

PAARAgraphs



The Official Newsletter of the

Palo Alto Amateur Radio Association, Inc.Celebrating 79 years as an *active* amateur radio club—Since 1937<http://www.paara.org/>

November Speaker

Wave Gliders

Kurt Kiesow III, KF6QNC

The next talk is about autonomous wave powered vessels using PSK communication. The site for the commercial production of the Wave Glider is:

<https://www.liquid-robotics.com>

Upcoming Events

- Nov 4 PAARA General Meeting, 7:00 PM
- Dec 2 Cubberly Community Center, Room
- Jan 6 H-6, 400 Middlefield Rd, Palo Alto
- Nov 16 Board Meeting, 7:00 PM
- Dec 21 Everyone welcome!
- Jan 18 Location: Marty, W6NEV, QTH



President's Corner

November 2016

Another Pacificon is in the can, and I had a blast. I hope you did too. We managed to get a Special Event Station up and running, though it was not the usual big station. I had a very interesting meeting with the new ARRL CEO while I was there. And there's an election coming up, but it might not be the one you're thinking about. It's the same time as the next Dream To Reality Raffle.

I hope that you had some time to have the Pacificon experience on the 14th through the 16th of October in San Ramon. This year, I was there on Friday to help with the PAARA sponsored W1AW/6 Special Event Station. We had a

**Darryl KI6LDM with Boy Scouts**

bit of a scramble getting the station together this year, as our plans fell through. Still, even though it was most definitely a smaller and less capable operation than we've done in the past with Rick, N6DQ's help, we made something happen. A dedicated crew of PAARA volunteers brought up the Field Day tower trailer and mounted one of our FD KT-34 tribanders up there. The antenna crew added a 40m double bazooka to that, and that gave us enough to have one station. These antennas were put up in the rain by the skilled PAARA crew. I brought a radio and an amplifier (tube powered, of course!) and that was enough to get some fun started. Before I got set up, however, PAARA member Christopher, AI6KG, hooked up his radio as a temporary setup and was on the air. The SE Station was well attended and there were Boy Scouts lined up at several points working Jamboree On The Air stations. CONDX weren't great, but were good enough. Some DX was worked into Central America, as well as working back to the East Coast. Special thanks for the SE Station go to Darryl KI6LDM, Jim K6SV, Joel KD6W,

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Directional Coupler Basics

Gary Barnes

Most amateur radio operators know the antenna system should have a low Standing Wave Ratio (SWR) such as 1:1. Modern amateur radios have an output impedance of 50 ohms; therefore the antenna system should have an impedance of 50 ohms. Maximum power is transferred to the antenna from the transmitter when both impedances match.

A Standing Wave Ratio meter measures the ratio between the antenna and the 50 ohm system. The closer the ratio is to 1:1 the better the match and the greater the power supplied to the antenna. The problem with using a SWR meter is the transmitter has to be on and may cause interference with other radio operators, or potential transmitter damage.

An antenna analyzer can be used to make this measurement without using the transmitter. Unfortunately, an antenna analyzer's accuracy is not specified by most manufacturers who make amateur radio equipment. Therefore, the measurement accuracy is unknown. A vector network analyzer has enough accuracy but the cost to buy one is high.

This article discusses the use of a directional coupler to accurately measure the SWR of an antenna system. For the purposes of this test, the equipment required to measure SWR are: a directional coupler, a radio frequency signal generator and a radio frequency power meter. The RF signal generator's output power level is less than 1.0 milliwatt (0.001watts or 0.0 dBm).

Directional couplers come in two types: coaxial and waveguide, but they operate the same. The directional coupler has a thru line where the signal starts at one end and then ends at the other end at the load or output terminal (from terminal 1 to terminal 2). The auxiliary line will sample the signal in the main line (terminal 3). The amount of signal sampled is called the coupling factor, and this value is in decibels. A directional coupler with 20 dB of coupling will have about 1% of the signal exit the auxiliary line and 99% of signal exit the main line. A directional coupler with 30 dB of coupling will have about 0.1% of the signal exit the auxiliary line and 99.9% of signal exit the main line. When a directional coupler has a coupling factor of 3 dB, half the power will exit the main line and the other half will exit the auxiliary line.

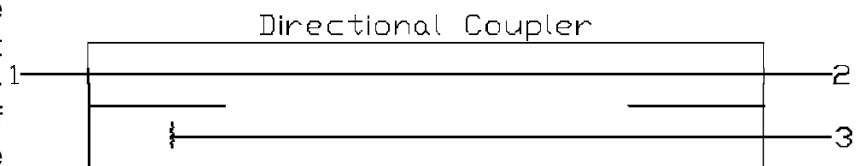


Figure 1

Another specification for the directional coupler is called directivity. This is the ratio of the forward signal to the reverse signal when the coupler is used to monitor the reflected power. This is used to measure return loss, and then SWR is calculated. The greater directivity of the directional coupler, the more accurate the measurement.

When the signal generator is connected to terminal 2, and a short is placed at terminal 1 and the power level in dBm is measured and recorded at terminal 3. Then the short is replaced with the load, and the power level in dBm is recorded again. The difference is the return loss in dB.

If you look down the main line of a waveguide directional coupler, you will notice a series of holes drilled between the main line and auxiliary line. Increasing the number of holes will cause an increase in the coupling to the auxiliary line. The load on the auxiliary line is factory selected for the best performance of the directional coupler. The coaxial directional coupler's coupling factor is controlled by the distance between the main line and auxiliary line, and auxiliary line's length. The load

(Coupler — Continued from page 2)

resistance is factory selected for the best performance.

A second auxiliary line can be added to the directional coupler. One will monitor the forward power or incident power and the second one will monitor the reverse power or reflected power.

Both auxiliary line loads are factory selected for best performance. The main line is terminals 1 and 2, while terminal 3 will provide the forward power level and terminal 4 will provide the reverse power level or reflected power.

Picture 1 shows a Hewlett Packard 778D Dual Directional Coupler. It has a frequency range from 100 Megahertz to 2000 Megahertz. The coupling factor is 20 dB and the directivity is 36 dB to 1000 Megahertz and 32 dB to 2000 Megahertz. A signal generator is connected to the type N(m) terminal on the left side and the load to be tested is connected to the type N(f) terminal on the right side. The input power is monitored at the upper-left terminal and the reflected power is monitored at the lower-left terminal.

Picture 2 shows a Hewlett Packard X785D Waveguide Directional Coupler. It has a frequency range from 8.2 Gigahertz to 12.4 Gigahertz (the X band). The coupling factor is 20 dB and the directivity is 40 dB. A signal generator is connected to the terminal on the left side and the load to be tested is connected to the terminal on the right side. The reflected power is monitored at the lower-left terminal.

The above directional couplers are for low level testing and not for transmitters. This waveguide directional coupler can only handle a maximum power of 1-watt. However, high power directional couplers are available.

The following is an example of a test for SWR for a 2-meter mobile antenna. The equipment I used was an Agilent radio frequency signal generator, Hewlett Packard power meter with dual inputs and with two power sensors, and a Hewlett Packard 778D Dual Directional Coupler. My directional coupler has two ports, with one port for forward power and the other port for reflected power. I connected a power sensor to each port of the directional coupler so I could measure both forward and reverse power to improve measurement accuracy.

I used two power sensors to improve return loss accuracy measurement. I used model 8484A power sensors which have a frequency range of 10 Megahertz to 18 Gigahertz, and a power range of -70 dBm to -20 dBm (0.1 nanowatts to 10 microwatts). I had the equipment on for at least 30

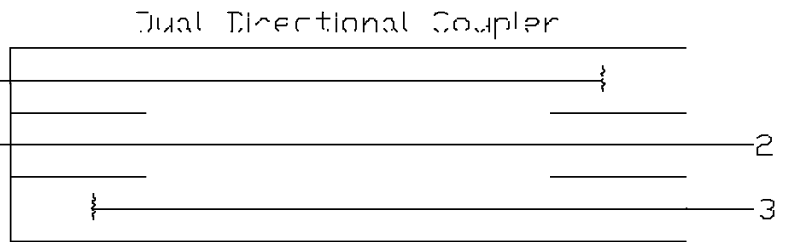


Figure 2



Picture 1



Picture 2

(Coupler — Continued on page 4)

(Coupler — Continued from page 3)

minutes, and then I zeroed and calibrated the power sensors per the owner’s manual. I connected the equipment as shown in Figure 3. Next, I recorded the data for each test point or frequency. The signal generator’s output was set to -3 dBm to provide the greatest power range for the power sensors without overloading them.

After the power sensors were zeroed and calibrated, I connect them to the directional coupler. With a type N(m) short connected to the directional coupler, set the RF signal generator to the first test frequency and record the power meter indications in dBm. Then change the RF signal generator to the next test frequency and record the power meter indications in dBm, and repeat this procedure for each test point.

I replaced the type N(m) short with the antenna to be tested. Then I set the RF signal generator to the first test frequency and recorded the power meter indications in dBm for each test point.

I subtracted the shorted reading from the load reading. The difference of the forward port level (shorted and load) should be zero dB. This difference is added to the return loss.

To obtain the return loss, I subtracted the shorted reading from the load reading. The table below has the results of the testing of the MFJ’s 2-meter antenna.

The chart is a plot of the VSWR vs. frequency of the above data.

The MFJ 2-meter antenna has a good SWR response for a magnetic mount.

Every antenna system should be checked for SWR on a regular basis once or twice a year. The new

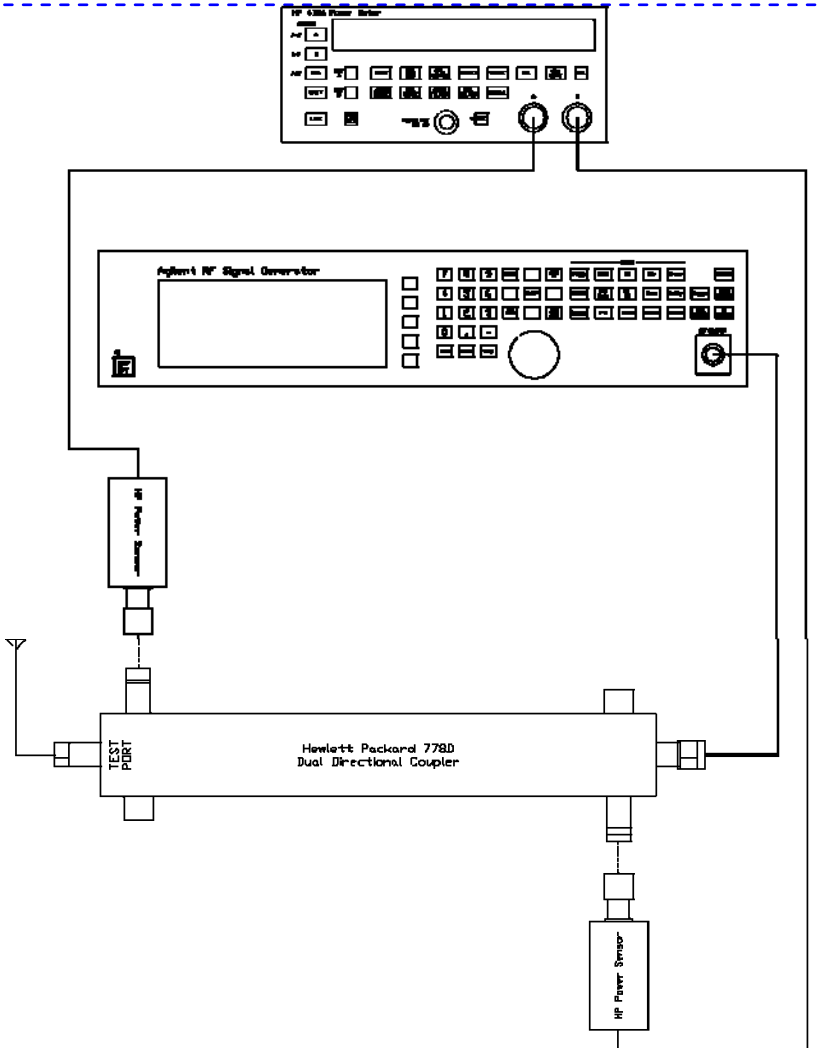
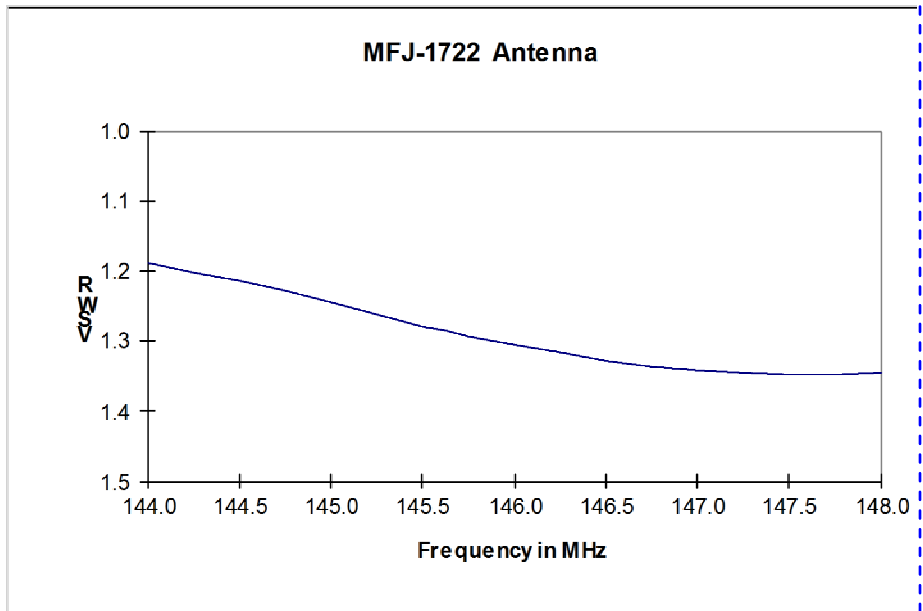


Figure 3 Antenna Test Setup



VSWR vs Freq for the MFJ-1722 Antenna

(Coupler — Continued on page 5)

(Coupler — Continued from page 4)

test results should be compared to the initial readings. If the SWR changes between measurements, the antenna should be thoroughly examined and the problem(s) corrected.

Test	Forward Port Level	Reflected Port Level	Return	Reflec- tion	Loss	Coeffi- cient	
Frequency	Shorted	Load	Shorted	Load			
(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)	(rho)	VSWR
144.0	-23.30	-23.29	-23.63	-44.86	21.24	0.0867	1.190
144.5	-23.29	-23.27	-23.61	-43.84	20.25	0.0972	1.215
145.0	-23.25	-23.26	-23.59	-42.86	19.26	0.1089	1.244
145.5	-23.24	-23.24	-23.57	-41.82	18.25	0.1223	1.279
146.0	-23.22	-23.23	-23.55	-41.12	17.56	0.1324	1.305
146.5	-23.21	-23.21	-23.53	-40.57	17.04	0.1406	1.327
147.0	-23.19	-23.20	-23.51	-40.26	16.74	0.1455	1.341
147.5	-23.16	-23.19	-23.49	-40.14	16.62	0.1476	1.346
148.0	-23.14	-23.16	-23.47	-40.18	16.69	0.1464	1.343

$$\text{Return Loss} = \text{Power}_{\text{Shorted}} - \text{Power}_{\text{Load}}$$

$$\rho = 1/10^{(\text{return loss}/20)}$$

$$\text{VSWR} = (1+\rho)/(1-\rho)$$

VSWR is Voltage Standing Wave Ratio

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Marty W6NEV, Dave K6WA, and Christopher AI6KG. In addition, the Mount Diablo Amateur Radio Club gave us great support. In particular, Patrick Miller, KK6DBX, was there to support us and keep an eye on the equipment during the night on Friday. Lastly, I wanted to thank Misa Siemons, KJ6BUE, Pacificon Chair who helped us coordinate this last minute effort. If you helped out and I forgot to mention you, be sure to let me know and I'll include you next month. It's just my faulty memory :).

Of course, there were other things going on at Pacificon too. There were many great talks and lots of vendors to see. I made several rounds of the vendor halls and got a chance to chat with some of the people whom I see there each year. There was some time to chat with Wayne and Eric from Elecraft and ask about the

KX2. While I was saying hello to Eric, I was able to find our November speaker at the Elecraft booth. I think you'll enjoy this talk. I also ran into people I get to see but once a year. I'd love to see them more often, but we are all busy and sometimes this is the only chance. The highlight for me, though, was spending an extended period of time one-on-one talking with Tom, NY2RF, the new ARRL CEO. Tom has some great ideas for reinvigorating our beloved hobby and strengthening the ARRL as an organization. We discussed at length some of my ideas for how to do that, as well as some future projects where I might help that effort. I'm really excited by the prospect of pushing Amateur Radio forward into the future for the next century. Some of these future plans may involve PAARA too, so keep a sharp eye.

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Ignore that other election. The election for the 2017 PAARA Leadership Team is reaching a fever pitch! We have a preliminary slate of candidates. Nominations are open until the end of the November general meeting, and then we are ready to rumble. If you want to vote in the ever-contentious PAARA election, be sure your membership is current for 2016 (not 2017, though we'd love your renewal as well). At the election meeting in December, we will be raffling off another KX3! Be there or be square.

That's it for now. The possibly final PAARASHOOT / PAARAPLINK will have happened by the time you read this. I'm sure it will be a great time for all. I'll take lots of pictures. CU AT CUBBERLY IN NOV DE K6WX

Kristen

Oct 2016 Board Meeting Minutes

The meeting was held at the home of Marty Wayne, W6NEV, commencing at 7:28 PM on October 19, 2016. In attendance were Kristen McIntyre, K6WX (Pres), Marty Wayne, W6NEV (VP), Jim Thielemann, K6SV (Secretary/Membership), Ron Chester, W6AZ (Treasurer) [via videoconference], Larry Rebarchik, N6DB (Dir), Darryl Presley, KI6LDM (Dir), and non-Board Member Doug Teter, KG6LWE (Field Day Coordinator), Joel Wilhite, KD6W (Technical Coordinator), and Clark Martin, KK6ISP, (ASVARO Representative). A quorum was present.

Kristen, (K6WX), commented on how many MDARC members came up to thank her and PAARA for pulling the special event station together. These comments were the result of having to completely change the plans, 3 weeks before Pacificon, that had been in the works for the last 10 months for the W1AW/6 special event station. Several comments were received by other members of the team that put the station together as to what a great club PAARA is. The board thanked the PAARA members who stepped up to assist in the effort

and several members of MDARC who also assisted. Without this effort there wouldn't have been a station. Jim, K6SV, mentioned receiving a comment regarding the special event station and not knowing what it was from the outside. After a short discussion, the board voted to purchase a banner the size of the PAARA banner with "Amateur Radio Special Event Station" or something like that on it. Marty will put something together for the board to review via email.

Kristen requested we all put on our thinking caps to come up with some new raffle prize ideas for the monthly meetings. If you have any ideas, let a member of the board or Jim Rice, K6AK raffle coordinator, know. The board also had a conversation regarding the upcoming Dream to Reality raffle in December. That conversation resulted in the board voting to raffle off an Elecraft KX3 with both the antenna tuner option and the 2M option along with the microphone and antenna adapters. So, it's time to start saving those pennies for The Dream to Reality Raffle in December.

Kristen also mentioned, though receiving a couple of new stories her reserve of stories is still thin thus is on the lookout for more stories. If you have committed to a story but not submitted it (there are several people out there fitting this category) please 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 that the November meeting speaker is Kurt Kiesow III, KF6QNC, who will be talking about autonomous wave powered vessels that

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use PSK to report their findings. He also reported to having speakers lined up through February. Very positive comments were made regarding last month's speaker Mike Wimble, KM6WP who talked about "His Journey into the field of Robots" at the October meeting. All who attended were very engaged in the presentation. Marty also commented on his current efforts at identifying the next PAARA field trip. A suggestion was given to Marty as a result of Pacificon. He'll be pursuing this lead so stay tuned. As always, let Marty know if you have any ideas for the next trip.

Marty provided the board with a T-shirt count. The board decided to donate the remaining Field Day 2012 shirts to the raffle. Marty will be checking with the T-shirt company on the current costs for producing more club shirts as the inventory is low or out in a couple of popular sizes. Should anyone be interested in one of the sizes which are out of stock, Marty will take their information down so they can be contacted once the desired size is back in stock.

Secretary's report: Jim, K6SV, reported that there are currently 194 PAARA members, the most since he's been keeping track. It's wonderful to see the increase to the membership. He also reported that there were 3 new members joining in October.

He again broached the touchy subject that the dues aren't covering the printing and mailing of PAARAgaphs any longer. The board discussed the options and timing of any change to the dues. Reluctantly, the board voted to increase the membership dues to \$25/year starting January 1, 2017. The family member rate will remain unchanged at \$6/year. If you plan on renewing for next year, renew before December 31st to take advantage of the current rate. Remember that you can renew at a meeting or at any time using PayPal though the PAARA web site.

Treasurer's Report: Ron, W6AZ, informed the board of the proceeds from the last month was

on par for this time of year.

Under Old Business,

Kristen reminded the board that it's election time. Clark Martin, KK6ISP, was named election chair at the October meeting. Clark reported that; Kristen, Marty, Jim, Ron, Rebar, and Darrel have agreed to run again. He also reported that Joel, KD6W, and Walt, K6WGY, have also thrown their hats into the ring. Now is the time to indicate your interest in a board or director position in your club. Election nominations close at the end of the November meeting.

The topic of ASVARO and the Flea Market was discussed again. There were a wide range of items discussed but boiled down to this year being the least profitable Flea Market for PAARA ever. Clark, KK6ISP, provided information on various subjects during the conversation. Kristen provided an article from "Nuts & Volts" entitled "Are Electronic Flea Markets a thing of the Past". It was by an author in SoCal. After considerable discussion, it was agreed that Clark would reach out to the other ASVARO member clubs to see what they are thinking regarding the current situation with the possible idea of calling a meeting to discuss the future of the Flea Market.

The inventory of PAARA "stuff" which is located at various members QTH's is continuing topic. No one really has a handle on exactly what "stuff" is in inventory, who is in possession of what equipment or what condition the equipment might be in. The task of creating a list of the inventory is in process but far from complete. Various storage options and potential costs were discussed but we don't know how much space is needed. Thus, the storage topic is tabled for now pending more information on the amount of space needed. Jim, K6SV, agreed to get with Gerry, N6NV, to get an idea on the breadth and condition of the equipment he has. This topic continues to be a work in progress.

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Kristen firmed up the next PAARApLink is scheduled for October 30th from 9AM ~ 4PM. It's more than likely it will be the last one due to the gun law changes that go into effect in January. If you ever wanted to be part of this event, plan to attend now or miss out. Logistics of the event were discussed as well as how lunch would be handled. Hamburgers are again the lunchtime fare. Members to help clean up at the end would be greatly appreciated.

Under New Business:

With the resignation of Rob Riley, KI6INR, from the board, that also left open the position of QSL Manager. Kristen appointed Marty to cover that position. The board voted in favor of the appointment. The board also thanked Rob for his service to PAARA as director, coffee steward, GOTA captain, and QSL manager over the years and wish him the best.

Kristen mentioned her meeting during Pacificon with Tom Gallagher, NY6RF, the CEO of ARRL. They discussed the various areas of the league that Tom is looking at updating or changing. Some of the changes were mentioned in Tom's talk at the Pacificon Banquet. They also discussed the possibility of Kristen writing a book and professionally recording some of her seminar talks.

The Board meeting was adjourned at 9:21 PM.

Jim Thielemann
 Secretary/membership
 K6SV

Please welcome to PAARA:

New members:

Jacob Tarrío-Barreiro	KK6RKA,
Will Hatzer	KM6EUV,
Ken Lino	AG6YL.



October Raffle Winners

Come to the Meeting to see November's Raffle Prizes

Palo Alto Amateur Radio Association, Inc.

PO Box 911 Menlo Park, CA 94026

Officers

President	Kristen McIntyre, K6WX	510-703-4942
	kristen@alum.mit.edu	
Vice President	Marty Wayne, W6NEV	408-246-7531
	mcwayne2@comcast.net	
Secretary	Jim Thielemann, K6SV	408-839-6815
	thielem@pacbell.net	
Treasurer	Ron Chester, W6AZ	408-243 2221
	ron@taxhelp.com	

Directors

Director ('15-'16)	Byron Beck N6UOB	408-369-1913
	N6uob@arrl.net	
Director ('16-'17)	Open	
Director ('16).....	Larry Rebarchik N6DB	650 465-8210 (c)
	n6db@arrl.net	
Director ('16).....	Darryl Presley, K16LDM	650 255-2454
	k16ldm@arrl.net	

Appointed Positions

Membership.....	Vic Black, AB6SO	650-366 0636
	ab6so@smrn.com	
Database.....	Jim Thielemann, K6SV	408-839-6815
	thielem@pacbell.net	
Chaplain	Rick Melrose K6RDM	408-341-9070
	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@wcwi.com	
Historian Position	<i>Position Vacant</i>	
Raffle Coordinator	Jim Rice, K6AK	650-851-2274
Field Day Coordinator ...	Doug Teter, KG6LWE	650-367-6200
ASVARO Rep.....	Clark Martin, K6ISP	
	kk6isp@comcast.net	
Webmaster	John Miller K6MM	
	webaron@gmail.com	
Technical Coordinator ...	Joel Wilhite, KD6W	408-839-5948
	kd6w@arrl.net	
QSL Manager.....	Marty Wayne, W6NEV	408-246-7531
Speaker Coordinator	Marty Wayne, W6NEV	408-246-7531

PAARAgaphs Staff

Editorial Board		
	Bob Van Tuyl K6RWY	Kristen McIntyre K6WX
	Ron Chester W6AZ	Vic Black AB6SO
	Joel Wilhite, KD6W	
Editor	Bob Van Tuyl, K6RWY	408 799-6463
	rrvt@swde.com	
Back Up Editor	Jim Thielemann, K6SV	408-839-6815
	thielem@pacbell.net	
Advertising.....	Ron Chester, W6AZ	408-243-2221
	ron@taxhelp.com	
Member Profiles	Diana Lloyd, K6YGM	650-988-8882
	dianalloyd76@gmail.com	
Technical Tips	Vic Black, AB6SO	650-366 0636
	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

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 1st 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, 650-325-8239

FARS — Foothills Amateur Radio Society

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

NCDXC — Northern California DX Club

Meets 3rd 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 1st 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 3rd 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

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 2nd 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
 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

American Red Cross, Santa Clara Valley Chapter

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

(Please send changes to [PAARAgaphs editor](#))



James Farrey
 Sales Manager

James Electronics Ltd
 1355 Shoreway Road, Belmont, CA 94002
 Tel: 650•592•6718 x 350 Fax: 650•802•1520
 Direct: 650•802•1511 jfarrey@jameco.com

www.jameco.com

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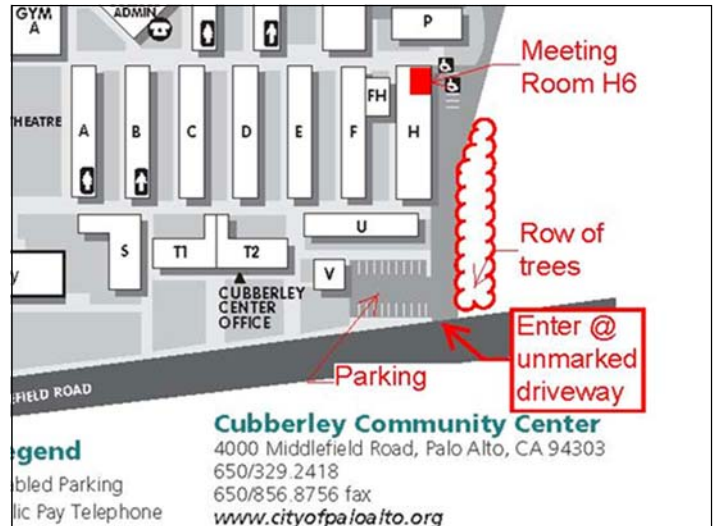
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PAARA Weekly Radio Net

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 st	Joel KD6W
2 nd	Doug - KG6LWE
3 rd	Jack - W1VSL
4 th	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
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Membership in PAARA is \$20.00 per calendar year,
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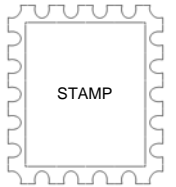
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PAARAgaphs — November 2016

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 PAARAgaphs Newsletter
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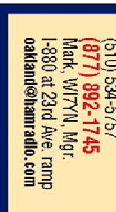
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- 50W/100W/100W/100W
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