

# PAARAgraphs



The Official Newsletter of the

**Palo Alto Amateur Radio Association, Inc.**

Celebrating 80 years as an *active* amateur radio club—Since 1937

<http://www.paara.org/>



## Prototype Algorithms for the Extraction and Classification of Electromagnetic Signals in Magnetometer Data

Dr. Karl Kappler

QuakeFinder and its international collaborators have installed and currently maintain an array of 165 three-axis induction magnetometer instrument sites in California, Peru, Taiwan, Greece, Chile and Sumatra. QuakeFinder is developing algorithmic frameworks aimed at isolating anomalous signals in the time series, especially signals associated with pre-earthquake processes.

The array and data are described following a brief review of the field of electromagnetic earthquake precursor research. Examples of signal identification filters which use principle component analysis are shown and the sources of the signals are discussed. Results are then presented from a specific application of this framework to magnetometer data.

This data driven approach starts with sliding windows applied to uniformly resampled array data (50 sps) with a variety of lengths and overlap. Data variance ( proxy for signal energy) is calculated on each window and a short-term average/ long-term average (STA/LTA)

*(Magnetometer — Continued on page 7)*

## Upcoming Events

- Feb 3 PAARA General Meeting, 7:00 PM
- Mar 3 Cubberly Community Center, Room
- Apr 7 H-6, 400 Middlefield Rd, Palo Alto
- Feb 15 Board Meeting, 7:00 PM
- Mar 15 Everyone welcome!
- Apr 19 Location: Marty, W6NEV, QTH



## President's Corner

February 2017

This year is starting off with an abundance of rain. I was just in San Jose and there was thunder, lightning, rain, and hail. Not to mention the wind! WX may not seem like it's that important to our hobby, but it is. We had a wonderful Homebrew Night this January, with more than the usual amount of PAARA member creativity on display. And then there was the Winter Banquet too. Lastly, it looks like we've decided on the next PAARAtrip.



As many of you know, I'm a big fan of rain and weather in general. As I write, we got some real weather that included some electrical activity. A few nights prior, there were high winds and lots of water pouring down on us. As residents of "sunny" California, we just aren't used to this. It's important, though, to keep the thought in our head that we can indeed have weather here. This is important for a number of reasons. First

*(President — Continued on page 6)*

## Field Day 2016/2017

Though we are starting the planning for Field Day 2017 already, the 2016 results were only published by the ARRL in November. Before really getting into the planning for 2017, we should “closeout” the 2016 event. As in 2015, we went into the event hopeful that the bands would cooperate. However, with the declining sunspots no “day of openings” occurred. As such, the number of total contacts was reduced by 752 from 2015 and by a whopping 1,436 off our best year of 2012. Now that’s some serious band degradation. Now the only positive there is that everyone had the same band conditions to work with.

Though the contact reduction is a bit disconcerting, there were lots of positives. This year there were 2 new categories for bonus points, safety officer and social media. We got all 200 points there and an additional 20 points for more GO-TA contacts than in 2016. Taking away the 200 new points from our bonus score, only 2010 saw a larger bonus score, thus we improved in this category over all other years except 2010.

Speaking of social media, I hope everyone is following us on Twitter. We have continued to post information on various topics related to club events. As we know it will be included for bonus points in 2017 you can get a jump on it by joining now. If you have a Twitter account, search for paaraW6ARA and join the fun.

In a category that doesn’t count for points, but in my humble opinion is an important aspect of the event, is how many people participate or stop by to learn what is going on. After all part of the reason for having the event is public outreach. This year we had 137 participants, the most in any records I have access to. I also know we



**Preparing for Field Day**



**Visitors**

were successful in attracting 5 new club members who had visited us at Field Day.

So, with all the preceding diatribe where did we place? We amassed 13,352 points this year in the 4A class. Nationally we placed 3rd in 4A 3,502 points behind the 1st place club. Third place out a total of 132 participants in 4A is right at the top of the heap. We also placed 15th out of all participants. Not bad for a “weekends” work!

Where does that leave us for 2017? Field Day this year is on June 24th & 25th with setup starting after 5PM on the 22nd and continuing on the 23rd. Hopefully everyone already has the date marked on their calendars. As always, we need a small army of people to help in every facet of the event. Of great need this year is someone to be the CWB or Digital station captain. If you have any interest in heading up this important station or learning about the position, contact Doug Teter, KG6LWE, our Field Day coordinator. As the event draws closer, we will be looking for lots of people to help with the antenna parties, event setup/take down, operators, helpers, visitors, friends and anyone else interested in a good time or learning what Ham radio is all about. It’s also a great way to learn about antennas and their assembly, tower erection, station setup among lots of other Ham topics.

Contact Doug Teter, KG6LWE at [dteter@wawi.com](mailto:dteter@wawi.com) for info or to sign up.

73, Jim K6SV

**Historic look @ PAARA Field Day results**

Year	Call	GOTA	Category	QSO points	Bonus points	Total points	QSO's	Partici-pants	NATIONAL *				PACIFIC DIVISION **			
									4A Category			All Cate-gories Rank	4A		All	
									Rank	Out of	Top Points		Rank	Out of	Rank	Out of
2002	W6OTX	N6NFI	2A			7,994	2,355	36	22	467	14,696	95	1	22	4	125
2003	W6OTX	K6YQT	2A			8,740	2,617	42	11	429	14,336	50	1	24	3	122
2004	W6OTX	K6YQT	2A			6,004	1,764	126	56	454	13,972	182	4	21	11	126
2005	W6OTX	K6OTA	4A			6,378	1,939	132	15	127	12,518	149	1	8	8	114
2006	W6ARA	K6OTA	3A			8,644	2,197	95	9	277	18,142	70	1	9	7	113
2007	W6ARA	K6OTA	3A			10,774	3,207	123	6	282	19,288	34	1	13	3	117
2008	W6ARA	-	4A			10,738	3,276	53	5	109	14,202	33	1	4	3	137
2009	W6ARA	W6OTX	4A	9,974	1,350	11,326	3,480	74	3	130	14,404	32	1	8	3	151
2010	W6ARA	W6OTX	4A	11,700	1,870	13,570	4,114	108	3	155	17,140	16	1	8	3	154
2011	W6ARA	W6OTX	4A	12,596	1,470	14,066	4,356	75	4	125	16,668	20	1	5	2	143
2012	W6ARA	W6OTX	4A	15,488	1,670	17,158	5,332	82	1	158	17,158	9	1	7	3	158
2013	W6ARA	W6OTX	4A	12,562	1,610	14,172	4,308	115	3	156	15,476	17	1	7	3	154
2014	W6ARA	W6OTX	4A	13,946	1,770	15,716	4,648	112	2	150	16,371	11	1	7	3	167
2015	W6ARA	W6OTX	4A	13,396	1,790	15,186	4,648	130	3	155	17,038	11	1	7	3	165
2016	W6ARA	W6OTX	4A	11,342	2,010	13,352	3,896	137	3	132	16,854	15	1	7	3	147

- \* National Category rank = PAARA's ranking compared to all participants in the same category nation wide
- \* National top points = the number of points earned by the top club in the same category we participated in
- \* National all categories rank = PAARA's ranking compared to all participants in all categories
- \*\* Pacific division Category rank = PAARA's ranking compared to all participants in the same category in the Pacific Division
- \*\* Pacific division all categories rank = PAARA's ranking compared to all participants in all categories in the Pacific Division

Data source: <http://www.arrl.org/results-database>



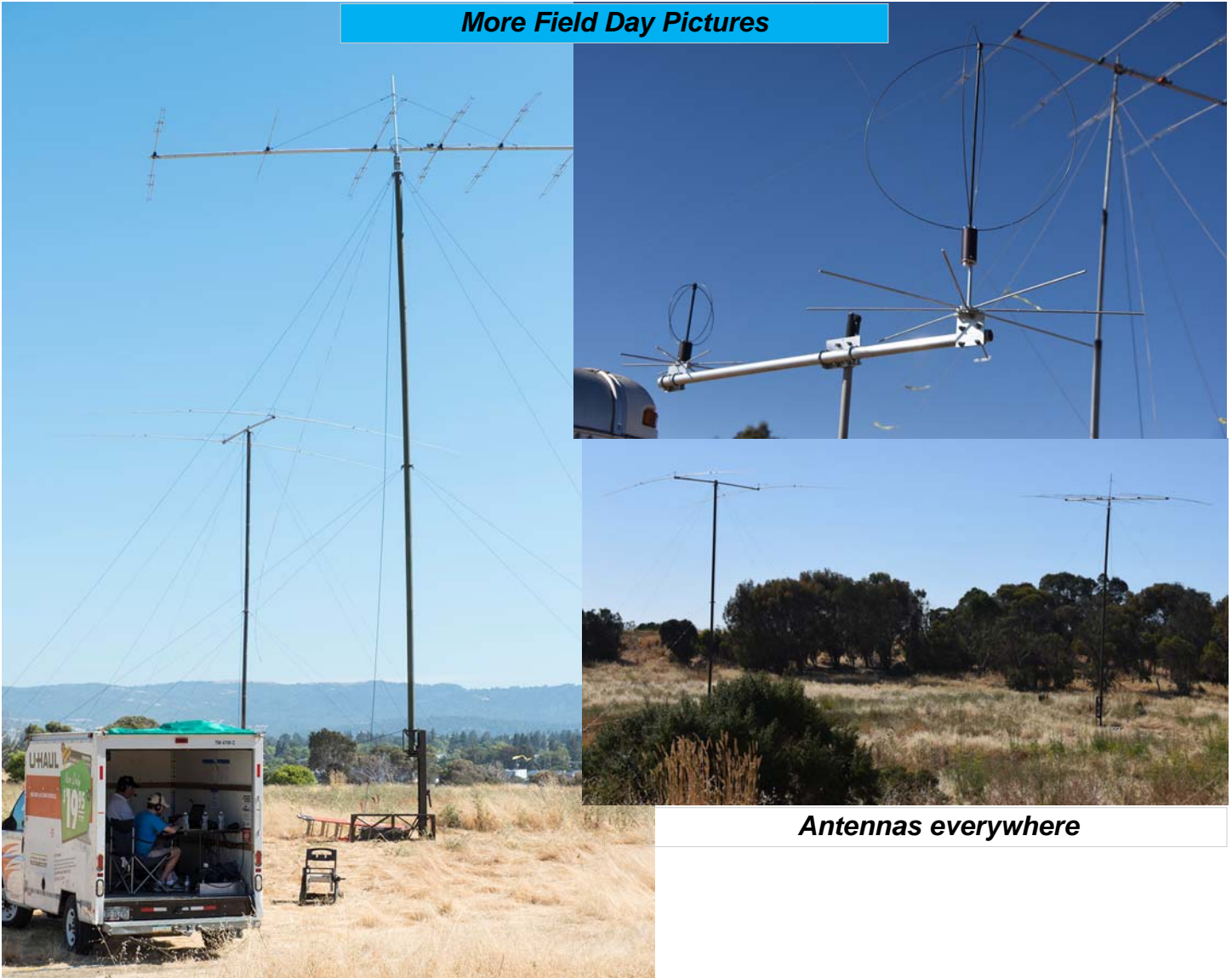
**Operators**



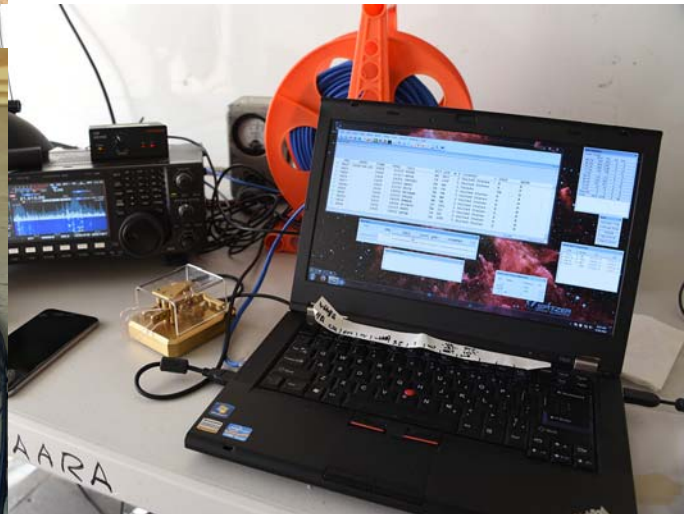
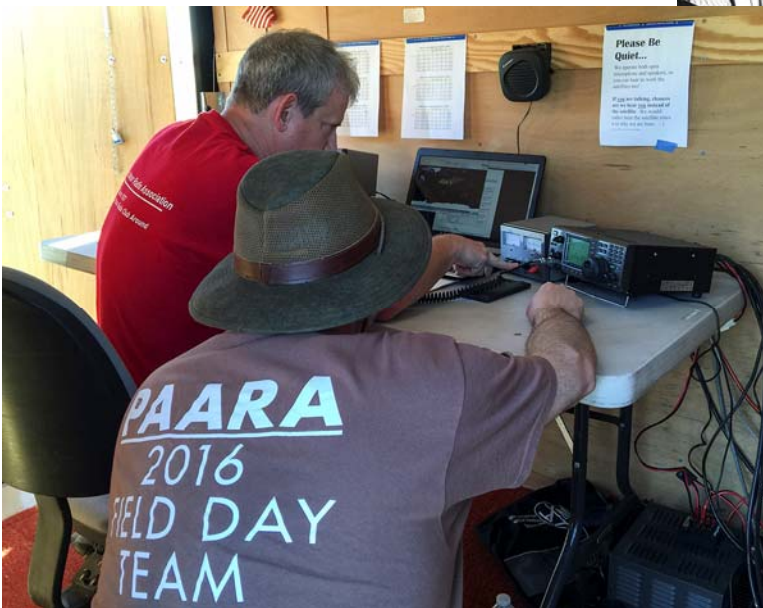
**GOTA Contacts**



**More Field Day Pictures**



**Antennas everywhere**



**Operators and Computer Logging**

### January 18, 2017 Board Meeting Minutes

The meeting was held at the home of Marty Wayne, W6NEV, commencing at 7:22 PM on January 18, 2017. In attendance were Kristen McIntyre, K6WX (Pres), Marty Wayne, W6NEV (VP), Jim Thielemann, K6SV (Secretary/Membership), Ron Chester, W6AZ (Treasurer) via teleconference, Larry Rebarchik, N6DB (Dir), Darryl Presley, KI6LDM (Dir), Walter Gyger K6WGY (Dir), and PAARA member Clark Martin, KK6ISP, (ASVARO Representative). A quorum was present.

Kristen, (K6WX), commented on how wonderful the January PAARA meeting was. “The meeting had the largest number of home brew projects I can ever remember being shown at a meeting”, she said. It was great to see the diversity in projects and the enthusiasm of the large number of attendees. The board agreed that the biggest hit was 12-year-old Roy Gross’s, KM6EOO, homemade remote controlled model of R2D2.

Kristen mentioned her reserve of stories is a bit better than last month. However, she only has a couple of stories for 2017. Please, if you’ve committed to a story but not submitted it (there are several people out there fitting this category) put pen to paper or fingers on the keyboard and let your creative juices flow! Do you have any projects, Field Day experiences, technical articles, hints n kinks, DX contacts, or experiences setting up your station or antenna, on the air experiences that might be of interest? If you have not previously drafted that story or have a new story, now is the time to get a byline of your own in PAARAgaphs and get that story submitted to Kristen for publication. “Remember it is ‘home grown’ stories that make PAARAgaphs great”, she said.

Vice President’s Report: Marty, W6NEV, announced Dr. Karl Kappler, the ‘Chief Scientist’ in charge of algorithm development at QuakeFinder a humanitarian research project on earthquake data collection, will be the February speaker. He also reported having a speaker lined up for April but none March or for the rest of the year. Please let Marty know if you know

of anyone who would be of interest to the club.

Marty commented that his efforts in identifying the next PAARA field trip have taken shape. He announced at the January general meeting the trip will be to the Western Railroad Museum in Rio Vista Junction on May 20, 2017. Tickets will be \$50/person which includes the bus trip both ways, admission, rides on whatever is operating that day and lunch. Information on the trip will be appearing in PAARAgaphs and on our web site. Information about the Museum can be found at: <http://www.wrm.org/>.

Secretary’s report: Jim, K6SV, reported that we have 205-members. Two new members joined at the January meeting. Currently there are 64 members who haven’t renewed for 2017. If you are one of them, you can renew via PayPal through our web site. Remember the dues are now \$25/year. The family member rate remains unchanged at \$6/year. If you don’t know when your membership expires, look at the mailing label on PAARAgaphs, next to your call sign is the expiration year of your membership.

Jim also mentioned that the club currently has roughly 3% of the members with no call signs, 15% technician licenses, 31% general licenses, 6% advanced licenses and 45% amateur extra licenses. Thus, the club is roughly split 50/50 between members holding general or lower licenses and those holding a license higher than general.

Treasurer’s Report: Ron, W6AZ, informed the board that the proceeds from the last month were on par for this time of year especially with it being membership renewal time. He also provided the board a draft of the P&L for 2016. The board discussed several areas of the report. One area had to do with advertising income. Through the discussion, the board realized no one was overseeing collecting advertising payments to PAARA. Walt, K6WGY, volunteered to take that on. Additional areas of discussion were the marked increase in meeting refreshments and printing costs. Through the discussions, and looking at past years, the board understands what the largest reason for

*(Minutes — Continued from page 5)*

the increased costs is. The main reason for the increases has to do with the larger membership and increases in meeting attendance which are both good “problems” to have. There have also been increases in the food costs as well as printing costs which contribute to the increased costs in these categories. The long and short of the review is the club had \$1,000 operating surplus, which was used along with some cash from reserves to purchase new repeater equipment.

#### **Under Old Business,**

Clark Martin, KK6ISP, (ASVARO Representative) advised the board on the ASVARO board meeting he attended earlier in the month. Clark provided information on the P&L that was presented at the meeting as well as other topics. The take away from the information was that nothing much is changing except the increase in fees clubs have to pay.

Marty reported on his progress in identifying a location for the PAARA banquet and the possible costs. Through Marty’s queries, it looks like Michel’s at Shoreline is in fact the most cost effective destination. All other suggested possibilities proved to be costlier. The most likely date still appears to be September 9th. The planning is still in the early stages. If you have any ideas on what you’d like to see for the event, let a board member know.

Darryl, KI6LDM, reported he created a “scraping” program to mine data on Bay Area hams who have either renewed or received their 1st licenses. Thus far, the number of transactions seems to be around 100/month. After some discussion on how to reduce the number of transactions, the count for new hams is more on the order of 10. He’ll be mining the data for a couple of months to see if December is representative of other months. The board also discussed developing the “message” we want on the card as well as creating a special web page. This is still a work in progress but it’s moving forward.

There are several other items on the agenda that haven’t been worked on very much or could

wait until the next meeting, thus at this point there is no new news on them.

#### **Under New Business:**

Walt, K6WGY, brought up the topic of “workshops” that could be conducted on a variety of topics. The board discussed the idea and commented that Field Day can be looked on as a big workshop. There are other smaller ideas of shorter duration than Field Day that could be done. If you’re interested in a workshop on a ham topic, mention it to any board member.

The Board meeting was adjourned at 9:15 PM.

Jim Thielemann  
 Secretary/membership  
 K6SV

#### **Please welcome to PAARA new members:**

Erik Gross	KM6EOP
Roy Gross	KM6EOO

*(President — Continued from page 1)*

and foremost is the safety of our own homes that can be affected by antennas and other radio relevant structures on our property. Lightning is “attracted” to the concentrated charge, and thus electric fields, at the sharp ends of antenna structures with high curvature. Our antennas usually have a path to the patch of earth beneath them, so they are of opposite polarity to the clouds above. The large electric potential over a short distance from the antenna to the clouds, makes the air molecules want to form a plasma. That plasma is the lightning that we see, and large currents and voltages can destroy not only our gear and parts of our home, but can cause fires from rapid heating. Please take appropriate precautions by providing a better, safer path to the earth for that current. There are many online resources to help you learn an appropriate way to do this. In addition, antennas are often suspended or lifted up into the air. High winds can stress those structures beyond their physical limits, or cause worn lines to break. It’s a good idea to check the security of your antenna systems when you know a storm is on the way, and to also check them periodically even when the weath-

*(Continued on page 7)*



(Magnetometer — Continued from page 1)

filter is applied to the variance time series. Event identification is done by flagging time intervals in the STA/LTA filtered time series which exceed a threshold. Flagged time intervals are subsequently fed into a feature extraction program which computes statistical properties of the resampled data. These features are then filtered using a Principal Component Analysis (PCA) based method to cluster similar events.

We explore the extent to which this approach categorizes pulses with known sources (e.g. cars, lightning, etc.) and the remaining pulses of unknown origin are analyzed with respect to their relationship with seismicity.

#### Bio

Originally from Winnipeg, Manitoba, Karl Kappler completed a B.Sc. in mathematics and physics from the University of Victoria, Canada, and MS and Ph. D. degrees in applied geophysics with an emphasis on signal processing from the University of California at Berkeley. He was a postdoctoral fellow at Lawrence Berkeley National Laboratory from 2008-2011, primarily working in electromagnetic methods applied to unexploded ordnance detection and classification problems. He has been a research geophysicist in mineral and oil-and gas applications working on topics ranging from field system development, to data acquisition, processing and interpretation as a consultant as well at SJ Geophysics in Vancouver, Canada and at GMI in San Diego California. Karl is currently Chief Scientist at QuakeFinder - a humanitarian research organization dedicated to earthquake forecasting based in Palo Alto CA. His main research interests are signal and noise separation and understanding noise sources in EM measurements.

(President — Continued from page 6)

er is good. Water incursion is also something to look for where feedlines traverse windows and walls. When you're done looking out for your own safety, then it's time to see if you can be of service to others in your neighborhood, whether this is through a local emergency services group, or just checking up on your neighbors.

The January PAARA annual Homebrew Night was one for the record books. I've never seen so much gear and so many people with fascinating things to show all of us. There was so much that I had to restrict everyone's time a bit so that we could fit it all in. It all worked out in the end, but what a wonderful display. Projects ranged from go-kit style power supply cases to tube transceivers built years ago, tiny oscilloscopes, an arc transmitter, and super-cheap QRP radios, antenna launchers. Our younger members showed home built DTV antennas, and finally an R2-D2 robot built from scratch! It was just wonderful. This is easily my favorite meeting of the year because of the creativity we can all see amongst our membership. Of course, you don't have to wait an entire year to show off one of these things. If you let me know in advance at any meeting, I'll make sure you get a few moments to show everyone some great new thing that you've built. You can see my pictures here: <https://k6wx.smugmug.com/Events/Homebrew-Night-2017/>

The FARS Winter Banquet just happened and was a well attended and fun event. Bob, KK6EK's talk about the VK0EK Heard Island DXpedition was fascinating (it was a penguin-style DXpedition), and it was great seeing all of my ham friends there. If you missed it this year, I hope you'll join us next year or at some future event. It's so fun getting together with everyone in a setting like that.

Speaking of getting together, I'll be at two ham-fests in February. I hope you'll join me. I'll be at the Palm Springs Hamfest (<http://almspringshamfest.com>) on the 4th, and the Yuma Hamfest (<http://www.yumahamfest.org>) 2/17 ~ 2/18. Later this year, we'll be having another PAARAtip where you can join us for more fun and adventure. Details coming soon, but keep your calendar clear for May. CU ON THE AIR DE K6WX



**PAARA 1/6/17 Raffle Prize Winners**  
 Left to Right

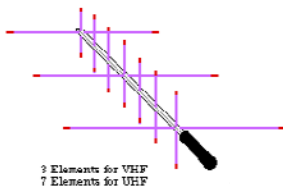
- 6th Will Hatzer / KM6EUV / MiniLog
- 5th Hiroki Kato / AH6CY / 40W Victorian Style Quad Loop Element Bulb
- 4th Dave Flack / W6DLF / ARRL Operating Manual
- 3rd Rachael Kinoshita / KK6DAC / Daiwa CS-201a / Two Position Coax Switch
- 1st Randy Silverman / K8TR / Tytera MD-380 / DMR Digital Portable HT
- 2nd Charles Garner / N6AF / Two Com Speakers
- Not Shown:
- 7th Henry Strickland / W6REK / Bongo Ties

**February Raffle Prizes**

1st Tytera MD-380 / DMR Digital Portable HT Operates in Analog and Digital Modes 5 Watt Output Uses Time-Division Multiple-Access Double # of Users Private Call / Group Call / All Call



2nd Arrow 2m Yagi Antenna 3 Element VHF 7 Element UHF Max Gain



3rd Lido LM801 EXP HT Cup Holder

4th Two FRS Radios

5th Headband Magnifier / 3 Separated Lens / LED Lighting

6th ARRL 2015-2016 Repeater Directory

7th Bondhus 7 Piece Allen Wrench Set

8th Keychain Light





## Palo Alto Amateur Radio Association, Inc.

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	n6db@arrl.net	
Director ('17) .....	Darryl Presley, K16LDM	650 255-2454
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	ab6so@smrn.com	
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	thielem@pacbell.net	
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	K6RDM@yahoo.com	
Public Affairs .....	<i>Position Vacant</i>	
Station Trustee W6OTX, K6YQT, W6ARA....	Gerry Tucker, N6NV	
Station Trustee K6OTA...	Ron Chester, W6AZ	
Property Manager .....	Gerry Tucker, N6NV	
Fund Raising Coordinator.	Bob Korte, KD6KYT	408 396 4745
	bob@rgktechsales.com	
Badge Coordinator .....	Doug Teter, KG6LWE	650-367-6200
	dteter@wvci.com	
Historian Position .....	<i>Position Vacant</i>	
Raffle Coordinator .....	Jim Rice, K6AK	650-851-2274
Field Day Coordinator ...	Doug Teter, KG6LWE	650-367-6200
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	ab6so@smrn.com	
Photographer.....	<i>Position Vacant</i>	

## VE Exams

Redwood City Main Library, Community Conference Room, 4th Saturday 10:30 am each month and De Anza Park, Sunnyvale, 2nd Saturday 10:30 am each month except November and December. See website for details and exceptions: <http://amateur-radio.org> or Contact Al, [WB6IMX@att.net](mailto:WB6IMX@att.net)

## Electronics Flea Market

Sponsorship by A.S.V.A.R.O. — Association of Silicon Valley Amateur Radio Organizations  
 Second Saturday of month, March-October, 6am-2pm  
 Howard M. Krawetz, N6HM 650-856-9761  
 Contact: <http://www.electronicfleamarket.com/>

## PAARA — Palo Alto Amateur Radio Association

Meets 1<sup>st</sup> Friday 7:00pm each month at Room H-6, Cubberley Community Center; Net 145.230 - PL 100Hz Mondays at 8:30. See our website at <http://www.paara.org> for more information or contact: Joel Wilhite KD6W, [KD6W@ARRL.NET](mailto:KD6W@ARRL.NET), 650-325-8239

## FARS — Foothills Amateur Radio Society

Meets 4<sup>th</sup> Friday each month at 7:30pm  
 Contact: <http://www.fars.k6va.org>

## NCDXC — Northern California DX Club

Meets 3<sup>rd</sup> Thursday 7:30pm each month,  
 Repeater for member info 147.360, Thursday 8:00PM  
 Contact: <http://ncdxc.org> or Mike Gavin W6WZ, (650) 851 8699

## QCWA Chapter 11

### Northern California Quarter Century Wireless Association

Meets third Wednesday monthly at Harry's Hofbrau in Redwood City @ 11:30 AM.  
 Guests are welcome. Saturday morning net on 146.850 MHz, PL 114.8

## 50 MHz & Up Group

Meets 1<sup>st</sup> Thursday each month at 7pm in the Texas Instruments Building E conference room in Santa Clara.  
 Contact: <http://50MhzandUp.org>

## SPECS

### Southern Peninsula Emergency Communication System

Meets each Monday 8:00pm on Net 145.27, 440.80 MHz  
 Contact: <http://specsnet.org> or Tom Cascone, KF6LWZ, 650-688-0441

## SCARES

### South County Amateur Radio Emergency Service

Meets 3<sup>rd</sup> Thursday 7:30pm each month, Belmont EOC, Belmont City Hall, One Twin Pines Lane, Belmont CA 94002. Net is on 146.445 [PL 114.8] & 444.50 (PL-100) 7:30 Monday evenings. Contact: President Gary D. Aden, K6GDA 650-743-1265 (D), 650- 595-5590 (N)  
 Web: <http://k6mpn.org> E-mail: [pres@k6mpn.org](mailto:pres@k6mpn.org)

## SCCARA

### Santa Clara County Amateur Radio Association

Operates W6UU & W6UU/R, repeater 146.985-pl  
 Nets: 2m, 7:30pm Mon; 70cm, 442.425+ (pl 107.2) Thur.  
 Meets 2<sup>nd</sup> Mon each month @ 7:30 PM.  
 Contact: <http://www.qsl.net/sccara> or Clark Murphy KE6KXO 408-262-9334  
 ARRL/VEC license testing contact 408-507-4698

## SVECS — Silicon Valley Emergency Communications

Operates AA6BT repeater (146.115 MHz+)  
 contact: <http://www.svecs.net> or Lou Stierer WA6QYS 408 241 7999

## TEARS — The Elmer Amateur Radio Society

Dedicated to operational training, knowledge building & FCC exam testing.  
 KV6R repeater under construction.  
 Contact: [AA6T@ARRL.NET](mailto:AA6T@ARRL.NET)  
 Most members are Extra Class or VE's. See QRZ dot com/kv6r for class info

## WVARA — West Valley Amateur Radio Association

W6PIY six-meter repeater on 52.58MHz. Normally, six-meters is linked with 147 and 223, while 441 and 1286 repeaters are linked.  
 VHF: 52.58 (-500) 151.4 ctcss UHF:  
           147.39 (+600) 151.4 ctcss           441.35 (+5.0) 88.5 ctcss  
           223.96 (+1.6) 156.7 ctcss           1286.20 (-12m) 100.0 ctcss  
 Meetings are 2nd Wednesday of every month except July, August and December.  
 Contact: <http://wvara.org>, Bill Ashby N6FFC, 408-267-3118, [president@wvara.org](mailto:president@wvara.org)

## American Red Cross, Santa Clara Valley Chapter

Contact: <http://santaclaravalley.redcross.org> or Scott Hensley KB6UOO, (408) 967 7924  
[shensley@Novell.com](mailto:shensley@Novell.com)

(Please send changes to [PAARAgaphs editor](mailto:PAARAgaphs editor))



**James Farrey**  
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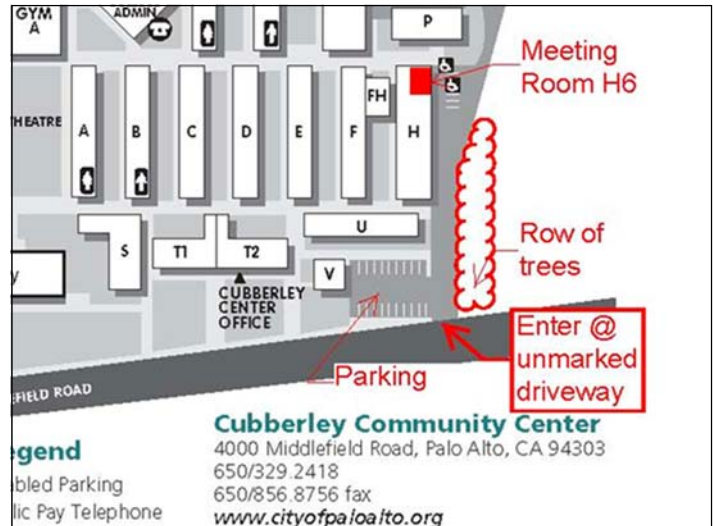
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## PAARA Weekly Radio Net

Info and Swap Session  
 every Monday evening at 8:30pm  
 on the N6NFI 145.230 MHz repeater

<u>Week</u>	<u>Control Operator</u>
1 <sup>st</sup>	Joel KD6W
2 <sup>nd</sup>	Doug - KG6LWE
3 <sup>rd</sup>	Jack - W1VSL
4 <sup>th</sup>	Rob - KC6TYD
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**Palo Alto Amateur Radio Association  
 P.O. Box 911, Menlo Park  
 California 94026-0911**

Club meetings are on the first Friday of each month,  
 7:00pm at the Room H-6, Cubberley Community Center.

Radio NET & Swap Session every Monday evening, at  
 8:30pm, on the 145.230 –600 MHz repeater, PL 100Hz.

Membership in PAARA is \$20.00 per calendar year,  
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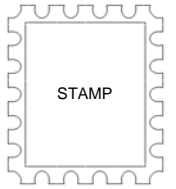
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PAARAgaphs Newsletter  
P.O. Box 911  
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