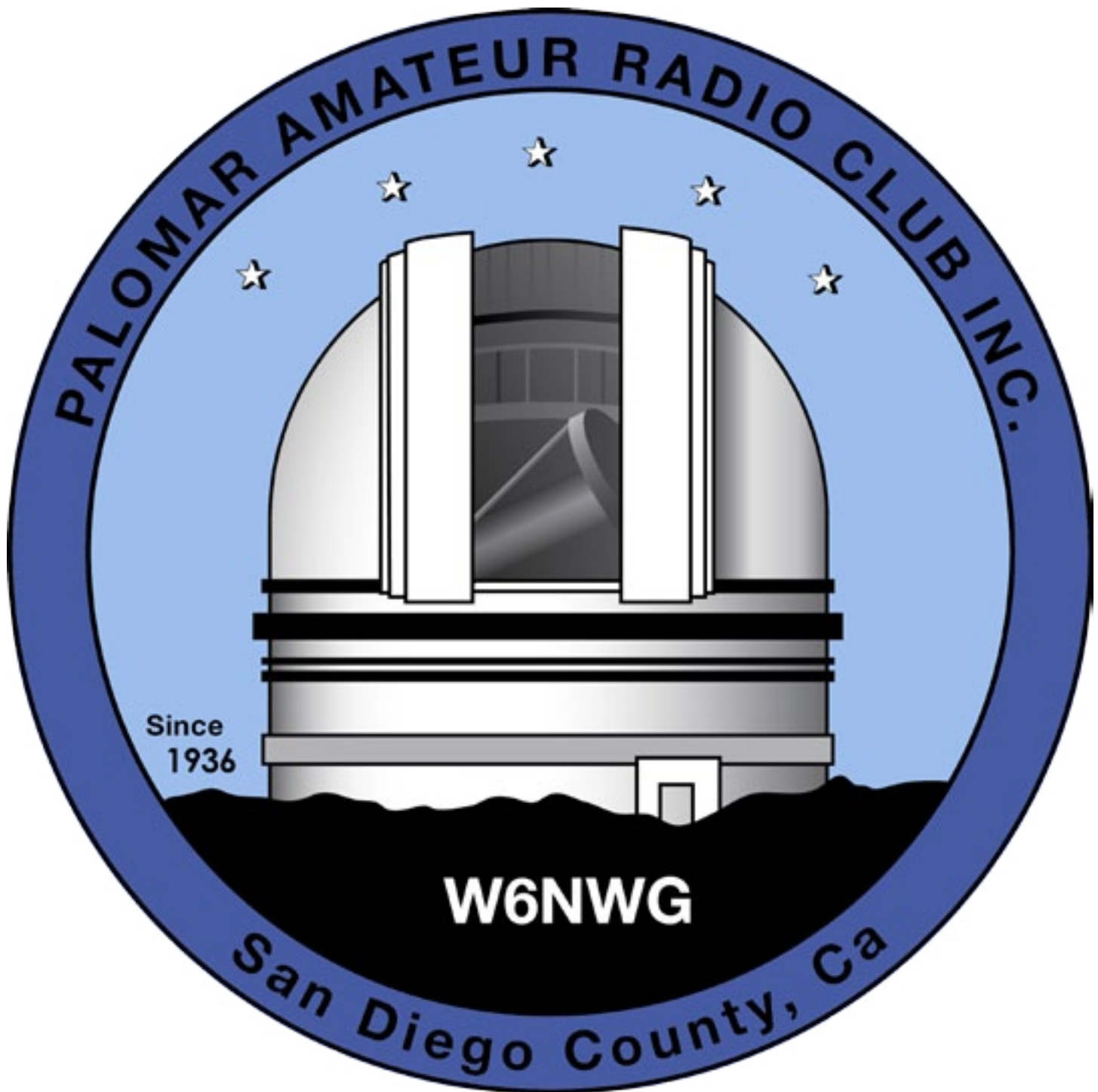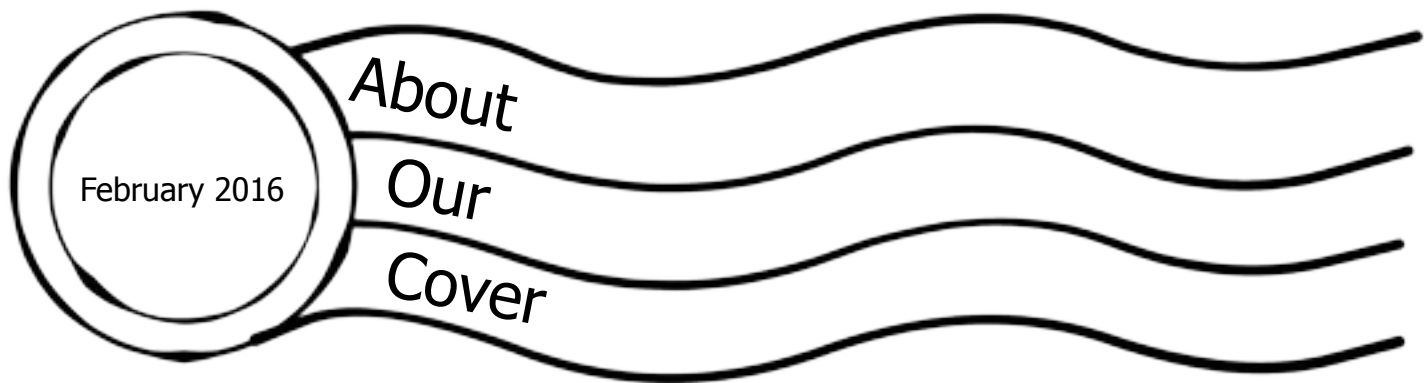
Our cover is an image of a USSR postal stamp dedicated to Amateur Radio Satellites. Specifically, the Radio-1 and Radio-2 satellites, 23 February 1979.

Radio Sputnik RS-1 and RS-2

The first Russian satellites were launched on October 26, 1978 from Plesetsk C1 with Cosmos 1045. Weight 40 kg each. Orbit 689 x 1709 km. Inclination 82.55 degrees. 390 x 420 mm diameter. Inverted Vee VHF antenna and a quarter wave whip HF antenna.

RS-1 and RS-2 both contained sensitive Mode A (145 MHz uplink and 29 MHz downlink) linear transponders telemetry beacon and Codestore unit similar to AMSAT-OSCAR 6. Transponders aboard RS-1 and RS-2 could be kept operating for only a few months before battery problems disabled both spacecraft.

References:

Pat Gowen, "RS - The Amateur Radio Satellites of the Soviet Union," AMSAT Newsletter, 10(4), Dec 1978, p. 4.

Bernie Glassmeyer, "Two Russian Amateur Radio Satellites Launched," QST, December 1978, p. 54.

RS10

Anniversary

Article
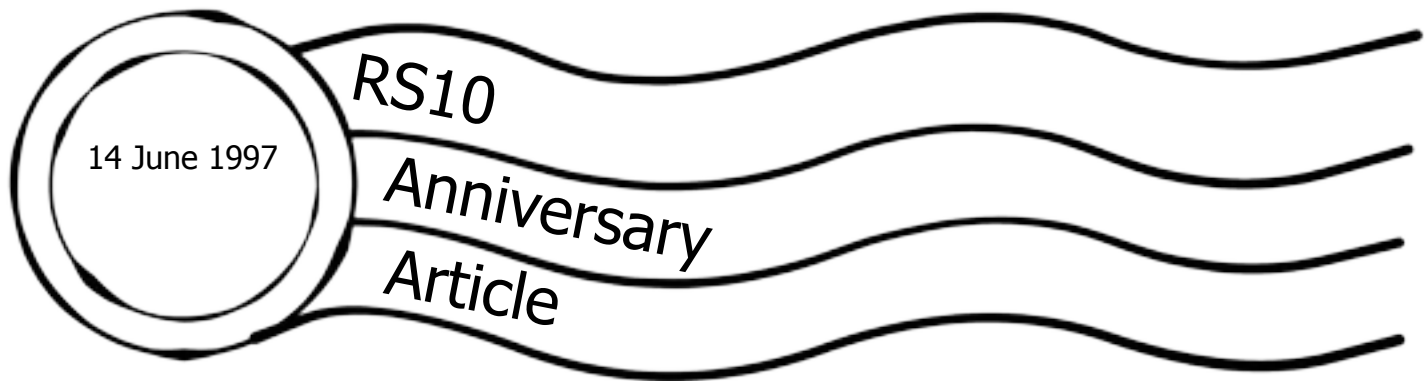
14 June 1997

Satgen429 Happy Anniversary RS10

by GM4IHJ (BID SGEN429) 14 Jun 97

From ftp://ftp.amsat.org/amsat/articles/satgen/sgen429.txt

On 23rd June 1987, RadioSport 10/11 lifted off the Plesetsk launch site high in the Russian Arctic. Ten years later we celebrate this superb satellite, which while some 9 or more other amateur radio satellites have come and gone, continues to provide excellent service.

Indeed, to get the whole Russian effort in perspective. They have built and successfully orbited for years, more than one third of all amsats ever launched. For in addition to RS10 we can add :-
   RS1 and RS2   comsats launched Oct 78
   RS3/4/5/6/7/8 two beacon sats and 4 comsats launched Dec 81
   ISKRA2 and ISKRA3 comsats launched May and Nov 82
   RS14 comsat launched Jan 91
   RS12/13 comsats launched Feb 91
   RS15 comsat launched Dec 94
   RS16 presently beacons only launched Mar 97

Accessible to relatively simple ground stations, these RS satellites have provided the first introduction to space radio for a whole generation of radio amateurs, with their almost infinite Mean Time Between Failures MTBF (in marked contrast to the quarterly or monthly down time incidents of the digital amsats). Whilst in addition to this vital simple service, they have also provided thousands of interesting DX contacts, including the only confirmed antipodeal amateur radio satellite two way communication (UK to and from New Zealand by G3IOR).
Something the high altitude sats have yet to achieve.

For the radio experimenters the RS sats have been simply priceless. Although many books contain drawings of theoretical downward looking ionospheric radio sounders , only the RS series of satellites has given regular service in this important and often overlooked field. Uosat 9 was there albeit on much reduced antenna performance for a short while, but for consistent ionospheric studies through most of two solar cycles and ongoing into the next, only the RS sats have been continously available.

At present, at solar activity low, there is some but not much sub horizon DX via the RS sats , but over the next few years this will improve greatly and the RS sats will be there for those seeking propagation data and or super DX, and none of this will require you to fork out a fortune to pay for specialised equipment. Any ordinary amateur radio station equiped for HF and VHF transmit and receive, at low power can use RS sats, and, the antenna requirements are minimal for those who wish to try this sport.

So if you have not tried them, take a look at RS10 or RS12 to start with. RS15 does require more sophisticated operating techniques to get the best out of it, but then it does give the best DX at this solar activity minimum, though RS12 will come into its own as the sunspot numbers begin to climb.
PS. Good news for experimenters interested in downward looking ionospheric sounders . CHAMP a German built gravity and magnetic research sat planned for launch in July 99 will carry atmosphere and ionosphere sounding equipment.

Russian Ham Satellites
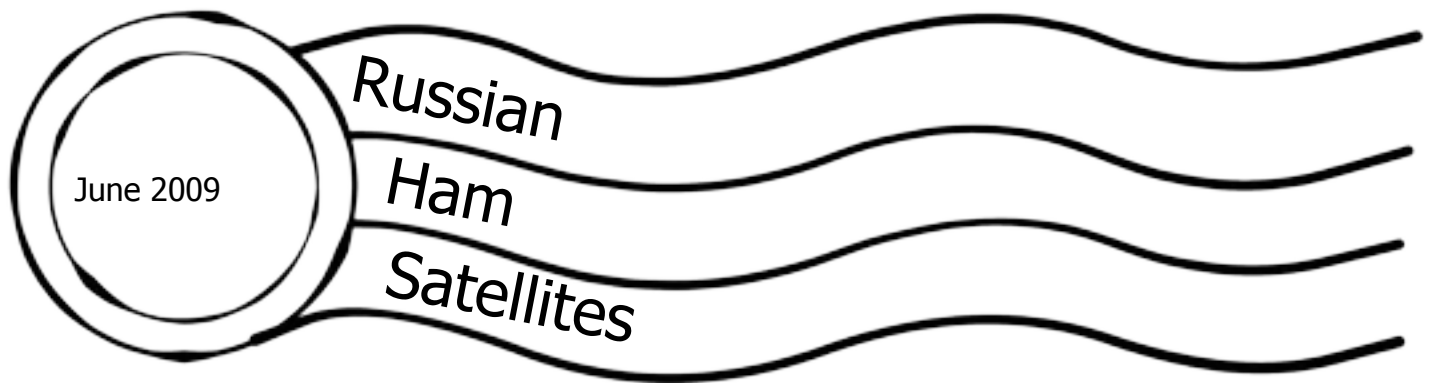
RADIO SPUTNIK RS SERIES

by Andrew Barron ZL3DW

Over the years USSR and Russian hams have built and operated 20 separately numbered amateur satellites called Radio Sputnik, or RS for short. Also three smaller USSR hamsats were called Iskra, which is Russian for "spark". Many New Zealand hams will remember operating through RS10/11 and RS12/13. They had more transmit power than the newer cube sats and excellent receiver sensitivity which made them easy to use. For Mode A operations, just a few watts of transmitter power and a small 2-Meter antenna were all that was required for the up link. A dipole antenna and a receiver capable of tuning the 10-Meter Amateur band was all that was needed for the down link.

The first two Russian ham satellites were launched together on October 26, 1978. RS-1 and RS-2 both contained sensitive mode A (145 MHz up link and 29 MHz down link) linear transponders a telemetry beacon and Codestore unit similar to AMSAT-OSCAR 6. The transponders aboard RS- 1 and RS-2 could be kept operating for only a few months before battery problems disabled both spacecraft. Since the Russians were limited to only a few watts of transmitter power on the 2- Meter band, the Mode A transponders carried on their RS satellites had to have very sensitive up link receivers.

Six new Russian satellites were launched together on a common launch vehicle on December 17, 1981. RS-3 and RS-4 were experimental satellites and did not contain transponders for general use. The remaining satellites all contained Mode A linear transponders. In addition, RS-5 and RS-7 both contained "auto transponders" called ROBOTS. These ROBOTS made it possible to carry on a CW telegraphy contact with the spacecraft. A typical communication with the ROBOT would be initiated by the radio amateur on the ROBOT up link frequency and the satellite would respond with a short message and issue a QSO number.

The RS-10/11 satellites were really two packages attached to a primary spacecraft, the COSMOS 1861 navigation satellite. They were launched 23rd June 1987 and lasted until November 2000. Each of the ham satellites had two radio amateur transponders onboard. Only one was switched on at a time. Both satellites had a 40 kHz wide linear transponder allowing for CW and SSB contacts and a CW ROBOT similar to RS-5 and 7.

RS-14/AO-21 was launched on January 29, 1991, the results of a joint venture between AMSAT- U and AMSAT-DL. The amateur equipment rode piggyback on the INFORMATOR-1, an experimental geological satellite. As of September 16, 1994 the spacecraft was switched off, including the amateur equipment onboard. The reasons cited were those of cost in maintaining the craft in space when the usefulness of the primary payload was exhausted. The amateur community lost a valuable asset. RS-14/AO-21 was a very popular satellite with radio amateurs. The equipment to communicate through RS-14/AO-21 was simple and easy to operate. RS- 14/AO-21 functioned as a "repeater in the sky" and routinely transmitted digitally recorded voice messages commemorating events like the 25th anniversary of the first landing on the moon by broadcasting Neil Armstrong's first words as he stepped on the moon.

RS 12/13 was launched February 5, 1991 on board a Russian Cosmos C launcher. RS-12/13 was also two amateur radio packages attached to and drawing power from a primary spacecraft, the COSMOS 2123 Russian Navigation Satellite. Each satellite had two radio amateur transponders onboard. Only

one was switched on at a time. Both satellites had 40 kHz wide linear transponders allowing for CW and SSB contacts and a CW ROBOT similar to RS-5 and 7. RS12/13 had down link transmitters on 2m and 10m and up link receivers on 2m and 15m, these could be combined in any combination including 21 MHz up link into 29 and 145 MHz down links and 21 MHz and 145 MHz up links into a common 29 MHz down link. No other Amateur communications satellite had used 15-Meters for an up link before. It is thought that superpower proton flashes from the Sun caused damaged to the COSMOS2123 and RS-12/13 transponders about July/August 2002 (thanks Jerry, K5OE/3).

RS-15 was launched December 26, 1994 from the Baykonur space center. The satellite is a spherical like unit about 1 meter diameter and its weight is approximately 70 kg. On board was a mode A [2m – 10m] transponder, two radio beacons, CW - broadcast bulletin board (2kb), remote control system and telemetry system. The satellite had no orientation or stabilization systems. The 10m beacon is still active when the satellite is in sunlight.

RS-17 (also known as Sputnik 40) was a 1/3rd scale model of Sputnik 1 the 1st man made satellite. It was built by high school students to commemorate the 40th anniversary of the launching of Sputnik I (1957). It was launched by hand on November 4, 1997 by Russian cosmonauts from the MIR space station. RS-17 broadcast its bip-bip signal for 55 days. The rate of the beeps was dependant on the satellite temperature the same as the signal from Sputnik 1.

Sputnik-41 / Radio Sputnik 18, was the same as RS-17. It was launched by hand on November 10, 1998 from the MIR space station.

RS-22 is a training satellite built by the Mozhaisky military academy in St. Petersburg, Russia. It was launched into a low 693 x 675km orbit. RS-22 carries a CW beacon on 70cm that sends telemetry in the form of 16 groups of 5 to 7 characters framed by "rs22". Code is sent at about 5wpm with a pause of approximately 10 seconds between each group. The satellite is still fully operational with a beacon on 435.3520 MHz CW.

RS30 "Yubileiny" (Russian for jubilee) was launched 23 May, 2008 into a fairly high near circular orbit at a maximum altitude of 1500 km, to mark the 50th anniversary of the launch of the first Russian (URSS) artificial earth satellite. Among other missions the satellite will solve a wide range of educational, research and technological tasks. It is transmitting cw telemetry on 435.315 MHz and possibly 435.215 MHz. There have been some reports of image transmissions. According to the launch team the satellite will broadcast audio and video about the history of the Soviet and Russian space programs, as well as signals imitating those broadcast by Sputnik in 1957. The transmission lasts for 4 minutes; the down link signal consists of a call signal and TM- data (10 seconds), a voice message (1 minute), a 50 second pause, the first artificial satellite imitated signals (10 seconds), an image (1 minute), then another 50 second pause.

Sources:
web sites including: http://www.cira.colostate.edu/ramm/hillger/amateur.htm http://www.n2yo.com

Spacetoday.com
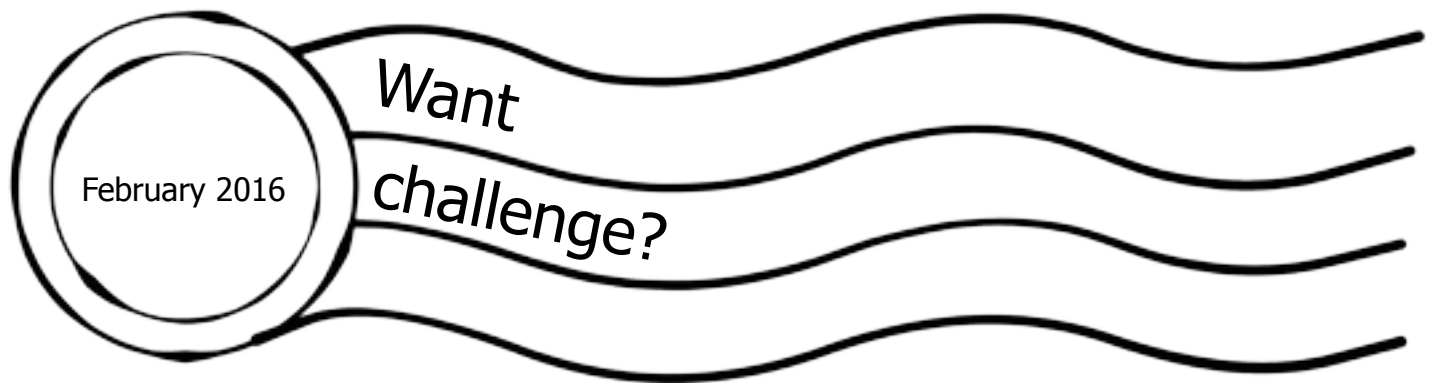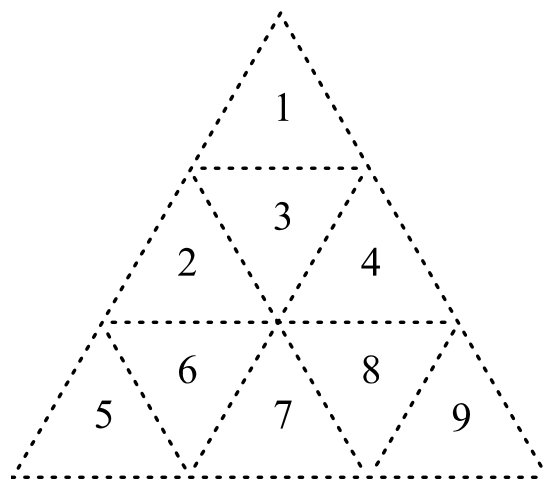AMSAT NA
www.amsat.org/amsat/sats/n7hpr/rs.html http://www.dk3wn.info/sat/afu/sat_rs30.shtml

Do have a story about any of these satellites? Let Scope know! scope@palomararc.org
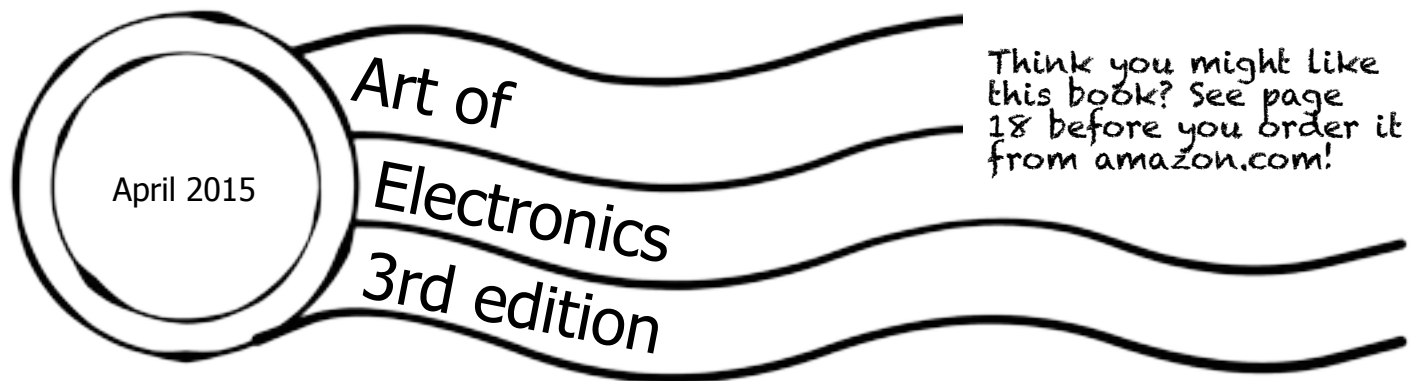
Stamp Folding Puzzle #2

Fold this block of equilateral triangular stamps into a packet 9-deep with stamps in the following order:

$$2\ 6\ 7\ 5\ 9\ 3\ 4\ 1\ 8$$

(Hint: tuck 5 between 7 and 9.)

SCOPE page 26

"Who among us has not kept a cherished copy of AoE on our workbench throughout our careers? Engineers, hackers and makers of all stripes, rejoice for the third edition ... has been worth the wait! Packed with tons of delicious knowledge to navigate electronics in both work and hobby. An encyclopedia of electronics knowledge, [The Art of Electronics] is a pleasure to read through for tips and tricks and is an unbeatable resource! Take a day out to read a chapter - you will learn things you didn't even know you didn't know. Or, refer to the pinouts, diagrams, and techniques as necessary to guide you through a difficult project. If you think electrical engineering is magical then you must pick up this tome!" -Limor 'Ladyada' Fried, Adafruit Industries

"First of all, after I forklifted [Chapter 5] onto my reading table, I sat down and read it. It is simply spectacular. That may be overly exclamatory language but it is the only appropriate verbiage I can summon. Spectacular, deep and wide. I especially like the comments about interpreting specifications and the deconstruction of the Agilent voltmeters is just, well, wonderful." -Jim Williams, Linear Technology Corp

"Wow. Chapter 5 details every circuit artifact that I've encountered in the past thirty years in a through, pragmatic, and straightforward way. My only 'twinge' is that [it] disclosed and explained (in glorious graphical detail and with real part numbers) many topics that I thought were my personal trade secrets ... I love the plots. I know that it must take an enormous effort to collate all of the device characteristics. It's worth the effort. The way ... [it] present[s] the data allows the reader to get terrific perspective on a lot of landscape in a single view. Nice work." -John Willison, founder, Stanford Research Systems

"Horowitz and Hill's third edition beautifully upgrades their earlier work, with substantial updates to detail, and without compromise to style, content, or technical quality. Like the second edition I've used for years, it is laser-focused on the working engineer. Delivered in folksy Horowitz and Hill style, it is rich with the kind of nitty-gritty information that's invaluable to circuit designers and manufacturers, much of which is absent (or difficult to find) elsewhere. This new book is a superb update, one which I'm sure will be treasured by those close to the art of analog circuitry." -Walt Jung, author, IC Op-Amp Cookbook

"This epic work was created by two of the best experts in the field (with many others providing information). It defines the current state of the art in electronics ... Most parts of the book will continue to be relevant for several decades. The 1124 pages (even more densely packed with highly accurate information than the pages of the second edition) will delight everyone who already knows about electronics ... It is almost certain that you will like the third edition even more than the second ... The information that is now available in the book is absolutely fantastic, both the quality and the quantity, and you should get [it] as soon as you can ..." -Wise Warthog blog

W6W Special Event Station
Ft. Rosecrans Goes to War

5-6 December 2015
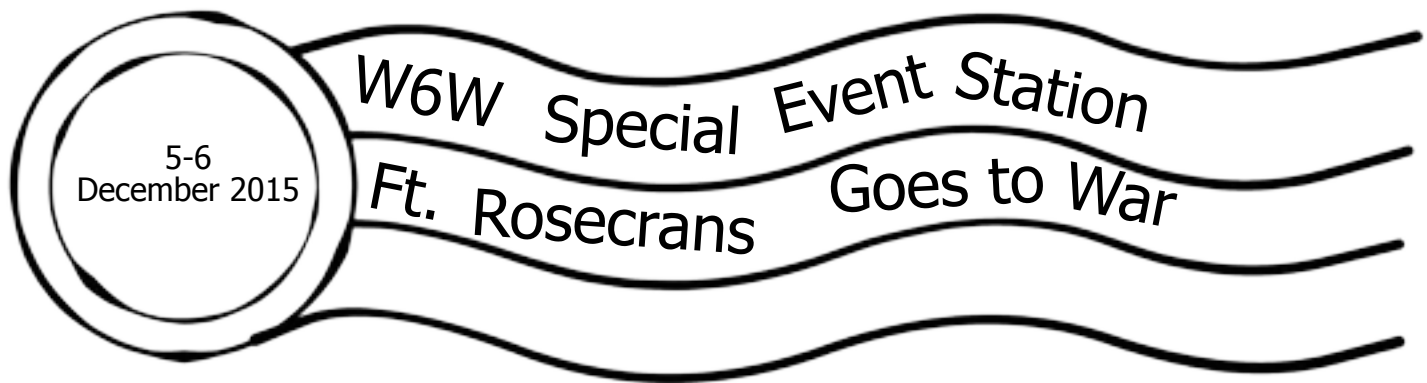
The special event station W6W was on the air over the weekend of December 5th and 6th,and we had a VERY successful demonstration of amateur radio! The special event call sign was obtained from the FCC via the ARRL and the station used it during the 14 hours of operation.

The Cabrillo National Monument Foundation in San Diego, CA sponsored an event called "Fort Rosecrans Goes to War", and the local amateur radio community participated by operating the special event station from Fort Rosecrans and the Cabrillo National Monument on Point Loma.

The amateur radio operators set up radios and antennas at the Cabrillo Monument visitor center and operated from 9:00 AM to 4:00 PM on both days. The hams commemorated the event by making as many radio contacts as possible and exchanging a QSL card with stations reached locality, nationality and internationally.

24 local hams from all over San Diego participated. Many were from Palomar ARC. All had a fun time. We worked 370 QSOs in the 14 hours on the air. We were operating during park hours of 9-4 Saturday and Sunday.

QSOs	QTH
333	USA
18	Canada
13	Japan
4	Mexico
2	Aruba

Although we did use VHF, UHF and HF, about two thirds of the QSOs were on HF. About one third were on VHF. It is a nice straight shot to LA and Orange County from Point Loma at 422 feet above the Pacific Ocean.

There were vintage WWII radios on display and operating at the event as well.

Those visiting saw a hands on demonstration of amateur radio in action. We had quite a few visitors at the tables. We tried to have the radios operating and at least one person to speak to any visitors at all times. That seemed to work very well.

A unique QSL card is being designed and will be sent as soon as possible.

Mike NA6MB
Gayle K6GO

WW2 Vintage Gear on display.
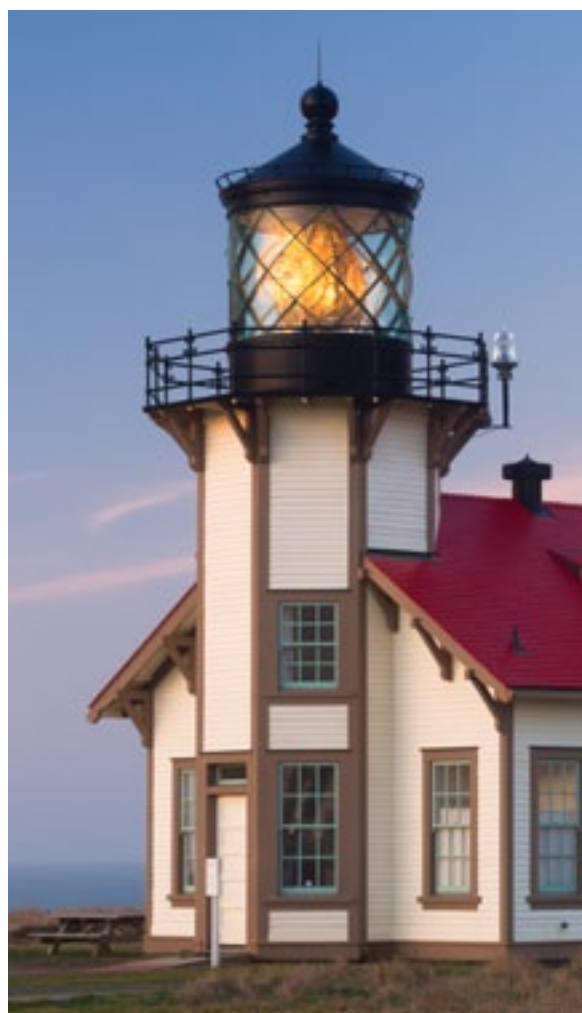
Equipment set up! Above left, Gayle K6GO operating. Lighthouse above right with distinctive lens.

Antennas and Point Loma Lighthouse. Flag at half-staff because of Paris terror attacks.

Above, Cabrillo Monument.

The end of a successful day of operating!

2016 SW Division Convention

Yuma Hamfest
Yuma, Arizona
Feb. 19 & 20, 2016

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

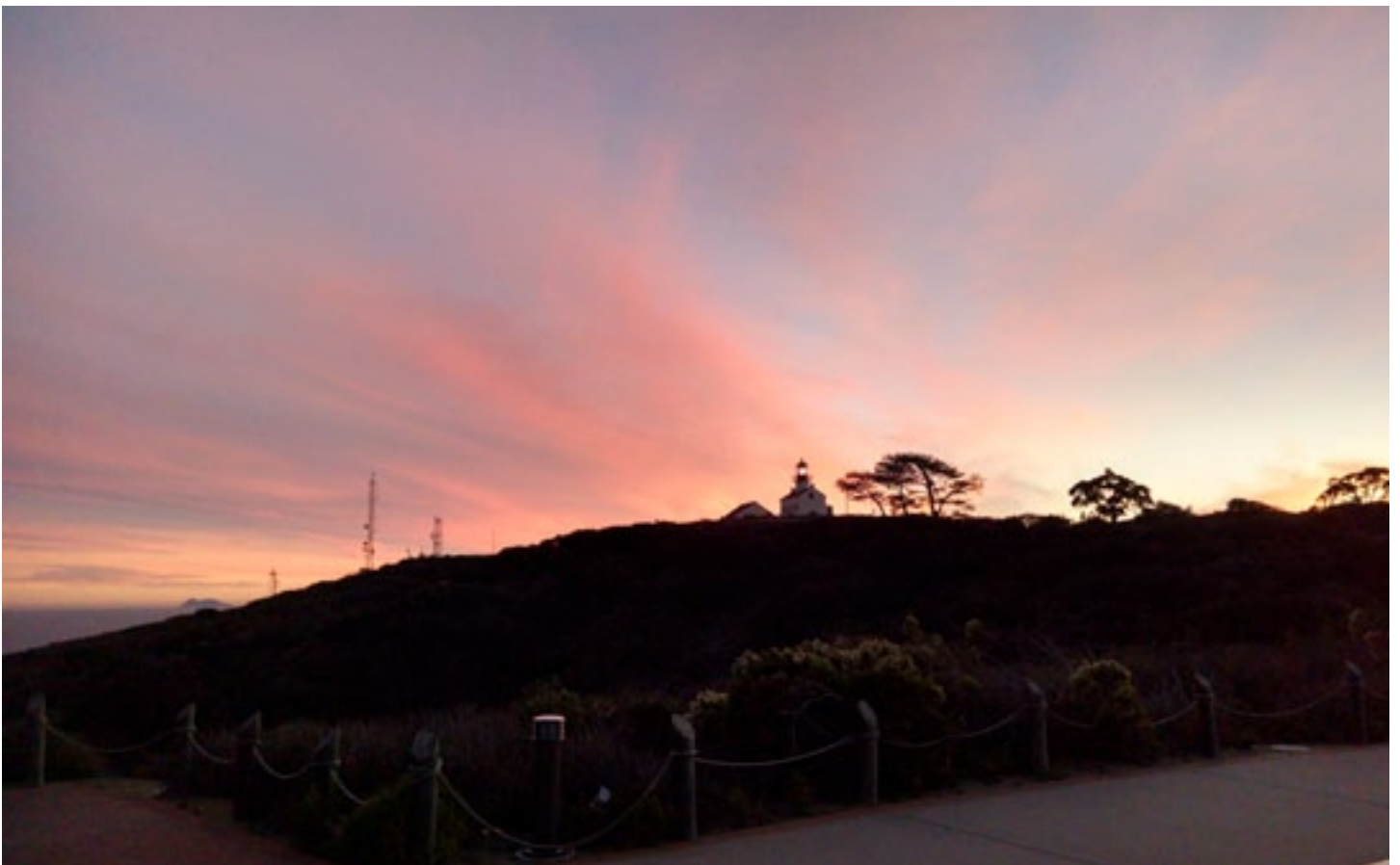# www.yumahamfest.org

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
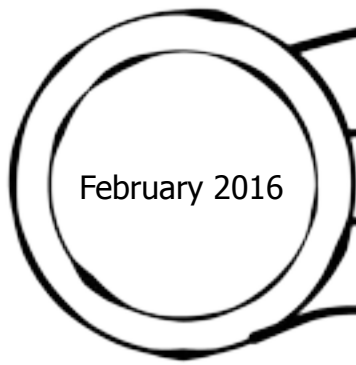
Want puzzle?

Bill Bennett ▶ **Palomar Amateur Radio Club**
5 hrs · 🌐

I tried this with the local club and wanted to try it with the PARC club. What is R5's voltage and power, And the "Trick" question how much AC gain does this "circuit" have? And why is this a trick question?

6volts

R1
5K

C1
C

R4
400

Q1
NPN

Q2
NPN

out

R2
2k

R3
200

R5 What is R5's
40 Voltage and
Power?

How to
Write for
The Scope

Submission
Guidelines and
Style Guide
by
Michelle
W5NYV

Submission Guidelines

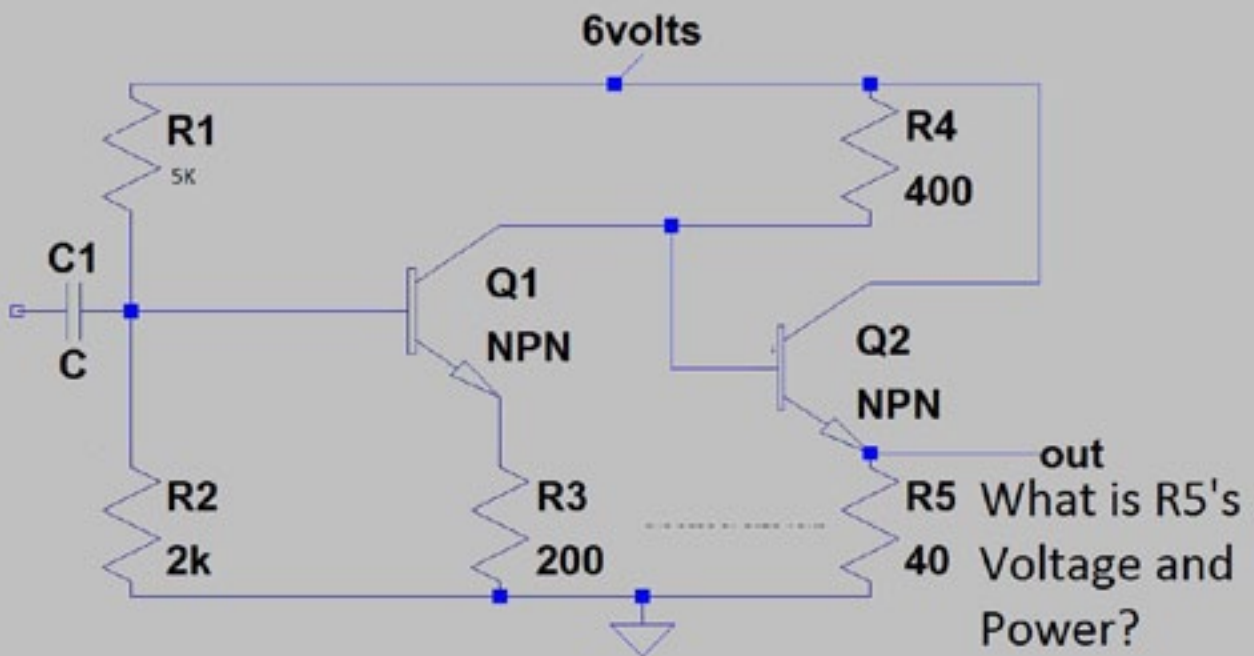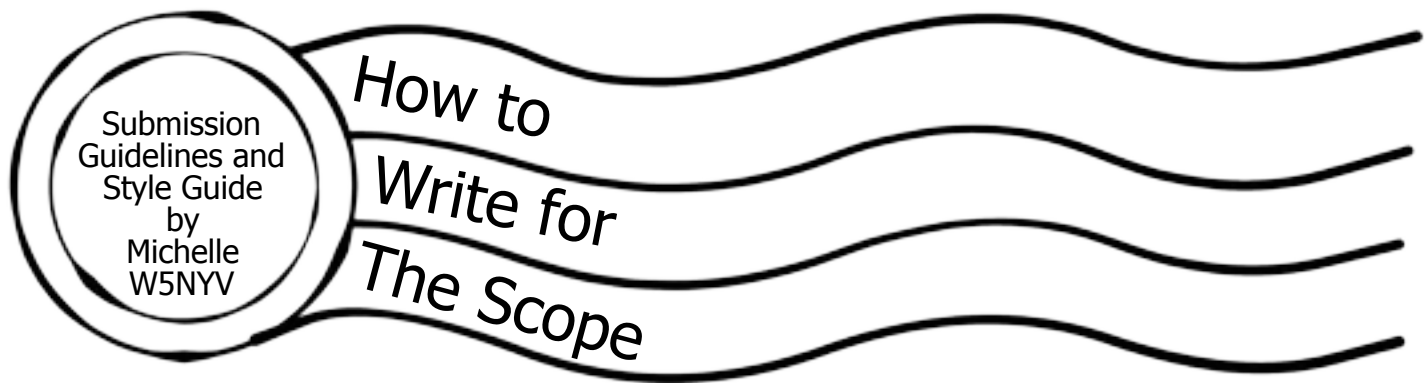Article submissions in most modern file formats are accepted. Plain text in the body of an email, with attached full resolution photographs, is most preferred. Dropbox and several other file transfer services are supported.

Sending a fully-formatted PDF, so that the author can control formatting and exact wording, is also accepted. We use Tahoma font for body text, but will accept PDFs with other fonts. If any editing is necessary, then it will be negotiated with the author, and will then be the responsibility of the author.

For 2016, the Scope theme is postal marks and radio-related stamps. Postal theme artwork is welcome! Scans of amateur radio stamps, stories about stamps in general, interesting or quirky postal marks, fun things to do with the mail, puzzles about stamps, interesting stamp-related narratives, stories about current mail technology, QSL cards, QSL bureaus, and QSL collections are all very highly desired throughout 2016.

We want to publish articles about amateur radio and amateur radio related events and interests. Amateur radio covers a very broad swath of subjects. Contesting, technical experiments, narratives about the hobby, stories about how you became a ham, suggestions for an interview, ideas for more puzzles and games, experiences in community service, emergency communications, tours and travelogues of places of interest to amateur radio operators, mobile installation articles, ham shack articles, good operational practices, ideas for what PARC should be doing in 2016, and many other subjects are what we want to print in the Scope every month.

Articles that misrepresent a person, subject, or event will not be printed. Articles that are attack pieces, demean groups or individuals, or ridicule others will not be printed. The editorial staff

of the Scope, in coordination with the Palomar Amateur Radio Club Board of Directors, has the final say on what is published in the club newsletter. Being a member of the club does not guarantee that a submitted article will be published. No payment is given in exchange for any article. Copyright remains entirely with the original author.

Style Guide

Time: Use 24-hour time in the following format.

"We started the event at 9:00 and began tear down at 16:00."

Name and Call Sign: Name is followed by call sign with no commas.

"Michelle Thompson W5NYV began writing the article."

After the first name and call sign is listed in an article, the style is to shorten it to first name and call sign with no commas.

"Michelle W5NYV was writing all day."

Do not use ellipses unless you know exactly how to use ellipses.

Ellipses… are not… the same thing… as a comma… or a pause…

Capitalization should be used for proper nouns. Proper nouns are the names used for an individual person, place, or organization. They are spelled with initial capital letters. For example, Michelle, New Mexico, and Boston Red Sox.

"And… that's it! That's All there is To It!"

What's the next step? Write an article, or propose one. If you need help, just ask! Mail to: scope@palomararc.org
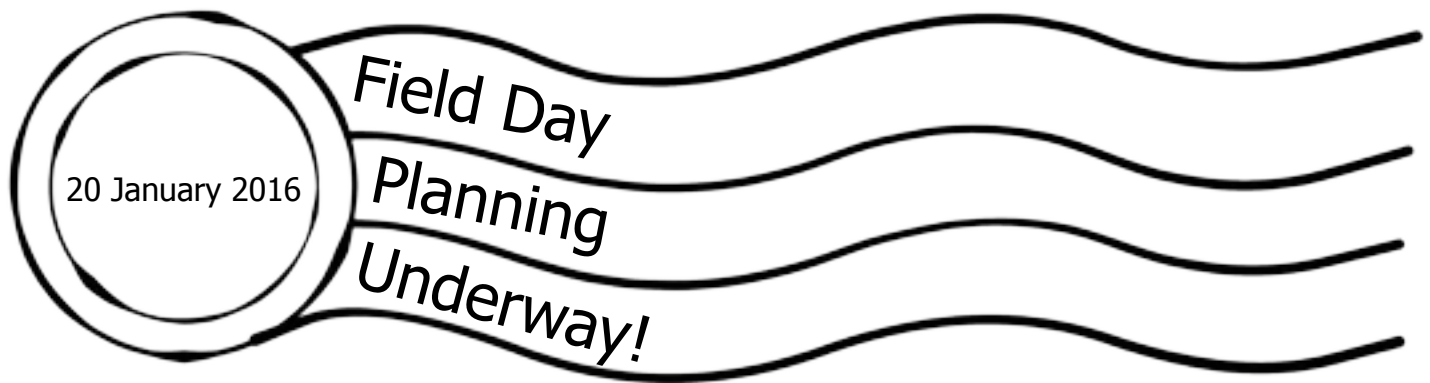
Above, Howard KY6LA gives a powerful demonstration of Maxwell's equations.

Above, Mitch K6BK and Robert WA3IHV discuss current events.

20 January 2016

Field Day Planning Underway!

Did you know FD is almost here? Well, not exactly. In case you did not have it on your calendar, FD this year will be June 25-26. The club's preparations are already underway!

The Club's Field Day site is already reserved. It will be at the same location as last year's in Escondido near the border with Valley Center. Other logistics are on order. The Fire Department is arranged to fill the barrel counterweights, food services are planned, etc.

In answer to member's requests, including the responses shown in the survey last month, this year's preparations for Field Day will be oriented to several hand-on objectives.

There are plans for giving interested members an opportunity to work with the FD gear. Yagi antennas, dipoles, feed lines, controllers, tower maintenance, etc. will be performed on work parties scheduled well in advance. We hope to carry out much needed refurbishment of some of the equipment (renewed hardware, clean connectors, etc.). And in carrying out this hands-on effort, we should be able to offer excellent elmering opportunity to give newly licensed hams a lot of experience in the world of HF equipment and preparations for EMCOM.

It is hoped that members who responded they are interested in FD preparations will set their calendars to help in these preparations, and volunteer accordingly. The work parties to carry out the work will be announced shortly. They will be scheduled at conservative weekend hours.
This year will be a great PARC FD year!

PARC Field Day planning has begun so early in the year that the 2016 ARRL Field Day Logo hasn't been designed yet.

Design a PARC Field Day logo and send it in! We need some graphical design to go wtih our Field Day planning reports!

Survey Results Summary

6 January 2016
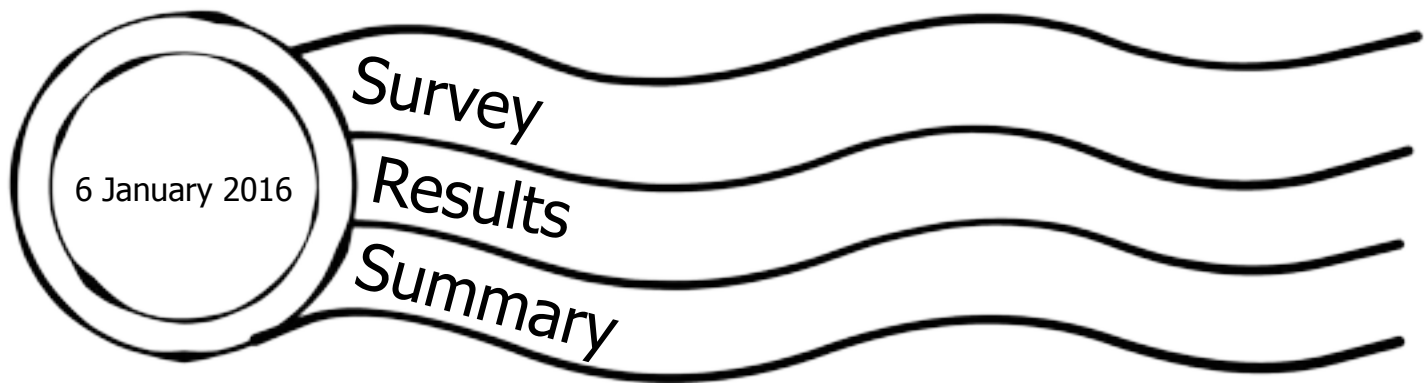
Attached is a brief summary of the results of the informal survey conducted at the January 6th., 2016 General Club Member meeting.

There were 35 survey forms distributed in the meeting. 24 responses were received in return. The survey responses reflect the comments of 69% of the attendees as there was no effort to make sure none of the meeting attendees left the meeting without returning the survey. The summary shows the collective response ratio among the 24 responses received.

This informal survey was intended as a means of learning about Club member nterests. The Palomar Amateur Radio Club Board of Directors will consider the answers as a way of identifying things you are interested in doing. Our objective is to plan Club activities and programs that will benefit you, and make PARC a club where your interests about our hobby are enhanced. Use the back of this form to add any further comments.

Please answer the questions in a manner that gives good understanding of your interests.
1.   Are you active on the ham bands? Yes: 23;   No: 1

2.   If active, what bands and modes do you use? (List all that apply).
        HF + VHF/UHF   13
        HF 4
        Microwave/HF/VHF/UHF 6
        No answer: 1

3.   Do you participate in PARC activities? Yes 19; No 3; No response 1.

4.   If you do, in which club activity have you participated? (List all)
        No responses.

5.   If you have not, or do not participate in Club activities, why not?

Yes: Maybe 1, as the "Yes" was not checked, but gave a reason as follows:
One respondent did not check the yes, but wrote that he or she was a tech and was not sure they could work the bands. Answer seemed associated with later answer that hams need more elmering.

No:
Live Out Of Area
Work Interferes / Work Conflicts: (2)
Events should be marketed

Survey results continued next page

6.	What club activities do you wish the club to sponsor that would improve or motivate your participation?

a.	Activities that cause us to use radios. Need to do so while hiking, or outdoor activities.
b.	More operating days and more outreach.
c.	Need more mentoring.
d.	Have genuine elmering that encourages new hams to participate.
e.	SDR demonstrations. The experimentation and digital ATV.
f.	Hands on activities.

7.	Of the following possible activities, in which would you actively volunteer and participate?

a.	Field day preparations (equipment maintenance, antenna tuning, etc.) 12
b.	Writing Scope article about your favorite ham radio subject 8
c.	Participate in a PARC subcommittee Yes 8

Which one? :

Technical   3
As needed   1
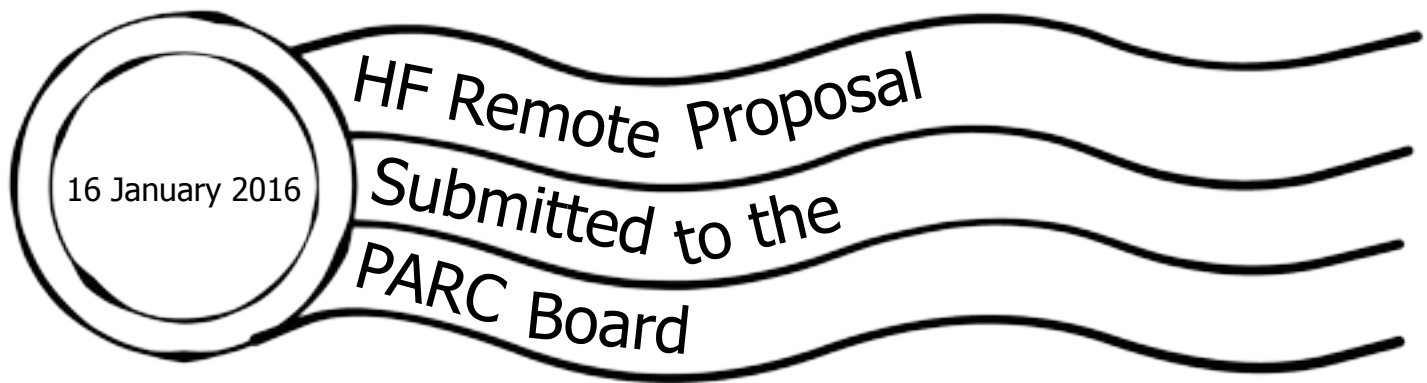Remote Site   1
ARRL Scholarship   1

Conclusions: From a limited survey it is not wise to draw general conclusions. However, as far as the small population of Club member attendees at the meeting (after all, it was a night of severe winter storms in Southern California!), some preliminary conclusions are:

1.	Club members are very active on all ham bands.
2.	There is good participation in Club activities.
3.	Respondents to the survey want more hands-on programs.
4.	There is interest in getting genuine elmering.
5.	PARC has to do better advertising about possible activities.
6.	Field Day is popular.
7.	Members are willing to participate in committees for specific functions.

The PARC Board of Directors is reviewing future Club activities and planning programs to respond to this survey's general conclusions, limited as they may be.

The Board of Directors plans to carry out further similar surveys in order to get better focus on the kinds of activities and programs that are of interest to the Club's membership.

The HF Remote Special Interest Group, established in February 2015, has submitted a proposal to the PARC Board about buildling an HF remote station at the club repeater site on Palomar Mountain. The full text of the proposal is below.

The PARC HF Remote special interest group (HF-remote) was formed last February, and has grown to 8 people. PARC has graciously provided an email list server, will potentially provide the hosting of the HF remote operation webpages, and is open to the possibility of using the repeater site to deploy the HF remote hardware.

The members of HF-remote have experience in deploying and/or using a variety of HF remote operations, ranging from handi-hams remote stations to private remote stations to club stations (Los Angeles) to "rent a super station" remote sites.

Our consensus is that HF remote on Palomar would be a positive addition to the club, should require club membership to transmit but not to monitor, and that the primary hardware recommendation (Flex Radio) needs upgraded environmental controls to be successfully installed at W6NWG.

Three of the eight members are willing to provide substantial financial investment in the radio and antenna hardware required.

Most HF remote deployments require internet access at the remote site. While we can avoid this by using a dedicated VHF or UHF base station to ship audio and control commands up to the site, we recommend either purchasing commercial internet access through Valley Center Wireless, or tasking the mesh committee (in coordination with Mark Raptis) to provide (possibly donated) internet through a mesh network deployment.

Primary recommendation:
Flex 6700: $7500
Internet equipment: $200
Antenna: under study, estimated to be in the range of $500 - $2000+ to fully take advantage of the Flex, preferably directional.
Ongoing costs: $45 per month for Valley Center Wireless
Software development: estimated 30 hours to develop and test the authentication and authorization to properly control the radio for multiple access.

Risky to deploy in current buildings due to environmental limits of the Flex 6700.

Feature-rich. This is about the best experience in HF remote that money can buy.

Use case: log in directly to the radio with computer, iPad, mobile phone, or other device. User interface is from Flex.

Secondary recommendation:
HF radio such as an ICOM 7100: $1000
Raspberry Pi: $50

Internet equipment: $200
Antenna: under study, but a wire loop would be an OK first step for this type of deployment.
Ongoing costs: $45 per month for Valley Center Wireless
Software development: estimated 50 hours to develop and test the authentication and authorization to properly control the radio, as well as figure out how to configure a current model wireless router for VPN, and then provide multiple access.

Could be deployed in current buildings, depending on the environmental limits of the HF radio selected.

Does not support the features the Flex offers. User interface development will fall upon the user base to develop and maintain.

Use case: log in to the Raspberry Pi using a VPN, and then access radio audio. Audio is shipped over the internet (via pulseaudio) to operator's computer running an application such as FLDIGI. User interface is whatever application the operator chooses to use to handle the audio stream from the Raspberry Pi.

The group has been a real pleasure to work with. It's been an honor to support them over the past 11 months. I'm optimistic that they will continue support an effort to turn one or both of these proposals into reality. Members of the group that don't already have HF remote stations of their own will be some of the first users of a PARC HF remote system, and intend to help maintain and troubleshoot the operation for the club.

-Michelle W5NYV
 Potestatem obscuri lateris nescis.
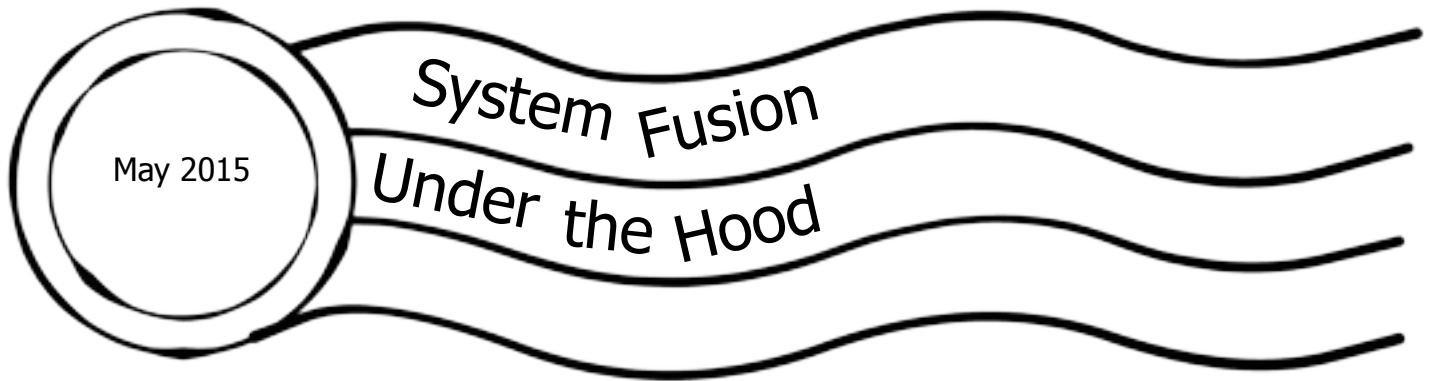
FTM-400D microSD Card Forensics

May 2015, Paul Williamson KB5MU

In an attempt to learn more about the Yaesu model FTM-400D C4FM transceivers, I connected a logic analyzer to the interface between the radio and its microSD card. Among other functions, the SD card provides storage for photos, including both those taken locally with the camera microphone and those received over the air. External computer access to those photos would open up all sorts of interesting possibilities.

The transceiver's microSD card slot is buried inside the chassis. In order to probe the connections without disassembling the radio, I needed the equivalent of an extender card for the microSD slot. I also had an inkling that a WiFi-enabled SD card might be useful in making the photos more accessible, but those cards are only available in the full-size SD card format. I solved both problems by buying a KZ-B19 "SD to Micro SD FPC Extender" made by BPlus Shanghai. $17 on Amazon. It's a flexible printed circuit (FPC) with a dummy microSD card at one end and a full-size SD card socket at the other. The SD socket has exposed contacts that are easy to clip onto with the standard logic analyzer "grabber" probe clips, as shown here. I could even continue to use the same microSD card with the extender, by putting it into the usual microSD to SD adapter that comes packaged with most microSD cards.

The standard that governs the SD card interface specifies three different ways that a host can talk to an SD card. I had already probed the connections with an oscilloscope, and determined that the radio was probably using the slowest, lowest-cost method, known as SPI (for Serial Peripheral Interface). I hooked up the logic analyzer probes accordingly. Besides the two ground (V_{SS} or GND) pins and the power (V_{DD} or V_{CC}) pin, there are four signals involved: a chip select (CS or SS) pin that enables the interface, a clock (SCLK) pin that marks when the individual bits are to be latched on either side of the interface, and a data pin going in each direction (DI [Data In] or MOSI [Master Out Slave In] and DO [Data Out] or MISO [Master In Slave Out]).
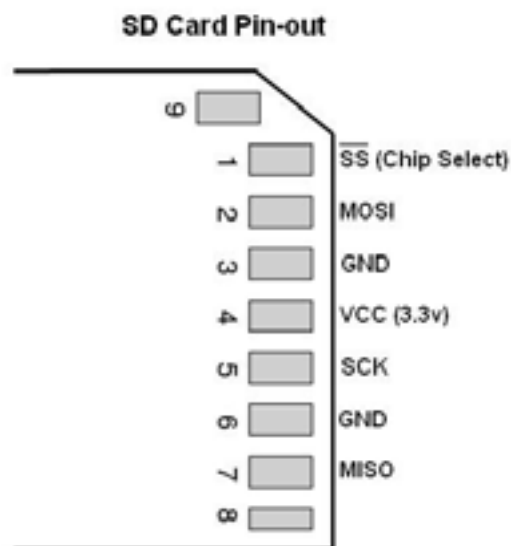
First, I captured the transaction that the radio does with the SD card on powerup. Here's an overview of the entire powerup sequence as shown by the Logic software that comes with the Saleae Logic Pro 16 logic analyzer.

SD Card Pin-out
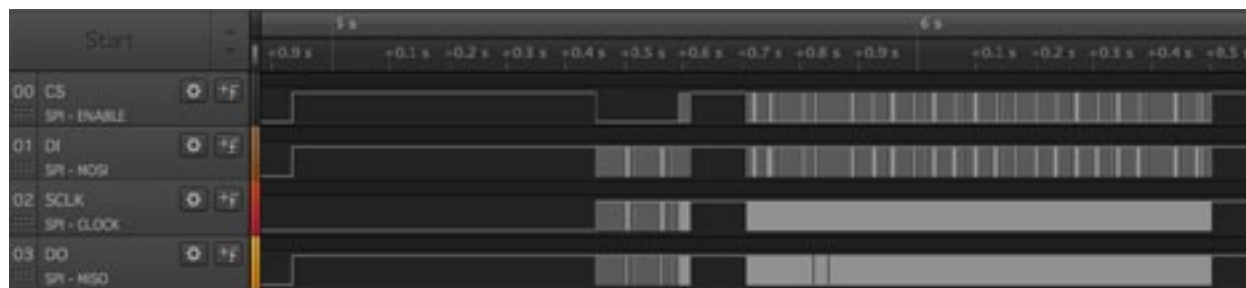
About half a second after the interface signals power up, there is a burst of information exchanged in both directions which lasts a little over a second.

In the trace, we can see the standard initialization sequence for bringing up a SD Version 2 card in SPI mode. It is defined to start with a sequence of at least 74 clock cycles at 410 kHz with CS held high. Here we see 85 cycles.
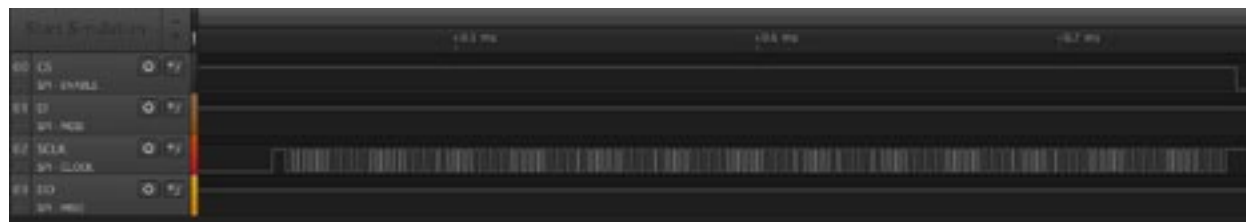
Next the host sends a CMD0 to the card, still at 410 kHz. The CMD0 is a six-byte sequence consisting of the command code 0x40, a four-byte argument of all 0x00, and a CRC check byte (here 0x95). After one idle byte on the bus, the card responds with a one-byte status code of 0x01, which indicates that it is in the idle state.

The fields shown in white on blue above are generated by a software module within the logic analyzer software called a protocol analyzer. The protocol analyzer for SPI knows how to interpret the various signals into logical byte transfer operations. To the right are the settings for the SPI protocol analyzer. The two settings for clock polarity are different from the analyzer's default settings.

The protocol analyzer module is also capable of exporting its results into a comma-separated values (CSV) file for further analysis. The CSV file for the above transaction looks like this:

```
Time [s], Analyzer Name, Decoded Protocol Result
5.450769360000000,SPI,MOSI: '255' (0xFF);  MISO: '255' (0xFF)
5.450794260000000,SPI,MOSI: @ (0x40);  MISO: '255' (0xFF)
5.450813780000000,SPI,MOSI: '0' (0x00);  MISO: '255' (0xFF)
5.450833320000000,SPI,MOSI: '0' (0x00);  MISO: '255' (0xFF)
5.450852840000000,SPI,MOSI: '0' (0x00);  MISO: '255' (0xFF)
5.450872380000000,SPI,MOSI: '0' (0x00);  MISO: '255' (0xFF)
5.450891900000000,SPI,MOSI: '149' (0x95);  MISO: '255' (0xFF)
5.450911440000000,SPI,MOSI: '255' (0xFF);  MISO: '255' (0xFF)
5.450937640000000,SPI,MOSI: '255' (0xFF);  MISO: '1' (0x01)
```

Initialization for this card (a Kingston 8GB SDHC card) takes 141 milliseconds. During the startup sequence it performs 634 byte transfers with a clock speed of about 410 kHz, during which it verifies that it has a valid card capable of higher speed transfers. After that, the clock speeds up to about 6.25 MHz and stays there for all future activity. That speed is less than the maximum speed the card reports being capable of (25 MHz for all modern cards), so it must be limited by the radio's hardware.

Even with the help of the SPI protocol analyzer, the results captured by the logic analyzer at the byte level are very tedious to interpret by hand. I wrote a rough and ready Python program (available at http://www.mustbeart.com/kb5mu/ham/parsesd.py) to step through the CSV file and translate the byte transfers into logical operations. Here's the output of my program for the entire initialization sequence:

```
5.450794260000000 CMD0 GO_IDLE_STATE
Response:   1
5.450997620000000 CMD8 SEND_IF_COND
Response:   1
5.451295420000000 CMD59 CRC_ON_OFF
Response:   1
5.451499940000000 CMD58 READ_OCR
Response:   1
5.451799000000000 CMD55 APP_CMD
Response:   1
5.452000200000000 ACMD41 Initialize
Response:   1

… many more repetitions of the above four lines while the card initializes …

5.592937860000000 CMD55 APP_CMD
Response:   1
5.593141460000000 ACMD41 Initialize
5.593344300000000 CMD58 READ_OCR
5.593626920000000 CMD10 SEND_CID
5.593773580000000 CMD9 SEND_CSD
5.593935080000000 CMD13 SEND_STATUS
5.593977680000000 CMD59 CRC_ON_OFF
```

Once card initialization is complete, the radio reads some data blocks from the SD card. It always seems to use the READ_MULTIPLE_BLOCKS command, even though it only reads a single block worth of data. It always issues the READ_STATUS command after doing a read, and in all the cases I saw the status was 0x0000, which indicates no errors. Despite that, the radio would sometimes read the exact same block multiple times. Other times, it would read again a block it had read recently, but not the very last block it read. Probably this just indicates that the software in the radio doesn't do any caching of read data, not even the last read block. Perhaps there isn't enough RAM available.

The first block read is at address 0. That would be the Master Boot Record, which contains the partition table. There's a single partition, as expected. Among many other parameters we see that it's a non-bootable partition, system ID = FAT32, relative sectors = 0x2000, total sectors = 0xe6a000. The relative sectors field tells us where to find the boot sector, and sure enough the next block read is at address 0x2000.

In the block at 0x2000, we see that the OEM ID, which would usually contain the operating system name, is full of spaces — this card was formatted by the FTM-400D, not by a computer. Bytes per sector = 512. Sectors per cluster = 64. Reserved sectors = 0x1196. Hidden sectors = 0x2000. Total sectors = 0xe6a000. Sectors per FAT = 0x735. No backup boot sector. Old style volume label = "NO_NAME____". System ID = "FAT32___". The value of reserved sectors plus the location of the boot sector tells us where to find the first FAT. 0x1196 + 0x2000 = 0x3196.

The radio does read the sector at address 0x3196, but first, it reads the next sector, at 0x2001. Why?

My Python program captures the data from each block read into a binary file. I used a hex editor program called *Synalyze It!* to investigate the results. Here's a screen shot of the next block it reads, at address 0x4000. It's the beginning of the root directory.
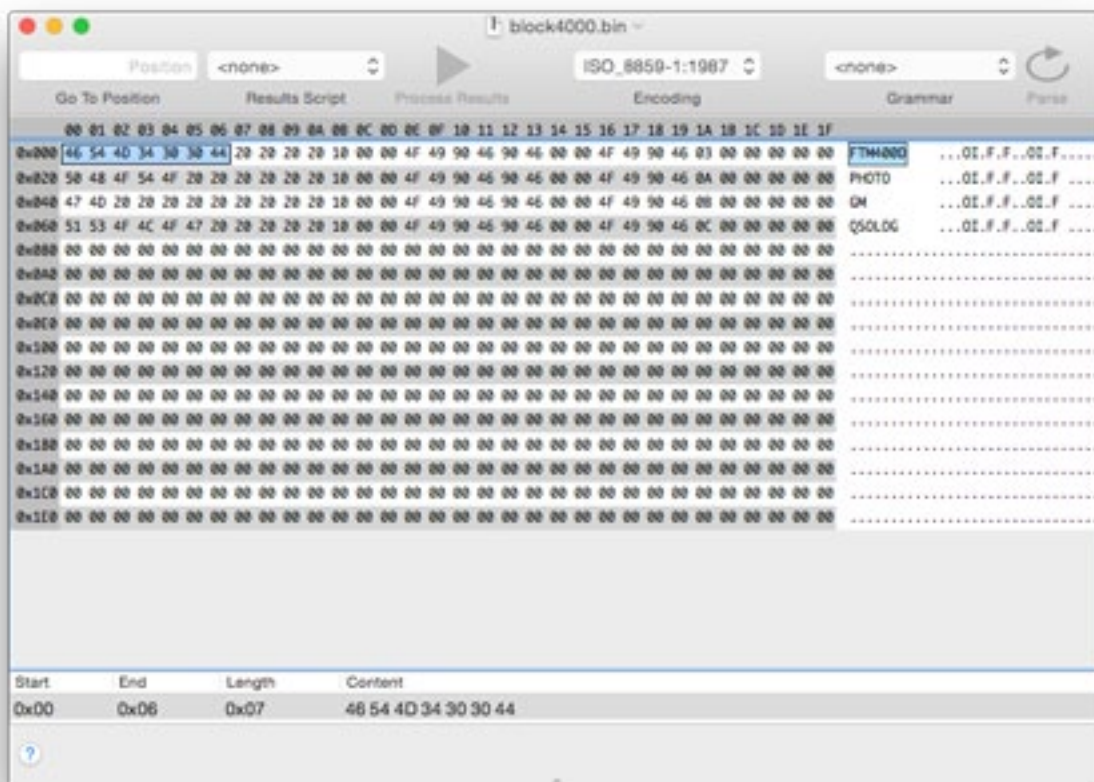
Sure enough, we see the file names of the folders FTM400D, PHOTO, GM, and QSOLOG. Then it reads that same sector again. Then it goes on to the sector at 0x4040, which contains directory entries for the directories BACKUP, GPSLOG, and PHOTO. Then it reads 0x4000 and 0x4040 again before proceeding to read the sector at 0x4080, which contains directory entries for CLONE, MEMORY, and SETUP. It goes on to read 0x40c0 (three times), which contains only directory entries for "." and ".." pseudo-directories. It does some more repetitive reading of these sectors before moving on to read the sector at 0x4100, which also contains only "." and ".." entries. Similarly 0x4140 and 0x4180 are blank except for these entries. All this activity amounts to peeking into a bunch of empty directories. Finally it gets to 0x4200, which contains directory entries for files MF0ob8000001.jpg through MF0ob8000004.jpg. It then reads consecutive sectors (0x4201, 0x4202, through 0x4208, reading each one repeatedly. These sectors contain directory entries for files up through MF0ob8000043.jpg. It has now walked through the entire /PHOTO directory.

Next it backs up to the top, this time coming down into 0x4240, which is another empty directory (/GM) and 0x4280, which contains directory entries for the files in /QSOLOG: QSOMNG.dat,

`QSOMSG.dat`, `QSOMSGDIR.dat`, `QSOMSGFAT.dat`, `QSOPCTDIR.dat`, and `QSOPCTFAT.dat`. Like the JPEG file names, these last four file names are too long for the old-style DOS file naming convention of 8 uppercase ASCII characters plus three more as an extension. The FAT32 format accommodates that in a compatible way by storing the filename twice. One copy is crunched down to 8.3 format (e.g., `QSOPCT~1.DAT`), and the other is stored in full, encoded as a UCS-2 Unicode string of up to 255 characters. The long file name has to be packed rather oddly into one or more extra directory entries.

The radio has walked the entire directory tree of the SD card and looked at all the directory entries without opening any files. It must be just checking for a valid directory structure. A total of 191 data block reads were performed, but only 24 unique blocks were read. The pattern of access is consistent with a lazily-coded hierarchical walk of the directory tree.

Lastly, it goes back to the top and reads 0x4000, 0x4280, and 0x5a00. This is a file read of `/QSOLOG/QSOMNG.dat`. This is a 32-byte file containing mostly 0xFF bytes. The meaning of this file is obscure for now.

Powerup with Eye-Fi Card

Next I decided to try a different card. This one was a first-generation 2GB Eye-Fi card, designed to transmit pictures stored by a digital camera by WiFi to a nearby computer or remote server. If the Eye-Fi card could be used with the FTM-400D, it might be possible to get received photos out of the radio with minimal fuss. I had already noticed that plugging the Eye-Fi card into the radio did not enable the SD Card menu, so I expected the initialization to fail.

The initialization began much as before. This is an older, smaller device, so it is formatted FAT16 instead of FAT32. The radio was able to read the Master Boot Record (at 0x0000) and the boot sector (at 0x1e200), which proves that the SPI interface is working and compatible. However, the next read never completed. It should have been the root directory. The card acknowledged the command, but never sent the data token indicating it was ready to transmit. The radio polled every millisecond or so for about 88 milliseconds before giving up. It then issued a stop command, checked status, and re-tried the read command. This went as before, and was repeated for a total of about 3.1 seconds before the radio gave up entirely and stopped trying.

The address it failed to read from was 0x5c000. The boot sector advertises a total number of sectors of 0x3d880f, so that address ought to be in range. However, the number of reserved sectors is only 1, which means the root directory ought to be right after the boot sector, at 0x1e201. I don't know where it got 0x5c000, or why it failed to read that sector.

I quick-formatted the Eye-Fi card on a Mac using the recommended formatter program from the SD Association, SDFormatter. This didn't make any difference. The card was still formatted FAT16, the boot sector was still at 0x1e200, and it still tried and failed to read at 0x5c000. I tried again with an overwrite format. That also made no difference. Then I tried formatting it with Disk Utility on the Mac. No difference. I then forced the format to FAT32 by using the command line

        sudo distill eraseDisk FAT32 EYE_FI MBRFormat /dev/disk15
as suggested by an answer found on superuser.com. This changed the addresses involved, but did not change the sequence of events.

The user manual for the FTM-400D is ambiguous on microSD card requirements. In one place it says that they must be SDHC cards, which the first-generation Eye-Fi card is not. In another

place it says microSD or microSDHC. It does say that the card must be one of 2GB, 4GB, 8GB, 16GB, or 32GB. These sizes are all in the range of FAT32 and SDHC, but a 2GB card can be FAT16 and plain SD. Apparently that's not good enough.

I had another Eye-Fi card that was somewhat more modern, though still not the latest and greatest. This one is an 8GB X2 Eye-Fi card, which is marked SDHC. The newer card was recognized by the radio. I traced the power-up sequence without formatting the card first. It appeared to work, but not quite as simply as before. I found *writes* to the card as well as reads. It was creating the standard directories that the radio uses. This wasn't captured before because I had been testing with a card that had already been used in the radio.

I then tried to format the bigger Eye-Fi card in the radio. This operation seemed to be taking a very long time. After over 15 hours, I gave up and tried to cancel it with the Back button on-screen. No effect. Then I tried power cycling the radio by holding down the power button. No effect. Apparently it crashed the radio. I tried pulling out the SD card. No effect. I had to turn off the power supply to get control of the radio back. Putting the unsuccessfully formatted card into the Mac, it appeared at first glance to be OK. It had the FTM-400D special files on it, and it had the volume label it had before the formatting attempt (CANON_DC). Disk Utility, however, reported that it was damaged.

```
Verifying volume "CANON_DC"Verifying file system.** /dev/rdisk15s1
** Phase 1 – Preparing FAT
** Phase 2 – Checking Directories
/FTM400D starts with free cluster
Remove? no
** Phase 3 – Checking for Orphan Clusters
Found orphan cluster(s)
Fix? no
Found 6 orphaned clusters
97 files, 7981856 KiB free (249433 clusters)
File system check exit code is 8.Error: This disk needs to be repaired. Click Repair Disk.
```

I reformatted the card with SDFormatter, successfully. I tried again to format the card in the radio, this time with the logic analyzer tracing. This failed in another way. Tracing from powerup, the normal initialization seemed to complete without difficulty. The trace then shows 11.49 seconds of inactivity with CS high (inactive), corresponding to the time I took to enter the format command. Activity resumes with the radio sending a read command (address 0x30c4, a valid address it had already read from once and written to 11 times). However, the card is completely unresponsive from then on, showing a constant low on the DO signal. The radio polled every millisecond for 88ms, then issued a STOP command. The radio tried every ~18 microseconds for nearly two minutes before giving up.

This failure apparently has nothing to do with formatting the card. The card was already unresponsive before the radio made any attempt to format it. This is a mystery. For now we can only conclude that the FTM-400 is picky about what kinds of SD card it will accept.

Idle Activity

While the radio was idle, there was no activity on the SD card.

Capturing a Photo

Next, I took a picture using the camera mic and captured another burst of activity. The photo capture activity took 1.9 seconds. The radio was set to capture pictures in its default mode, 320×240 pixels and normal quality. The resulting file was 6101 bytes long. For perspective, a cheap digital camera creates files a thousand times as big and manages to store several of them per second. The FTM-400D is not optimized for SD card performance!

Once again the operation started with a READ_MULTIPLE_BLOCKS command, starting at what is apparently the top of the directory structure. It scanned the directory until it found the block where it could store the new file entry. It then re-read that block, and wrote it back out with 90 bytes changed, using the WRITE_MULTIPLE_BLOCKS command. The new entry contains the long Unicode-encoded filename, in this case "`MF0ob8000044.jpg`", as well as the short DOS-style filename, in this case "`MF0OB~44JPG`" (where the dot is implied before the last three characters).

After the directory was updated, it started writing data. Early in the first block, the "`JFIF`" signature from the JPEG file format standard was visible. A single block of 512 bytes is written, and the radio waits for the write to be completed. Then the radio read out the following block from the SD card (which was full of zeroes), and then wrote it back with all the bytes changed. It then did the same for the next block, and so on. The block reads would appear to be completely wasted here. What's more, in between each block read and the write back of the same block, the radio pauses for about 34 milliseconds. This time is also completely wasted.

Then it reads back the block that contained the directory entry again. Then it makes some updates in other blocks, presumably updating the File Allocation Table. Then it updates the directory some more. And so on until the file creation operation is complete. Which is to say, I got lost in all the FAT manipulations and didn't feel like tracing through it in detail. I assume this includes updating the metadata files in /QSOLOG. A complete study of this will be needed if we hope to make good use of the interface.

Conclusion

I demonstrated that it is possible to capture the photo data being written out to the microSD card interface of the FTM-400, using a cheap extender and a moderately expensive ($600) logic analyzer. If we were willing to dedicate all that hardware, plus a computer, and write a bunch of software, it would be possible to monitor a channel for photo transmissions and make immediate use of the images received.

To do the job without the expensive logic analyzer should be possible with some custom hardware. It would not be necessary to emulate all the complex behaviors of an SDHC card, since an actual SDHC card could be used to take care of that. The custom hardware would only have to capture the data and make it available for a computer to interpret. A detailed design of that custom hardware is a project for another day.

I also searched high and low for an off-the-shelf solution to the problem of monitoring SD card transactions. I expected to find SD card emulators offered for embedded software engineers to use in developing and debugging microcontroller programs that need to talk to SD cards. They'd be expensive, but flexible, and marketed to the professional software trade. To my surprise, that product does not seem to exist. Apparently software engineers are left to fend for themselves in this area.

Bibliography

I found the documents at these links useful in understanding the SD card interface:
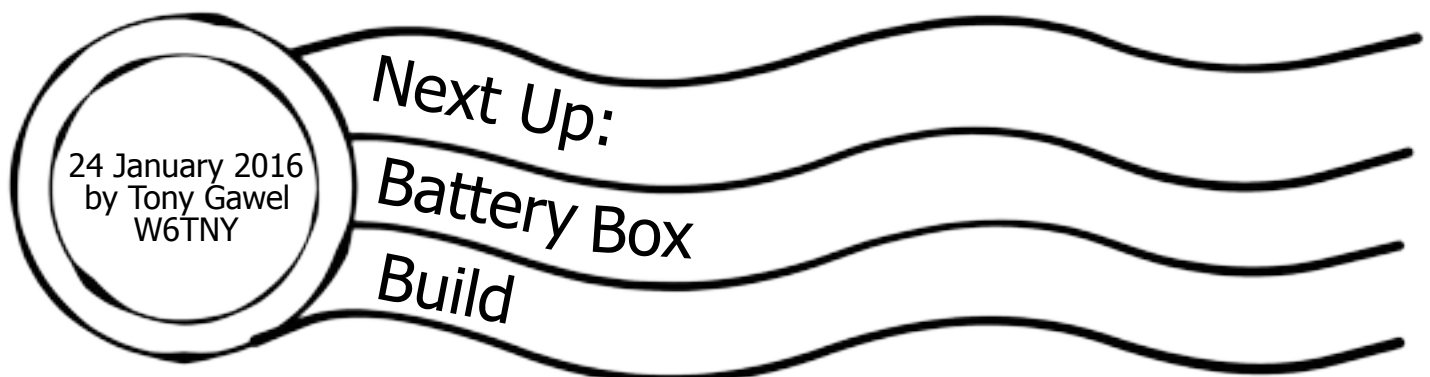
http://elm-chan.org/docs/mmc/mmc_e.html

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http://patrickleyman.be/blog/sd-card-c-driver-init/

https://www.pjrc.com/tech/8051/ide/fat32.html

http://social.technet.microsoft.com/wiki/contents/articles/5375.windows-file-systems.aspx#FAT

http://www.compuphase.com/mbr_fat.htm

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http://www.circlemud.org/jelson/sdcard/SDCardStandardv1.9.pdf

https://www.sdcard.org/downloads/pls/simplified_specs/archive/part1_200.pdf

24 January 2016
by Tony Gawel
W6TNY

Next Up:
Battery Box
Build

CERT and Emergency Communication Basic Battery Box
By Tony Gawel W6TNY

This Project is intended to provide CERT, EmComm teams and amateur radio clubs with a basic low cost Emergency Battery Box project that is simple to build and requires minimal tools. The article is designed to inspire a few ideas on what is possible by providing a Club/ Group activity that all members can participate in. The building process provides the builder with both comradery and pride of ownership in building their own (emergency) equipment (the fundamentals of Amateur Radio).

The battery Box is a quick, fun and inexpensive project for individuals and groups. If you have the components, the build can be completed in just a few hours or an afternoon. You start with the basic box and add your accessories and ideas as you go. The ultimate project you decide to build is determined by the skills of the group and your own imagination.

This project is not the high-end Mega EmComm box that many amateur radio operators often build! It is not designed to replace critical pieces of equipment either, but to supplement them. This project is designed for most people who want to be better prepared, and may not have the resources to build one of these so called Mega EmComm boxes.

Some of the advantages of the Battery Box project are;
1. The box is easily transported in the back of your car
2. It can be installed in your home/office
3. It can easily be taken in the field for EmComm or QRP operations.

A single box can provide limited emergency power during critical times but if the boxes are connected together the user can effectively add more battery capacity and air time when needed.
The unit is capable of supplying emergency 12 volt DC power in the field to charge most phones, HT radios, small HT repeaters, mobile radios operating on low power (QRP), and assorted led lighting. A well-constructed EmComm box can provide temporary power for those running HamNet Wi-Fi Mesh Nodes, etc.

What type of box you decide to build is based on your resources, skills and creative imagination. This article primarily focuses on building on the Cheap, building more Basic boxes, and for those that can afford to build the Cadillac box! The foundational design becomes the building block for the other

Figure 15 Box with Accessories Installed

- If any of the connector housings are loose, apply a little Hot Melt Glue (or silicone) to seal and secure the housing in place

Wiring Instructions:

- Gently place the lid back onto the battery box
- Push on the precut and terminated red wire into the 12v power jack and attach the wire to terminal 1 on the red terminal block.
- Insert the precut and terminated red wire to the Anderson connector and attach the wire to terminal 2 on the red terminal block.
- Push on the precut and terminated Black wire to the 12v power jack and attach the wire to terminal 5 on the red terminal block.
- Insert the precut and terminated Black wire to the Anderson connector and attach the wire to terminal 6 on the red terminal block.
- If you are using the USB charger and Meter:
  o Connect the switch red wire with 2 connections to the + side of the meter and + side of the USB connector.
  o Connect the other Red wire on the switch to terminal block 3
  o Connect the black wire on the switch to terminal 5
  o Connect a black wire from the USB module to terminal 4
  o Connect a black wire from the Meter – to terminal 5 (2 wires will go to this terminal)
- Loosen terminal 6 on the black terminal block and connect the black battery wire to the terminal block and then connect it to the black, Negative -, terminal on the battery.
- Loosen terminal 2 on the Red terminal block and connect the red battery wire. **With the fuse removed** install the red wire to the red battery terminal.
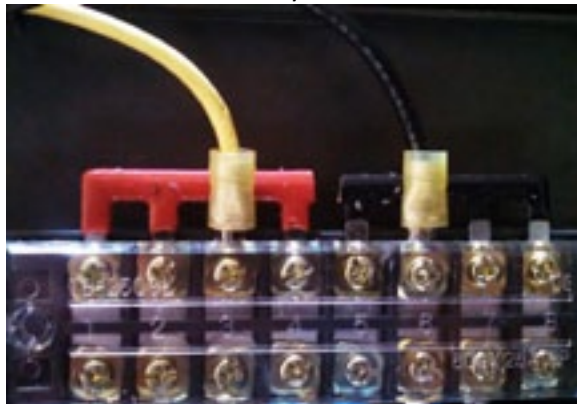

Figure 16 Attaching the Battery Wire to the Terminal Block

- **Note**: Before you insert the fuse, recheck you wiring making sure every connection is terminating into the correct position on the terminal block, and that every connection is fully seated
- Insert the fuse and check the polarity and voltage on each of the accessory jacks.
- Tape a spare fuse or two inside of the battery box

Build Sheet

- Plastic 30 cal ammo box
- ½" Dense foam padding
- Anderson 30 amp Power Pole connectors
    - 1 Red and 1 Black Anderson 12-14 awg wire
- 12v Power plug
    - 1 Red and 1 Black wire
- Battery
    - 1 Red and 1 Black Battery jumper wire with fuse
- Terminal block 8 terminal
- Nylon battery strap with clip or reusable tie wrap
- Battery box Templates
    - Bottom box
    - Top Cover

Tools

- Drill
    - 1/8" pilot hole drill bit
    - Step drill bit
- Hot melt glue or silicone sealer
- Voltage and polarity testers
- Razor knife

Parts list

1	30 Cal plastic ammo box
1	7 Ah AGM battery
1	Piece of ½" inch foam for the bottom
2	Pieces of ½" inch foam for the sides
2	Pieces of ½ inch foam for the front and back
1	Inline ATC fuse holder 12 AWG
1	15 Amp ATC fuse
1	Marine 12v power adapter
1	Anderson power pole adapter
1	8 positon terminal block
1	4 position Red Jumper
1	4 position Black Jumper
6	Spade connectors
2	Butt connectors
2	Push on Battery connectors
6	8" 12-14 AWG red and black zip wire

Optional Items

1   Marine USB charger
1   Digital Volt Meter
1   Waterproof switch
1   Buck power supply
1   Solar panel
1   Float battery charger

Additional Accessories Possibilities

- Larger battery
- Lithium ion Phosphate Battery
- Dual 7 ah Battery
- Additional Anderson Power Pole to 12v Plug Connectors

Figure 18 Anderson Power Pole to 12v Plug Adapters

- Additional 12V power plugs
- AES cable for camping and RV use
- Solar, wind, generator
- Anderson daisy chain cable

Figure 17 Daisy Chain Cable

Templates

designs. It only differs in the type of accessories that you decide incorporate. Key advantages of this battery box design is that it can be customized, expanded, added on to as you need which makes it affordable and easy on your resources. The recommended procedures for building the different types of boxes are the same, but the addition of optional accessories can increase the unit's functionality and overall cost of the project. An important consideration is that this design also lends itself to incorporating different battery sizes and types based on budget and availability. The build also attempts to incorporate a simple design to allow for quick battery replacement and for future upgrades potentially to the new LiPo4 light high capacity batteries (see Cadillac EmComm boxes).

The Build

I wanted to build a quick, fun and inexpensive project that can be shared with others and that was one of the primary reasons why I designed the box. It provides emergency 12 volt DC power in a small light-weight waterproof case. Various types of batteries are plentiful and often recycled batteries can be found for free or for just a few bucks. The building process has been simplified for non-technical people. The build begins with readily available 7 ah AGM UPS batteries which are inexpensive and available in most electronics surplus stores or from an older UPS unit. Another source of batteries may come from larger UPS systems. Depending on the type of UPS system if and when a battery pack fails there are often still a few usable batteries remaining. The 7ah battery which is typical in these UPS packs is a deep cycle battery which lends itself extremely well to these smaller types of projects.

Figure 1. Cadillac Box

Figure 2. Basic Box

Figure 3. Basic Box with USB Charge Adapter and Phone Cable

Section I

Safety

Battery Safety is an important consideration before you get started!
For example:

- Never disassemble a battery under any circumstances. The materials in a battery are often toxic and can cause severe burns and can damage your clothing.
- **Red wire goes to the Positive**
- **Black wire goes to the Negative**
- Never use a fuse larger than one that is rated or recommended for this project
    (Keep some spare fuses in your box)
- Do not short circuit a battery by crossing the positive and negative terminals as you can damage the battery and other electrical equipment components. It can also cause burns and/or injury to you.

- Never throw batteries into a fire as they can split, cause toxic fumes and leak acid.
- Don't reverse the polarity of the battery or you can damage your equipment and the battery.
- Don't use old and new batteries together. This can degrade the batteries.
- Always charge the battery at the correct voltage and amperage after use. Don't over-charge the battery as this can damage the battery and cause it to leak. Follow the charging procedures from the manufacturer.
- Store batteries in a sealed cool dry place when not in use (battery box).

Now let's get started with the fun!

Section II

Battery Box Construction

This project is based off of the readily available 7 ah AGM UPS batteries and a plastic 30 cal ammo box available at Harbor Freight or Amazon. The 7 ah AGM battery's typical size measures 5.9x2.5x3.7 inches which are a perfect fit for a small ammo box.

Basic Box

- Place battery box on a sturdy table
- Inventory your materials from the build sheet
- Carefully remove the lid from the ammo box and place it to the side

Figure 4 Empty Ammo Box

- Measure about 5 inches from the front handle and mark the bottom of the battery box
- Install two cable tie mounts on the bottom of the ammo box or if you are installing a nylon strap hot melt glue the strap to the bottom of the box
- Insert the reusable tie into the mounts before securing the foam pad
- Use hot melt glue to install the foam padding on the bottom of the ammo box to hold down the nylon strap/ tie wrap and to protect the battery
- Glue some ½" foam on the front of the box by the handle

Figure 5 Front Battery Foam Pad

- Insert the battery in the box and tighten up the tie wrap or nylon strap
- Place the foam padding on both sides of the box
- Cut ½ inch foam for the front of the battery and hot glue this to the foam on the side of the battery

Go to Section IV

Cadillac Box

- Place battery box on a sturdy table

Figure 6 Empty Ammo Box

- Inventory your materials from the build sheet checklist (see below)
- Carefully remove the lid from the ammo box and place it to the side
- Measure up about 5 inches from the front and mark the bottom of the ammo box
- Glue nylon strap, with the clips, in the bottom of the ammo box about 5" from the front. (pic)
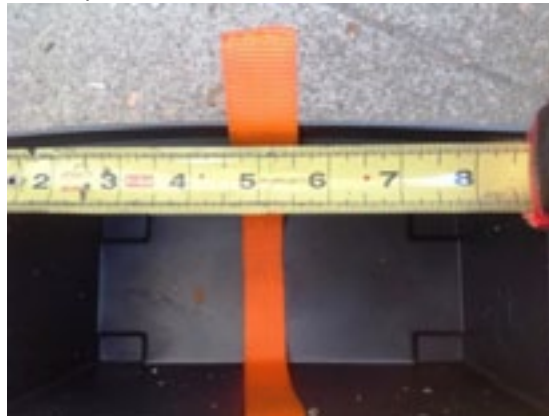
Figure 7 Glue Battery Hold-down Strap

- Measure the inside of the ammo box and cut piece ½" dense foam to fit the bottom of the ammo box to provide support for the battery.
- Drape the battery straps over the side of the box while you install the foam pad
- Hot glue this foam (with straps underneath – see image below) to the bottom of the battery box and place the battery on top of the foam until the hot melt glue sets.

Figure 8 Glue down Bottom Foam Padding

- In an effort to protect the battery from damage and side to side movement measure and place ½ inch foam pad on the interior front side (closest to the latch) of the ammo box.
- Hot melt glue this to the front interior side of the box

Figure 9 Installing Back Foam Padding

- Measure and cut two ½" pieces foam one for each side of the battery to secure it into the box

Figure 10 Installing Side Foam Padding
- Cut one ½" foam for the front of the battery

Figure 11 Glue in Front Foam Padding

Section III

- Select the terminal block (or similar) as indicated in the parts checklist. Carefully remove the clear plastic cover from the terminal block

Figure 12 Terminal Strip

- Using a screwdriver loosen the 8 terminal screws on one side of the block
- Select red bridge jumper clips and install the red jumper clips on the left 4 terminal screws and tighten them down (see image below)
- Then install the black jumpers clips on the right 4 terminals screws and tighten them down (pic)

Figure 13 Terminal Block with Bridge Jumpers

- Apply a small dab of hot melt glue on the bottom of the terminal block enough to install it to the center of the top of the interior of the ammo box. (pic) This allows room for connections on both sides of the terminal block and enough room to insert additional power accessories.

Go to Section IV

Section IV

Installing the Power Connectors

- Now set the battery box lid on the table on top of a block of wood.
- Now tape the template (See Template Section)to the top of the battery box and use it to mark the location of the 12v power jack
- (Option) Meter, USB Charger and Anderson connections (plus any optional devices)(pic)
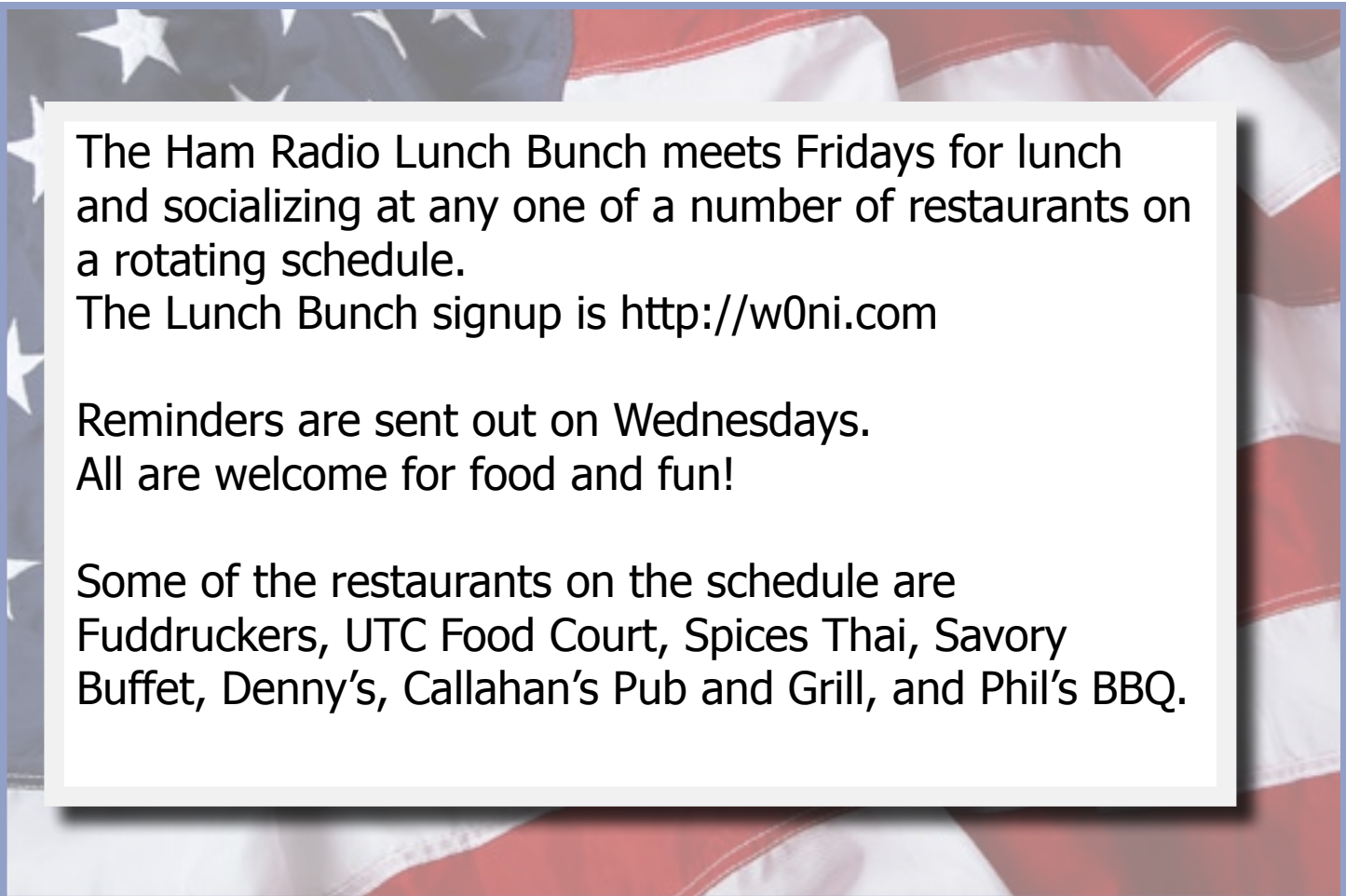
Figure 14 Drilling Holes for Accessories

Note: You should mark the potential placement of, but don't drill the extra holes required if you are not going to be installing the additional accessories at this time. This will maintain the box's moisture resistance until which time you modify the ammo box. Once you're ready to being installing the components you have on hand:

- Using the 1/8" drill, make a pilot hole for each device location you will be installing. Do not drill extra holes if you are not installing the other devices.
- Using the step bit, drill a 1 1/8" hole in the lid for the power jack and clean up any debris with a razor knife

Figure 15 Step Bit for Drilling Holes for Accessories

- In the example above, make a second hole for the Anderson connectors (optional)
  - o Optional: Mark and install the triple hole face plate on the top of the box.
  - o Optional: Drill the 3 holes for the volt meter, USB charger, and 12v power outlet
  - o Optional: Drill a hole for the power switch to power the volt meter and USB charger
- Insert the 12v power socket in the box lid and tighten the locking ring.
- Insert the Anderson module and tighten the locking ring, the pins and wires will be installed later
- Insert the optional volt meter, USB charger, and power switch, for the meter and USB charger, into the lid and tighten down the locking rings.

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.

29 January 2016
Michelle W5NYV

Phase 4 Ground Terminal
Downlink Receiver Standard
Intro to DVB-S2X!

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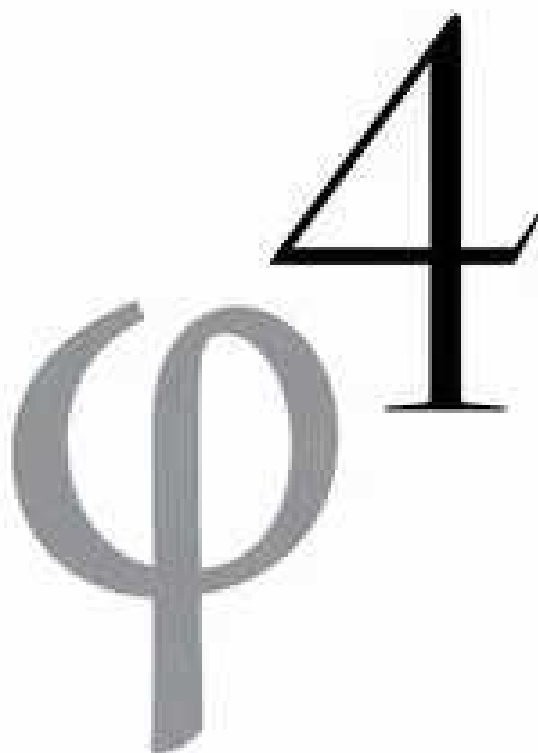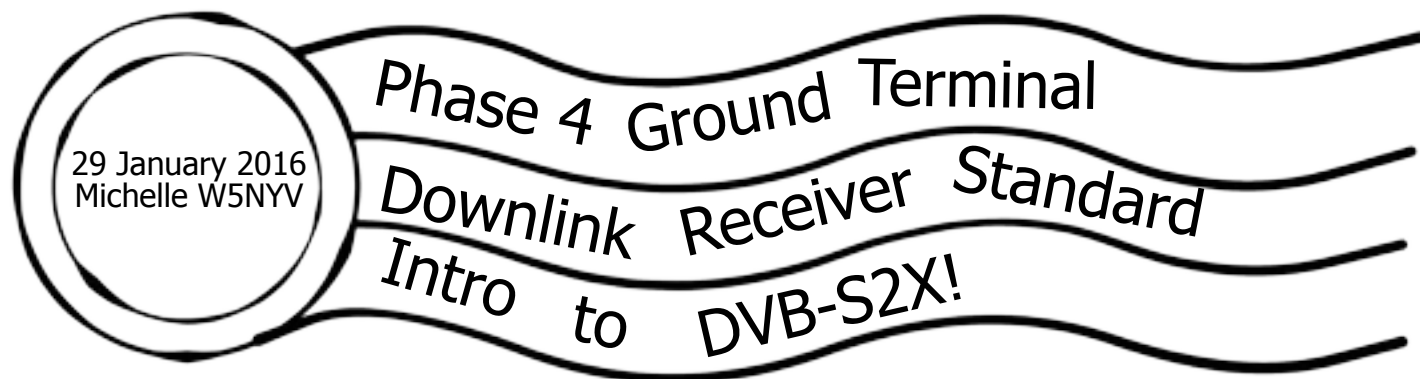
Digital Video Broadcasting Satellite standard (version 2!) is the transmission standard that Phase 4 Ground is expecting to receive from our upcoming amateur satellites.

Here's a brief video walk-through of the major landmarks of DVB-S2 and its recent extension DVB-S2X.

Phase 4 Ground team is directly supported by Palomar Amateur Radio Club.

(And, oops! The functional blocks are actually trapezoids, not parallelograms. My bad.)

Echolink Node Project Status

28 January 2016
Bernie Lafreniere
N6FN
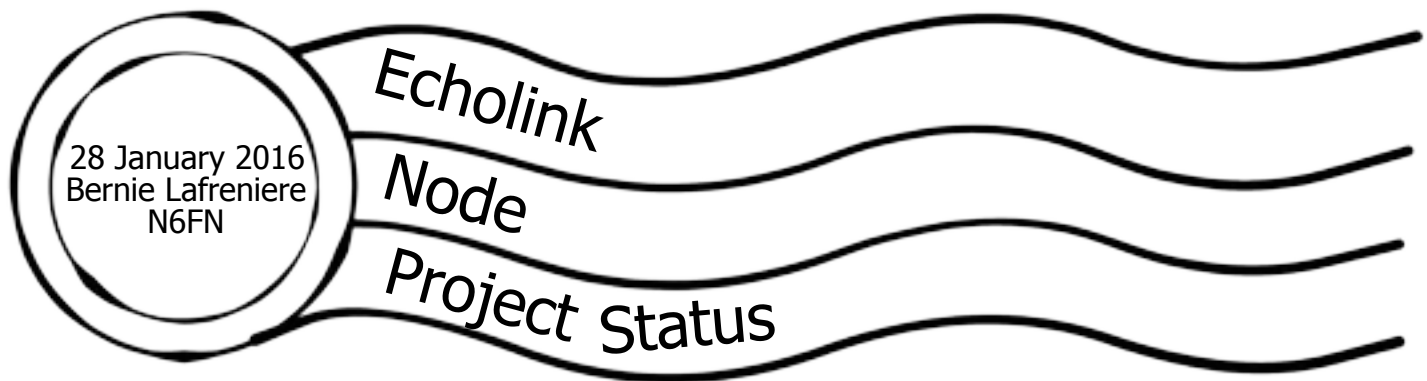
The club is interested in restoring EchoLink node operation on our 447.000 repeater, and as I was involved with setting up the club's EchoLink node on our old repeaters, I have been asked to look into what would be required for that to happen using the new Yeasu repeaters.

Up until about 6 months ago we had EchoLink node capability on our old 447.000 repeater. Several years ago Art, KC6UQH (SK) and I had modified the old repeater's hardware and firmware to allow it to operate as a node on the EchoLink network. The RF link to the 447 machine was housed at my residence and consisted of a modified Vertex mobile transceiver, a PC interface and an old laptop, which were used to bridge repeater traffic to the EchoLink network via my home Internet connection.

This node was in operation for about four years before the laptop died mid last year. As the club was on the verge of installing the new Yaesu repeaters, we decided to wait for that to happen before re-enabling the EchoLink node. Several months ago the new 447 repeater was installed and we started looking into what the issues might be with using it for EchoLink operation.

Upon investigation, the Yaesu DR-1X repeaters cannot be easily used for EchoLink remote node operation as the internal Yaesu repeater controller cannot be configured to comply with the ID and squelch tail elimination, turnaround delay and other requirements for operating on EchoLink,

Looking into it further we determined that the requirements for remote node operation could be accomplished by placing the Yaesu DR-1X in remote operation mode, which disables most functions of the internal controller, and attaching an external repeater controller using the DR-1X's "Control I/O" connector.

We have found two commercial controllers that have been tested with the DR-1X and have application notes and firmware written for enabling the DR-1X to operate in AMS (automatic mode select) mode, which allows mixed mode operation of Yaesu digital and normal FM signals.

Since the need for using an external repeater controller in order to facilitate an EchoLink node is substantially beyond the scope of "just" getting EchoLink running again, I went back to the PARC board of directors with my findings.

Since the application of external repeater controllers has the potential for resolving some of the club's larger requirements for controlling our collection of repeaters on Mt. Palomar, the board has decided to go forward with an investigation of available repeater controllers and how they might best be configured for controlling not just the new Yaesu DR-1X repeaters, but also our collection of other repeaters.

A group is in the process of being formed which will take on the task of further evaluating our controller requirements with the goal of purchasing one as a test case and configuring it to run several of our repeaters.

It turns out that the commercially available controllers we have looked at so far can each control up to three repeaters. Ultimately three of these controllers could be used to completely control the club's collection of repeaters. Using these controllers will allow the club to remotely (via an RF link) turn the repeaters on and off and reconfigure how they operate.

Featured Program:

At 7:30pm on 6 February 2016, Palomar Amateur Radio Club will have a program. The February program will highlight modern technology, and how it makes ham radio more fun. KB6NXC (Kris), a new PARC member, will demonstrate practical Arduino programming, describe how it was applied to robotics and ham radio, remote control, and other projects. He will perform a 3D printing demonstration, and show how 3D printing can be used by anyone to create ham radio projects. He will also show ham radio projects that were built using 3D printing. This program will be a hands-on tour of exciting things that continue the tradition of ham radio experimentation excitement!

Come at 7pm to socialize. 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