

# PAARAgraphs



The Official Newsletter of the

**Palo Alto Amateur Radio Association, Inc.**Celebrating 81 years as an *active* amateur radio club—*Since 1937*<http://www.paara.org/>

The speaker at the June 1st meeting is:

## Rogelio Bernal Andreo

In this talk, Rogelio will navigate through his own experiences as a deep-sky and nightscape astrophotographer, and how he took a discipline that was mostly driven by scientific goals and transformed it into an art where one can craft their own personal style while still respecting the science of it, where curiosity and inspiration become the driving force and where storytelling is just as important, all accompanied by many of his unrivaled and gorgeous images of our night sky.

### BIO:

Born in 1969 in Murcia, Spain, Rogelio moved to the US when he was 20. He earned his Bachelor's Degree in Computer Science from Harvard University and the Wentworth Institute of Technology in 1995. After earning his bachelor's degree, Rogelio moved to the SFO bay Area where he has worked for Netscape Communications and eBay as a lead software engineer.

In 2008, Rogelio began exploring astrophotography as a hobby and has developed a personal style defined by deep widefield images. His photography had led to international recognition and developed a meaningful influence on the astrophotography discipline. His work has appeared in several Science and astronomy publications including, *Astronomy Magazine*, *Ciel et Espace*, *Sky and Telescope*, and *National Geographic*. Rogelio's work has also been televised on BBC, *National Geographic*, the Discovery Channel and others.

His image, "Orion, from Head to Toes" was selected by *Discover Magazine's* Bad Astronomy, as the best astronomy picture of 2010. It was the first time this award was given to an amateur astronomer. He has won many awards including Astronomy Photographer of the Year several times

## Upcoming Events

June 1 July 6 August 3	PAARA General Meeting, 7:00 PM Cubberly Community Center, Room H-6, 4000 Middlefield Rd, Palo Alto
June 20 July 18 August 15	Board Meeting, 7:00 PM Everyone welcome! Location: Marty, W6NEV, QTH 
June 23-24	Field Day begins at 11am PDT Sat and runs to 11am Sun

## President's Corner

June 2018

Greetings from Dayton and the Hamvention in Xenia, OH. More on that in a moment. It's also June, and that means that Field Day 2018 is upon us. We are also about to go on the Intel Museum tour.



The Dayton Hamvention has just wrapped. I'm in my hotel room, getting ready to go to bed early so that I can make my flight at 8:50am tomorrow. It's been an amazing experience. I arrived here from another conference in Grapevine, TX, so the flight wasn't as long as it could be, but I did get in late at night on Thursday. It was, of course, raining, and it was raining very hard. Apparently, this is their monsoon season. Friday came with more rain as I drove to Xenia, about 25 minutes from downtown Dayton. The drive wound through farms and finally a big grassy field where I parked my car. The rain was down to a few sprinkles at that point as I walked to the main gate. From the sea of cars, I suddenly saw a tribander, and then a hexbeam, and then more and more antennas. This was it, the greatest ham radio show on

*(President — Continued on page 4)*

## The Future of Radio

I was drawn to amateur radio by the technical and tinkering aspects of the hobby. As a relatively new ham, I would like to share my perspective on how amateur radio is likely to evolve in the coming years.

As a child, I enjoyed reading *The Boys' First Book of Radio and Electronics*. But even then, in the 1980s, the book was out of date. It was published in 1954, in an era when radios were built using vacuum tubes. I found the information fascinating, but it was no longer practical for me to build a radio from vacuum tubes.

My first working radio was made with a Radio Shack 100-in-1 Electronic Project Kit. I was able to receive AM broadcast radio and even transmit over short distances. As I rode around town in the back of my father's 1978 Oldsmobile, my voice would spring to life from nearby AM receivers, much to the surprise and annoyance of drivers and passengers in the cars around us. These simple projects are still a useful introduction to radio, but they are far less exciting in the age of cell phones and the internet.

Decades have passed and I am now a ham but gone are the days of Heathkit and Radio Shack. It's difficult to find (and expensive to buy) high quality radio kits that can be built from discrete components. And while it's still possible to build a radio from basic electronic components, the results are no longer competitive with cheap off-the-shelf units. The few kits that are competitive are made from complex prebuilt plug-n-play modules that do little to teach the art of radio from first principles.

So how, in the first quarter of the twenty-first century, do we keep the technical art of radio alive and further increase its relevance? This question goes beyond rhetoric. To retain our tenuous claim to highly valuable portions of the radio spectrum, we need to do more than talk on the air. We need to innovate and contribute to the advancement of the radio art.

Initially, radio components were spark gaps, then vacuum tubes, then solid state discrete elements, then integrated circuits. Today, electronic components have advanced to the point that full computers, complete with memory and multiple peripherals, are available as individual components for a dollar or two.

So what are the relevant components for the

modern radio hobbyist? I would argue that today, the most important and relevant components are software. The hardware necessary for radio can be kept simple and fixed, while limitless innovation can take place in software.

If requiring a computer to build a basic radio concerns your inner survivalist, consider for a moment the ubiquity of portable computing devices and the much lower availability of soldering stations and through-hole parts. If disaster strikes and you need to MacGyver a radio from salvaged parts, it may be faster and easier to build it from software than to reclaim and reuse the surface-mounted discrete components found in modern electronic devices.

To test this theory, I attempted to build a software radio from parts that were already in my home:

- Computer: Windows 10 laptop
- Language: Python + numpy (for math) + pygame (for audio and graphics)
- Receiver: RTL-SDR (\$25)
- Antenna: homebrew dihedral wire antenna (resonant at 2m)

For those who are interested, the technical details are described in the sidebar.

My personal experiment with building a software radio from minimal components was a great success. Working from first principles, I was able to capture, visualize, heterodyne, filter, detect, decode, play and display broadcast FM radio and associated digital data from a raw stream of I/Q samples with around 10-15 hours of effort. By processing every sample myself, I learned a great deal about how radio works at an intimate level and I built a toolbox of simple software components that can be reused in other projects.

I would like to end with a call to action. We should encourage the further development of simple and inexpensive direct sampling transceivers as well as books and articles on making radios from software so that we, as radio amateurs, can build and share full-featured software radios that will communicate in a wide variety of old and new analog and digital modes in narrow bands, spread spectrum and across multiple amateur bands. If we pursue this path, I'm confident new generations of innovators will become inspired and the greatest achievements of Amateur Radio will, as always, lie ahead.

Gary Snethen W6ARY

*(Future of Radio—Continued on page 3)*

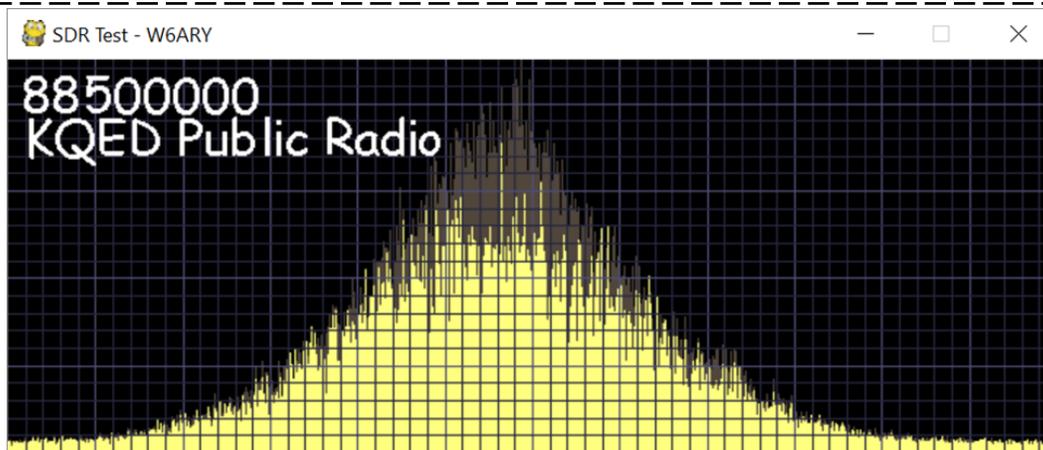
(Future of Radio—Continued from page 2)

### The Future of Radio Technical Details

The program I wrote connects via TCP/IP to a free program called `rtl_tcp`, which accepts simple commands and controls the RTL-SDR hardware. This made it simple to access the hardware from Python and allowed me to optionally connect the RTL-SDR to my desktop PC and use it remotely from my laptop.

The data arrives from the TCP/IP connection as pairs of bytes, one for I and the next for Q. Taken as a pair, each I/Q pair represents a single complex-valued sample point. Python and numpy handle complex numbers as a basic type, so the program first converts the incoming I/Q stream into a stream of floating-point complex numbers.

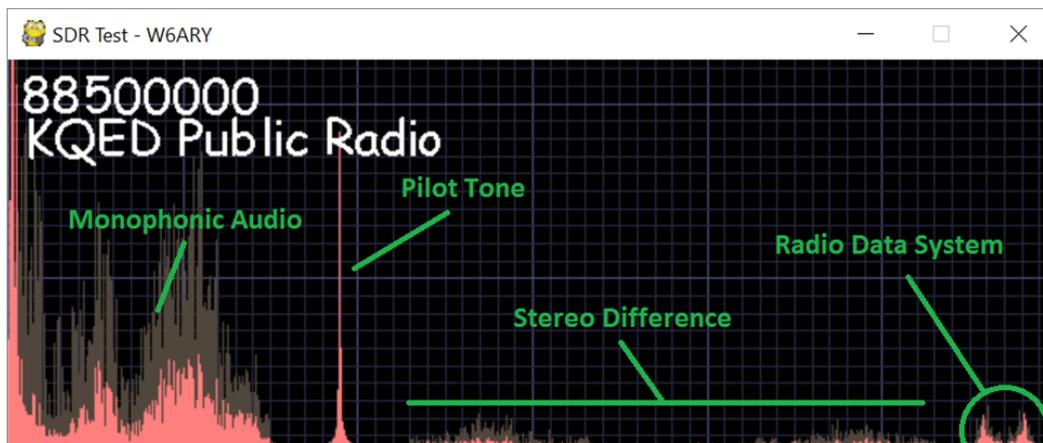
A contiguous block of 2048 complex samples is periodically pulled from the stream and passed to numpy's FFT function. This produces a 2048-sample block of spectrum data, which is then rendered to the screen to visualize the RF spectrum:



The above RF signal is KQED, 88.5 MHz, chosen for the strength and consistency of the signal here in the Bay Area. To demodulate this FM signal into audio, the stream of complex samples is first converted to a stream of real-valued phases by running each complex number through numpy's `arctan2` function. The derivative of this phase stream is then calculated by subtracting each sample from its neighbor. The resulting stream of real-valued samples is the unfiltered audio frequency stream.

The audio spectrum visualization is created by passing a 2048-sample block of the audio frequency stream through the FFT function. In the case of audio, the input is real-valued and this results in the spectrum being mirrored about a frequency of zero. To avoid redundancy, only one-half of the resulting FFT data is used for the visualization.

(Future of Radio—Continued on page 4)

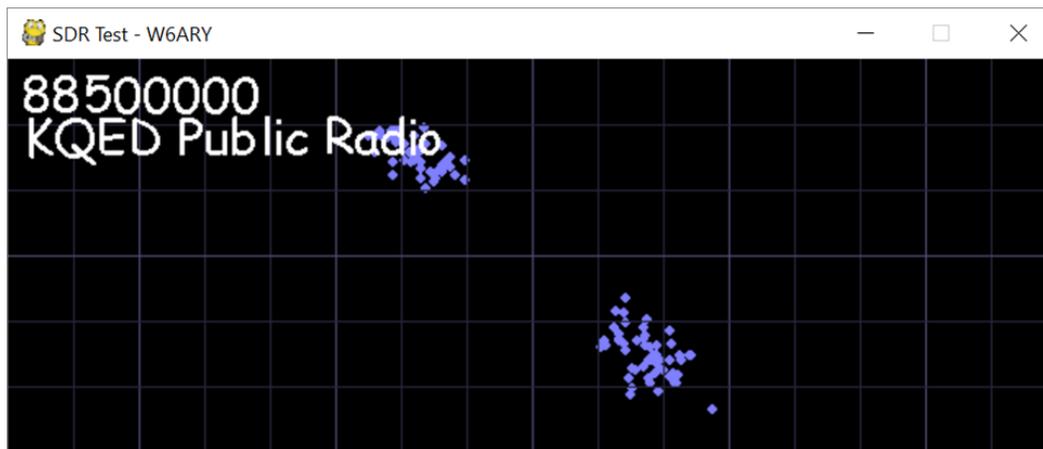


*(Future of Radio—Continued from page 3)*

As shown in the figure on page 3, the audio spectrum contains more than simple audio. A monophonic audio signal is located at 0-15 kHz. This is the sum of the left and right stereo channels, L+R. It was designed this way for backwards compatibility with old monophonic radios.

At 19 kHz, there is a constant sinusoidal pilot tone. This tone is used as the base frequency for accurately decoding the stereophonic signal. Next is the stereophonic signal itself, which is centered at 38 kHz, precisely twice the frequency of the pilot tone. This stereophonic signal is L-R, the right channel subtracted from the left channel. To decode the left channel, the L-R signal is added to L+R monophonic signal and the result is attenuated by half, resulting in L. To decode the right channel, the L-R signal is subtracted from L+R and the result is attenuated by half, resulting in R.

At the far right of the audio spectrum are two bumps centered around 57 kHz, which is three times the frequency of the pilot tone. This is the Radio Data System signal, a low bandwidth digital data stream which contains the station identification, basic program information and other information. This data is encoded using binary phase-shift keying (BPSK). The program decodes this by taking I/Q samples of the audio signal at a rate of 57 kHz and extracting the phase of each I/Q sample. If the phase remains constant between adjacent BPSK blocks, it represents a zero bit. If the phase inverts, it represents a one bit. A simple constellation chart is generated by rendering each complex sample on the complex plane:



The RDS bit stream is comprised of groups of 104 bits. The proper framing of each group is determined by looking for the encoded station ID, which is a sequence of bits that remains the same in every block. The program then decodes the text blocks, which contain programming information inserted by the broadcaster. In the above figure, the text "KQED Public Radio" is RDS text data that is being extracted from the BPSK signal. This same RDS text is decoded and displayed when listening to analog FM stations in many newer cars.

*(President — Continued from page 1)*

earth. Inside the gate the place was full of people. I later heard that about 25,000 people attend Hamvention each year. It seemed like that was true. I took a look around but made straight for the flea market area. I wanted to find the IOOK Technology Center, and all of my fellow IOOK Vice Presidents. Of course, it was the last row I walked, and I had mud all over my shoes by that time. They were very surprised to see me since I didn't tell them I'd be there.

After greetings all around, I headed toward the exhibits and eventually the ARRL booth. I had a quick lunch and sat next to the only ham operator in Mozambique,

Johannes, C93PA. Who knew! The exhibits were calling to me, so I finished my lunch quickly. Just before I got to the booth, I stopped by the JARL booth and saw Masa, JR1AQN, who was operating FT8 at Pacificon, and Ken JA1CJP, who processes license applications for JA. It was great to see them. At the ARRL booth, I said hi to ARRL president Rick, K5UR, and several of the board members. I also met Bob Vallio, W6RGG, and our Pacific Division Director Jim, K6JAT. We had some fun chats about all sorts of topics, and I was the greeter for the booth for a few hours. That evening, I went to the home of Keith, WA8ZWJ, for the 37th annual IOOK "Gathering Of

*(President — Continued on page 5)*

*(President — Continued from page 4)*

The Faithful”. There was good food, drink, and conversation, including a tour of Keith’s shack.

Saturday the weather was nicer and I decided to explore and see what I could find. Parking looked to be crowded, so I used one of the remote lots. The vendor booths were packed and most of them were companies you would recognize. I talked to some SDR vendors, saw an amazing Italian magloop, saw some nice amplifiers, and an amazingly big tower. I also ran into Michael, KE8AQW, who has come to PAARA many times, but has now moved back to Michigan. He was wearing a PAARA tee shirt! I spent some time at Ham Radio 2.0, a reimagining of ham radio that Ward, N0AX, is promoting, and ended up in a debate with some 20-something hams about what is or is not a sandwich. That was great fun. I stopped by the Society of Amateur Radio Astronomers and asked if someone had ever built a multi-dish radio interferometer. Turns out someone had. I’ve always thought that

would be a great project. Finally, I went back to the League booth and talked about education there. Bob Vallio tried to get me a ticket to the Contest Dinner that evening, but it didn’t work out, so I joined IOOK for another fun dinner. I had drinks at the hotel with the ARRL board members, and there was more great conversation. I spent Sunday doing similar things. Since Hamvention ends at 1pm, I decided to go see the infamous Hara Arena. Of course, I met two other hams there doing the same thing. The Arena was in sad sad shape, and I took a couple of pictures of the interior, through the glass. The festivities ended with pizza with IOOK. It was a wonderful experience, and I will be back next year.

Next month we will have a Field Day recap. I hope to see you all there at Bedwel Bayfront park on June 22nd ~ 24th for Field Day. And don’t miss the Intel Museum Tour. CQ FD W6ARA ON 40M ON FD DE K6WX

-Kristen (K6WX)



**April Raffle Winners, from L to R:**

4th ~ Gail, KK6PDB , LED Headlamp | 8th ~ Joe, WB6JOE, Auto Emergency Kit | 3rd ~ Alan, AG6ZE, FSR radios | 6th ~ Bob, KK6YRV, Toolbox Organizer | 1st ~ Darryl, KI6LDM, Arrow Yagi Antenna | 7th ~ Doyle, KG6YUN, Hybrid-power calculator | 2nd ~ Greg, KE6DO, Daiwa 2 position coax switch

## May 16, 2018, Board Meeting

The meeting was held at Marty's QTH, commencing at 7:25 PM on May 16, 2018. In attendance were Kristen McIntyre, K6WX (Pres) via videoconference, Marty Wayne, W6NEV (VP), Ron Chester, W6AZ (Treasurer) via videoconference, Jim Thielemann, K6SV (Secretary/Membership), Larry Rebarchik, N6DB (Dir) via videoconference, Darryl Presley, KI6LDM (Dir), and non-board member Clark Martin, KK6ISP, (ASVARO Representative). A quorum was present.

Kristen, (K6WX), mentioned receiving inquiries from a couple of other clubs that are interested in partnering with PAARA to assist with Ham related activities. She mentioned the recent "Radios In The Park" hosted by SBARA as being something PAARA was asked about assisting with. This would be similar to our assistance with the Special Event station at Pacificon.

Kristen mentioned her reserve of stories continues to be low, thus there is a need for more. 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 'homegrown' stories that make PAARAgaphs great", she said.

Vice President's Report: Marty, W6NEV, announced an exciting speaker for June, Rogelio Bernal Andreo will be talking about "Astrophotography" and his deep-sky experiences. Marty also mentioned that he is looking for speakers for July and October. Please let Marty know of anyone who would be interested in presenting at a PAARA meeting.

Secretary's report: Jim, K6SV, reported that there were 3 new members and 1 re-joining in May. The current membership stands at 170. He also mentioned editing PAARAgaphs for the next two months, filling in for Bob Van Tuyl, K6RWY, who will be on vacation.

Treasurer's Report: Ron, W6AZ, reported the proceeds from sales of various items was \$576 for the month of April. Ron also provided the board the income report for last year. The report tracks previous years income. He hopes to provide the expense report at the next meetings.

Under Old Business,

As you recall, the Electronic Flea Market (EFM) was held at Fry's in Sunnyvale for the last 2 months. Fry's is now the new home for the rest of 2018. Reports from attendees were very positive with a good turnout. Almost all the spaces were sold which is also good. The board did have some conversation about the costs for the new venue. Clark, KK6ISP, will work at getting answers from

ASVARO.

Marty, W6NEV, reminded the Board that the next field trip is to the Intel Tech Museum in Santa Clara on May 26.

The event is followed by a picnic at Baylands Park in Sunnyvale. Marty mentioned that there are 12 people who signed up. He also mentioned being able to accept any "drop-in" attendees, should you decide to go at the last minute.

Jim, K6SV, reported that he and Joel, KD6W, installed the microwave dish on the tower to establish a redundant internet connection at the repeater site. The link was confirmed as being active and usable. There is still a little work to configure the equipment and test it before this effort can be called complete. The battery backup part is still in process. There is a consideration to install a small wind generator there to charge the batteries in place of solar panels, which had been previously discussed. However, getting the batteries online is the 1<sup>st</sup> step.

Marty, W6NEV, and Jim, K6SV, updated the Board on the status of the Field Day preparations. The 1<sup>st</sup> antenna party was successfully completed. The straps on the KT34XA were completely removed and re-cleaned to eliminate the issue we had last year with the antenna being a broadband RF radiator. With the cleaning and tightening, the SWR remained stable when the antenna was wiggled around which wasn't the case before the cleaning. The KT34, used for the GOTA station, was also re-worked a bit. The 2<sup>nd</sup> antenna party is scheduled for 5/19/18. Jim reported that he, Doug, KG6LWE, and Bob Korte, KD6KYT, attended the Boy Scout Troop meeting in San Carlos on Monday. We provided a roughly 60-minute presentation on Amateur Radio, Emergency Communications, and Field Day. Seemingly, the presentation was well received with one scout emailing the scoutmaster that he wanted to work toward earning the radio merit badge!

Darryl, KI6LDM, mentioned there were 35 new ham licensed in April. The information has been forwarded to Rachel, KK6DAC, for mailing of the new member invitation cards.

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:

There was a short conversation on the current cost to PAARA for badges. A bit more information needed before making any decision but it's more than likely the cost of badges will increase as the engraving costs seem to have increased.

The Board meeting was adjourned at 9:02 PM.

Jim Thielemann, K6SV  
Secretary/membership

Please welcome

New members: Mikko Sannala, AB6RF, Christopher Gavin, W6CRS, Rick Karlquist, N6RK

Re-joining member: Ken Dueker, KB6BPM

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

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Director ('18) .....	Darryl Presley, K16LDM	650 255-2454
	ki6ldm@arrl.net	

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	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	
Asst. to the Treasurer....	Bob Korte, KD6KYT	408 396 4745
	bob@rgktechsales.com	
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	dteter@wvci.com	
Historian Position .....	<i>Position Vacant</i>	
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Field Day Coordinator ...	Doug Teter, KG6LWE	650-367-6200
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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-September, 6am-12 noon  
 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.k6ya.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: 441.35 (+5.0) 88.5 ctcss  
 147.39 (+600) 151.4 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://santacalaravalley.redcross.org> or Scott Hensley KB6UOO, (408) 967 7924  
[shensley@Novell.com](mailto:shensley@Novell.com)

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



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***Badges are ready for  
 pickup.***

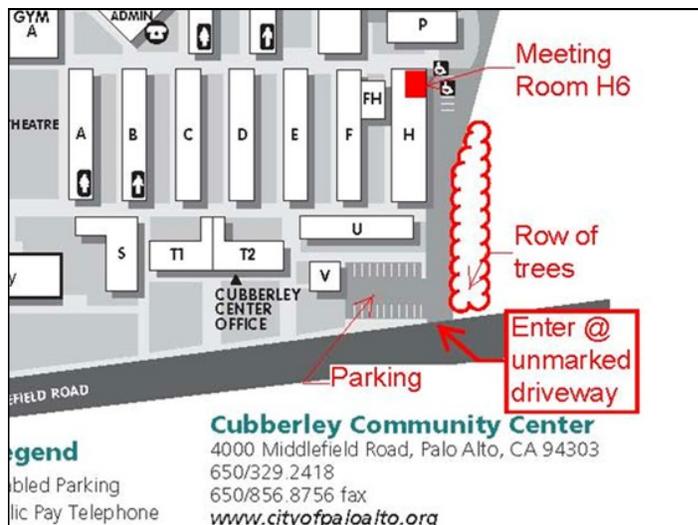
If you would like to  
 order a badge, see  
**Doug Teter, KG6LWE.**

## 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
5 <sup>th</sup>	Rob - KC6TYD

If you're interested in trying out at Net Control,  
 Contact Doug, KG6LWE. It's good practice,  
 and lots o' fun! Give it a try.



**Meeting Location — Middlefield Road  
 between San Antonio and Charleston in Palo  
 Alto. 4000 Middlefield Road**

<http://www.foto.mail.ru/list/shkurkin>

Vladimir Vladimirovich

SHKURKIN

Editing and Translation Services  
 English-Russian-English

shkurkin@ix.netcom.com

**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.

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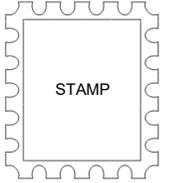
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