

QRO

MONTHLY NEWSLETTER OF THE PALOS VERDES AMATEUR RADIO CLUB

AUGUST 2016

No PVARC family picnic on Sunday, August 21:

The Pt. Vicente Lighthouse grounds are needed for a two-week activity that also spans the 2016 International Lighthouse & Lightship Weekend. We will not be conducting lighthouse radio operations nor holding our Sunday picnic this year.

This QRO issue has been revised and abbreviated from its original layout due to our ILLW cancellation.

International Lighthouse & Lightship Weekend is Aug. 19-21

We were really excited about staging our annual radio operation and family picnic at Pt. Vicente Lighthouse during International Lighthouse & Lightship Weekend, August 19-21.

But as communicated by email to all PVARC members we cancelled our ILLW activities this year on just several days advance notice. The Pt. Vicente Lighthouse grounds were being required for a 14-day activity whose equipment and other deployed assets made it impractical to hold our usual ILLW event.

We'll be back at Pt. Vicente next year for the 2017 Lighthouse Weekend, so please join us then.

In the meantime, observe the spirit of International Lighthouse & Lightship Weekend by working on the HF bands as many lighthouses and lightships as possible.

452 lighthouses worldwide entered ILLW 2016, with a few more possible—try working some from your QTH

Country	2016 ILLW Lighthouses & Ships	Country	2016 ILLW Lighthouses & Ships
Algeria	1	New Zealand	6
Argentina	8	Norway	3
Australia	63	No. Ireland	3
Austria	2	Panama	1
Belgium	2	Poland	4
Brazil	1	Portugal	8
Canada	14	Puerto Rico	5
Canary Is.	1	Russia	1
Chile	1	Scotland	22
Cuba	9	South Africa	14
Denmark	8	Spain	3
England	33	Sri Lanka	2
Estonia	3	Sweden	19
Finland	6	Trinidad	1
France	8	Turkey	1
Germany	69	Uruguay	3
Iceland	4	United States	68
India	3	Venezuela	1
Ireland	6	Wales	9
Italy	5	Total	452
Latvia	2		

Malaysia

Netherlands

21

This year's world-wide count of lighthouses and lightships registered for ILLW dropped significantly from recent years.

The 2016 ILLW event has 452 lighthouse and lightships entered vs. 544 in 2014 and 507 in 2015.

The most likely factors for the decline were difficulty gaining site access due to heightened security and the downward solar cycle phase causing some poor DX conditions in recent months.

The PVARC's 2016 ILLW cancellation was our first ever for Lighthouse Weekend. As with the lastminute cancellation of our 2013 DXpedition to Two Harbors on Catalina Island due to boat service being suspended because of dangerous weather we again had an "adrenaline collapse" after the decision was made.

In remembrance: Knut Myhre, N6BNP (SK)

We were saddened to learn PVARC member Knut Myhre, N6BNP, became a Silent Key on August 13, 2016. He is survived by his wife Yoko as well as son John and daughter-in-law living in Norway.

Knut had been a PVARC member since 1981 after an unusual worldwide career brought him to the Port of Long Beach. He served as PVARC Vice President in 2009, as one of our first weekly net control operators, and worked with Soleado School's International Space Station radio project.

Born and educated in Norway, Knut had said he worked in his home country for only six months after graduating from a naval engineering college. His career then spanned the world while employed for a Norwegian marine inspection service that certified the sea-worthiness of ocean vessels for maritime insurance underwriters prior to each ship's voyage and cargo handling.

Knut was first licensed as an amateur radio operator in Norway during 1954 while in high school and continuously retained his LA1IF call sign. He later operated from other locations worldwide. While in Japan for nearly eight years Knut learned Japanese and obtained his Japanese amateur radio licenses by taking the exams in that language. He was transferred to the Port of Long Beach in 1973 and in 1975 took his FCC amateur radio Novice, General, and Advanced license exams all in one day. He purchased a home in Rancho Palos Verdes in 1978 and lived there since.

In 1995 Knut was sent by the marine inspection service to help open its operations in Shanghai, China. He spent just over six years there and also obtained an amateur radio license in China. He retired in 2001 and became a naturalized U.S. citizen in 2005.

We will truly miss Knut. He was a familiar voice on the PVARC's weekly club nets and a friendly presence at our monthly meetings who brought a smile to all. Knut especially enjoyed CW DXing.

Details on funeral or memorial services for Knut were not immediately available but will be provided in our weekly email bulletin.

In remembrance: Eric Siess, W6EWS (SK)

A well-attended Celebration of Life for PVARC member Eric Siess, W6EWS (SK), on July 28 reflected his extensive career, family, and personal accomplishments. Eric's passing at age 58 following a lengthy illness was reported after last month's **QRO** newsletter appeared.

Eric earned his Ph.D. in electrical engineering from USC and spent his entire professional career at TRW / Northrop Grumman in North Redondo Beach. He worked in Northrop Grumman's Advanced Technologies Group on many highly-classified projects. Your **QRO** Editor had the pleasure of inadvertently sitting at one of the two "Northrop Grumman" tables during the Celebration of Life and learned how highly Eric's professional colleagues regarded him.

Eric obtained his amateur radio licenses in 2009 at PVARC VE sessions but he also had long-standing interests in outdoor activities including hiking, camping, and travel. He was additionally a certified genealogist who frequently gave lectures to genealogy groups. Eric is survived by his wife Susan, KK6QLY, two adult children, and a step-daughter.

Good question: Why doesn't my VHF/UHF radio have an antenna tuner?

By Jerry Kendrick, NG6R

A companion article in last month's **QRO** issue, *Operating With High SWR*, explored the use of an antenna tuner, or matchbox, to condition the impedance of an antenna system so as to present a 1:1 standing wave ratio (SWR) to an HF transmitter or linear amplifier. The article also justified how to live with the resulting high SWR on the coax cable between the HF transmitter and the antenna. But, is this a consideration only at HF? Or, do I also need to be concerned with operating high-SWR antenna systems on VHF and UHF? Why is it that I've never seen an antenna tuner for these bands?

There are key differences from HF that many hams think make the use of antenna tuners for VHF and UHF unnecessary. First, the length of a VHF or UHF antenna is quite short relative to HF. For example, a quarter-wave vertical ground plane antenna for two meters is only about 19 inches long. So, if a too-high SWR is measured at the mid-band operating frequency of 146 MHz, the antenna can be easily shortened by cutting successive segments (maybe a sixteenth of an inch at a time) from the antenna (or, not quite so easily lengthened by either splicing in a short extension or tossing out that antenna element and starting over with a longer aerial—we've done both!).

Another difference from HF is that the small component size, circuit board placement and circuit complexity for such an antenna tuner would not be justified. In general, it's just too easy to modify the antenna dimensions to warrant such an expensive unit design and construction. But, that's not to say that such tuners don't exist. MFJ has a dual-band antenna tuner (MFJ-921) that covers 2m and 1.25m bands. They also have a dual-band tuner (MFJ-922) that covers 2m and 70cm bands. But, there aren't many such tuner designs in the marketplace because most hams don't believe they need them.

Another factor in deciding to purchase and use a VHF/UHF tuner is the significant insertion loss that eats away at the available power before it can even leave the shack. A specification of 0.5 dB is typical, dropping about 3.3W from a 30W transmitter output.

Probably one of the most critical considerations is the significant coaxial cable loss that occurs at VHF and UHF frequencies, especially when operating with high SWR. (Remember that an antenna tuner only controls the SWR between the transceiver and the tuner—a few feet at most—but has no effect on the high SWR in the coax between the tuner and the antenna.) A couple of example calculations would be helpful in analyzing the benefit (or lack thereof) of using an antenna tuner for these bands.

For both examples, we will choose the 1.25m VHF band and select a mid-band frequency of 223.5 MHz. The first example will use <u>no antenna tuner</u>. Assume a 30W transmitter and 50 feet of RG-213 (Belden 8267) coax cable from shack to antenna. Assume a 2.5:1 SWR. (This means that we haven't tuned the antenna for a better SWR.) Based on this SWR, the effective power from the transmitter will be 81.6% of the available transmitter power, or 24.5W.

[See: http://www.packetradio.com/pdfzips/SWRvsPowerNwatts.pdf for a table relating loss to SWR.]

Using the on-line calculator cited in last month's companion article, http://www.qsl.net/co8tw/Coax_Calculator.htm, and plugging in all the relevant parameters, we see that the power out at the antenna is 14.9W.

Continued on next page ▶

Good question: Why doesn't my VHF/UHF radio have an antenna tuner?

► Continued from previous page

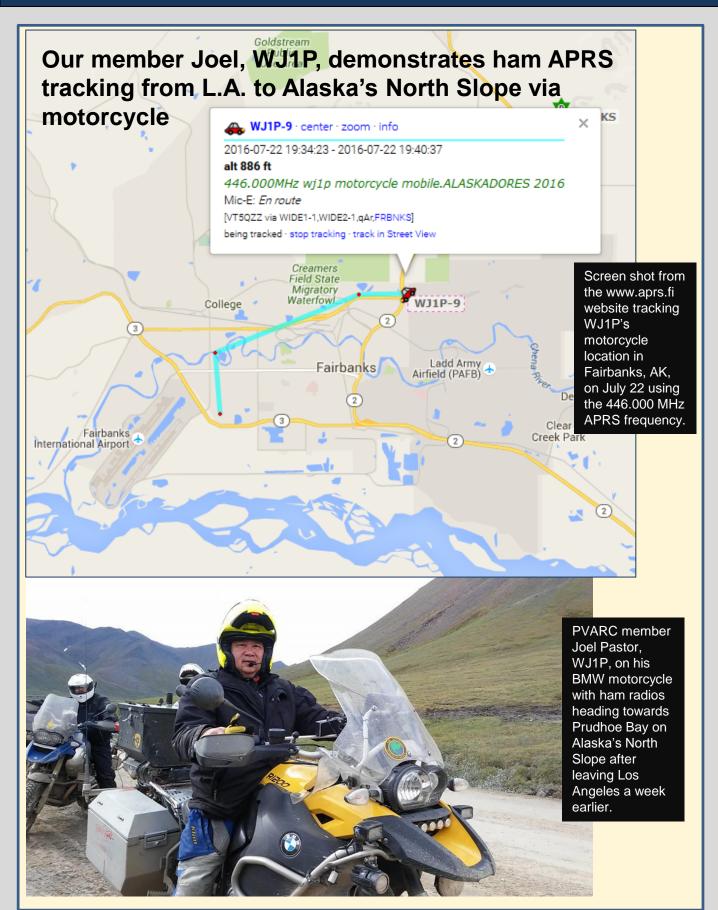
Now, for the second example, let's introduce an antenna tuner after the transmitter. This will provide a 1:1 standing wave ratio for the section of coax between the transmitter and antenna tuner. It will also enable the entire 30W of transmitter power to be available to the antenna tuner. (However, don't forget that the antenna tuner itself has an insertion loss of 0.5dB or 3.3W. So, only 26.7W of effective power will exit the antenna tuner.) Again, employing the cited on-line calculator, we find that the power out at the antenna is 16.3W using an antenna tuner (compared to 14.9W with no antenna tuner). The reader can be the judge, but is the expense of the antenna tuner justified by realizing this modest improvement?

Bear in mind that a 2.5:1 SWR at the transmitter (i.e., using no antenna tuner) could be potentially damaging to the final output stage. So, the argument for use of an antenna tuner might be justified on that basis, if not on improvement in radiated signal performance.

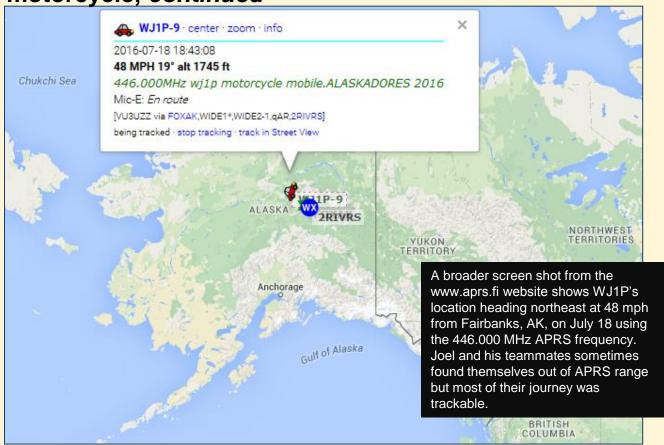
One final consideration. If the antenna is not easily tunable (like a Yagi or quad antenna) or wasn't really designed for the frequency of interest (perhaps, like a commercial aviation-band antenna that's being adapted for ham radio), a high SWR might be inevitable. Here, another approach should be considered.

Instead of purchasing a general-coverage antenna tuner, a specific in-line impedance-modifying circuit might be synthesized that can change the inherent SWR of the antenna system and pull it in to approximately 1:1 SWR for the frequency of interest. An on-line Smith chart program can be used to synthesize such a circuit, a technique explained in detail in the April 2016 **QRO** article entitled *A Matchbox Design Example*. Of course, at VHF and UHF frequencies, discrete components like were used in that example for 29.5 MHz, might have to be replaced with series and/or shunt matching stubs that are more appropriate at these higher frequencies. The key to such a synthesis task is to know the impedance (both components: real/resistive and imaginary/reactive) of the antenna system at the frequency of interest. With these data, measured using a good antenna analyzer covering the VHF or UHF band of interest, a specific in-line impedance matching circuit can be synthesized.

Editor's Note: PVARC member Jerry Kendrick, NG6R, writes frequently on technical topics for **QRO**. He is also an avid electronics builder and problem=solver as well as District Operations Officer for the Lomita Sheriff's Station unit of the Los Angeles County Disaster Communications Service.



Our member Joel, WJ1P, demonstrates ham APRS tracking from L.A. to Alaska's North Slope via motorcycle, *continued*





PHOTOS provided by Joel Pastor, WJ1P



PVARC radio operators needed for "Ride With The Tide" bike tour on Sept. 24

The PVARC is providing radio communication for the 2016 Ride With The Tide Bike Tour (formerly known as the RAT Beach Bike Tour) on Saturday, Sept. 24.

We've supported the Bike Tour's organizer, the South Bay Sunrise Rotary Club, since the initial RAT Beach Bike Tour in 2010. This year's tour returns to its original start/finish at Torrance Beach after four years at Redondo Beach King Harbor where it was paired with the city's Lobster Festival.

PVARC operators will be needed at these locations along the 62-mile route (some sites also serve the 31-mile and 15.5 mile routes):

Net Control and Start/Finish:

Torrance Beach

At SAG Stops for bicyclists:

- Hermosa Beach
- El Segundo (Dockweiler State Beach)
- Playa del Rey (Ballona Creek at Centinella Ave. bridge)
- El Segundo (Recreation Park near downtown)
- Torrance (Zamperini Field Airport)
- San Pedro (22nd Street Park)

Aboard roving vans:

- North side
- South side

Please advise Diana, AI6DF, if you can serve as an operator for this year's bike tour—we really need your help during the morning of Sept. 24. ■

♦ PVARC's financial report is available upon request to any member.

Palos Verdes Amateur Radio Club

An American Radio Relay League Affiliated-Club

Board of Directors:

President Diana Feinberg, AI6DF Vice President Laura Behenna, KK6BFI Bob Sylvest, AB6SY Treasurer Ron Wagner, AC6RW Secretary Clay Davis, AB9A, Directors Ray Day, N6HE

Appointed Offices:

QRO Editor Diana Feinberg, Al6DF Webmaster John Freeman, WW6WW Club Librarian Bryant Winchell, W2RGG

K6PV QSL Manager Jeff Wolf, K6JW K6PV Repeater Trustee Mel Hughes, K6SY Jeff Wolf, K6JW LAACARC Delegate

VE Coordinator Dave Scholler, KG6BPH VE ARRL Liaison Jerry Shaw, KI6RRD Malin Dollinger, KO6MD, Net Control Operators Dale Hanks, N6NNW, Bob Sylvest, AB6SY, Ron Wagner, AC6RW, Dan Yang, K6DPY

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Mailing Address:

Palos Verdes Amateur Radio Club

PO Box 2316

Palos Verdes Peninsula, CA 90274-8316

Monthly Meetings:

Third Wednesday (except August and December) at 7:30 pm at Fred Hesse Park, 29301 Hawthorne Blvd., Rancho Palos Verdes, CA. Visitors always welcome.

Repeaters (Open, though often listed as "Closed"):

Club: K6PV, 447.120 MHz (-), PL 100.0, CTCSS "PV-West": K6IUM, 449.980 MHz (-), PL 173.8, CTCSS

To order a Club badge:

Karen Freeman, KG6BNN, 310-541-6971

To order a Club jacket or patch:

Dave Scholler, KG6BPH, 310-373-8166

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Front page photo —Extensive smoke blown from the Sand Fire near Santa Clarita casts an eerie glow at sunset on the Pt. Vicente Lighthouse in this photo taken July 23, 2016.

PHOTO: DIANA FEINBERG, AI6DF

PVARC Short News Items

The PVARC's upcoming meeting topics...and beyond

PVARC members are presenting at PVARC meetings and those of other clubs during the remaining months of 2016—and an interesting visitor is also presenting at the PVARC.

We have no club meeting in August. Instead, our annual family picnic is **Sunday, August 21**, 12:30 pm at the Pt. Vicente Lighthouse in conjunction with International Lighthouse & Lightship Weekend, August 19-21. Our request to use Pt. Vicente Lighthouse grounds recently received U.S. Coast Guard approval.

At our **September 21** monthly meeting PVARC member Rocco Lardiere, N6KN, will give present how to restore older amateur radios. Rocco has acquired many vintage amateur radios and will discuss how to bring these to full operating condition. His working radio collection is extensive and fascinating

Our **October 19**th meeting features Doug Dowds, W6HB, founder and President of the Battleship Iowa Amateur Radio Association. He will present a history of this famous ship now docked in Los Angeles Harbor and its radio operations (both the military side and its new on-board ham radio station.)

Two PVARC Board members, Clay Davis AB9A and Bob Sylvest AB6SY, have developed a very exciting comprehensive presentation about "Solar Energy for Amateur Radio" for our **November 16** meeting.

Finally, our annual Holiday Dinner is **Thursday, December 8, 2016**, at the Los Verdes Golf Course in Rancho Palos Verdes (please note the change to a Thursday evening) with a program to be announced.

Meanwhile, the PVARC's Lighthouse Weekend presentation is being given to two North County clubs. Your **QRO** Editor Diana, AI6DF, presented "Amateur Radio's International Lighthouse & Lightship Weekend" to the Santa Clarita Amateur Radio Club in Newhall on August 17 and will also do so at the Antelope Valley ARC in Lancaster on September 22. She is also presenting "Recent and Upcoming Developments in the 220 MHz Amateur Band" at the San Fernando Valley Amateur Radio Club on October 21 and the Associated Radio Amateurs of Long Beach meeting on November 4.

PVARC member Chris Storey, KA6WNK, gave his Sheriff's Department communication system presentation (from our July meeting) to the South Bay Amateur Radio Club on August 18 and will present his "Reporting Emergencies" talk to the PAPA repeater system's Orange County group on August 27.



Need a PVARC patch?

If you want a PVARC logo patch for a hat, shirt, jacket, softside bag or whatever we have a new batch with higherresolution stitching.

New patches are available for \$4 each at all our meetings or by contacting Dave Scholler, KG6BPH, at 310-373-8166 (or email him at: jdavidscholler@hotmail.com.) If you order a PVARC club jacket one patch is sewn onto the jacket's left front and included in the cost. These jackets may also be ordered through Dave Scholler. ■

PVARC News Items

PVARC's HF Enthusiasts discuss more topics

The PVARC's HF Enthusiasts Group held its fourth meeting on Saturday, August 13, with eight club members attending. The next HF Enthusiasts Group meeting will be Saturday, September 10.

Among the topics covered on August 13 were:

- Ray, N6HE, had a three-input audio switching box he created;
- Clay, AB9A, showed a homebrew Arduino remote control head for his Icom IC-7300:
- Ron, AC6RW, displayed a WWII hand-crank ohm-meter from Japan;
- Jerry, NG6R, discussed a capacitance paddle CW keyer; and
- Carlos, WB6MCW, showed his homebrew version of the AB9A Arduino keyer.

Also attending and participating in the discussions were Hugo, KM6DQU; Jeff, K6JW; and Kelvin, K6KCV. ■

Helpful guidelines when submitting QRO articles

Our **QRO** newsletter welcomes articles about technical subjects and PVARC members' amateur radio activities of interest to fellow club members.

To facilitate layout and editing using the software that produces **QRO** please send your article as two separate files: 1) all the text as a straight Microsoft Word file and 2) any photos, illustrations, or diagrams in a second file or as separate JPEG files. If possible please keep the text portion to not exceed 800 words. Thanks!

WELCOME NEW MEMBERS OF THE PALOS VERDES AMATEUR RADIO CLUB

IN 2015-2016

ANTHONY BURNS, KK6SPH

KATHY HAYNES, KK6SPG

ROBERT MILLARD, KE6JI

DAISY MILLARD, (XYL) KE6JI

J. Brandlin, KK6TXM

THOMAS BACALJA, KK6ULM

GREG LUND, AI6IV

CANDACE KAWAHARA, KK6ULN

TIM MEADOWS, KK6ULL

JOHN CASHEN, W5UG (RETURNING MEMBER)

INGO WERK, KK6EWB

TOM BUDAR, K6RPV

JONATHAN GREEN, KK6VWK

SAEHUI HWANG, KM6BCO

MARK CHILDIR, KM6BCL

DALE GEHR, KM6BCI

ROMYLEEN MITRA, KM6BCJ

NICHOLAS KOWALCZYK, KM6BCN

ANNETTE SOLOMON, KM6DRA

BRUCE GILBERT, KM6DQX

CARL HINDMAN, KM6DRB

HUGO DOMINGUEZ, JR., KM6DQU,

JARED BOCKOFF, KM6DQV

STEVE WRAY, KM6DQW

THEODORE LEY, KM6DRC

JOE BARGER, N6KK

DENISE ANN HUGHES-MURPHY, K6DAH

Palos Verdes Amateur Radio Club

2016 Calendar

2016 Major Contest Dates

ARRL CQ Magazine and Other

Jan. 29-31: CO Worldwide 160-Meter (CW) Jan. 31-Feb 2: ARRL January VHF Sweepstakes

Feb. 12-14: CO Worldwide RTTY WPX

Feb. 19-21: ARRL DX (CW)

Feb. 27: North American RTTY QSO Party Feb. 26-28: CQ Worldwide 160-Meter (SSB)

Mar. 4-6: ARRL DX (SSB)

Mar. 25-27: CQ Worldwide SSB WPX May 27-29: CQ Worldwide CW WPX Jun. 11-12 ARRL June VHF Contest

Jun. 22-26: ARRL Field Day

July 9-10: IARU World Championships

July 16-17: CO Worldwide VHF

July 16: North American RTTY QSO Party

Aug. 6-7: ARRL UHF Contest

Sept. 10-11: ARRL September VHF Contest

Sept. 23-25: CO Worldwide RTTY DX Oct. 1-2: California QSO Party Oct. 28-30: CQ Worldwide SSB DX Nov. 5-6: ARRL Sweepstakes (CW) Nov. 19-20: ARRL Sweepstakes (SSB) Nov. 25-27: CO Worldwide CW DX Dec. 9-11: ARRL 10-Meter Contest

PVARC Meetings & Meals

Meetings 7:30 pm 3rd Wednesdays except August and December at Fred Hesse Park, 29301 Hawthorne Blvd., Rancho Palos Verdes. Guests welcome.

A no-host dinner at 5:30 pm before club meetings is held at the Red Onion Restaurant, 736 Silver Spur Road, Rolling Hills Estates.

2nd Saturday each month: PVARC "HF Enthusiasts Group", 9:00 am in the Ralph's Supermarket café area (Hawthorne Blvd. at Crest Road.

3rd Sunday in August: Annual family picnic at Pt. Vicente Lighthouse. (Cancelled)

December 8: Holiday dinner, Los Verdes Golf Course, Rancho Palos Verdes.

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PVARC Public Service Events

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Nov. 12:

Apr. 24: Ridgecrest Int. School 5K Rolling Hills Estates Aug. 13: "Hills Are Alive" 5K/10K "Conquer the Bridge" Race Sept. 5: Sept. 24: **RAT Beach Bike Tour**

Major Ham Radio Conventions

P.V. Half-Marathon/10K

Feb. 19-20: ARRL SW Div. & Yuma Hamfest, Yuma, AZ March 12: Palm Springs Hamfest Apr. 15-17: International DX Convention, Visalia, CA

Apr. 29-May 1: ARRL Nevada Convention, Las Vegas, NV

May 20-22:

Dayton HamVention Oct. 14-16: Pacificon, Santa Clara, CA

PVARC HF Operating Events

April 27-

May 1: Islands On The Air

DXpedition, Catalina

December

1 2 3

Island:

June 25-26: ARRL Field Day; Aug. 19-21: Intl. Lighthouse

> Weekend, Pt. Vicente Lighthouse (cancelled)

PVARC Ham License Classes

Fred Hesse Park (Fireside Room), 29301 Hawthorne Blvd., Rancho P.V.

Feb. 20 & 27; June 4 & 11; Aug. 27 & Sept. 10; additional dates to be announced.



Palos Verdes Amateur Radio Club P.O. Box 2316 Palos Verdes Peninsula, CA 90274 www.n6rpv.net/pvarc or www.k6pv.org

NEW MEMBER & MEMBERSHIP RENEWAL FORM

N EW:	or Renewal	.:r	MEMBERSHIP	Date:
Last Name:	Fi	irst Name:		Spouse:
Street Address: _				
City:				Zip:
Phone: Home	<i>\</i>	Work		Cell
Email address: _	(Unless otherwis	e noted emails	will be sent to	the applying member only)
				Birth Mo./Day:
Other amateur rac	dio groups you belor	ng to:		
Additional House	hold and/or Family N	lembers (if App	olicable):	
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Name	Call	Class	ARRL	Birth Mo./Day:
Name	Call	Class	ARRL	Birth Mo./Day:
			Individual ı	nembership (\$15.00) \$
		Household a	and/or Family r	membership (\$17.00) \$
		Additional dor	nation to suppo	ort PVARC activities \$
C	Cash: or Ch	eck #:	Date	TOTAL \$
Please make checks	payable to: Palos Ver	des Amateur Radi	o Club; Dues ba	sed on January 1 st to December 31 st year
All	New and Renewa	ıl Member app	olications mu	st be signed below.
accepting membersl		the Club's cons	titution and by-l	teur Radio Club and understand that b aws (available on-line at:
Signature:				Date:
Family Member Sig	nature:			Date:

Date: _

Family Member Signature:

Tell your friends and relatives about the PVARC's upcoming Technician and General license classes



Whether for emergency communication, communicating around the world, or learning a bit about electronics, there's nothing else like amateur radio (also known as "ham radio"). Amateur radio operators have long provided the communication "when all else fails" during disasters. Please tell your friends and relatives that with a short course, they can join the over 710,000 men, women, and children in the United States from all walks of life who are licensed to operate ham radios.

Two Free Amateur Radio Courses

FCC <u>"Technician"</u> course (entry level)
FCC <u>"General"</u> course (2nd level)
Each course is 2 sessions

The next sessions are on 27 August and 10 September, 2016

Technician 9:30 AM to 1:45 PM both Saturdays

General 2:00 PM to 5:00 PM both Saturdays

FCC tests will be 10:00 AM to Noon on Saturday, September 17, 2016.

The Palos Verdes Amateur Radio Club will make a brief presentation at 9:30 AM at the start of the 27 August Technician class on how to get further involved with amateur radio.

The location is Fred Hesse Park, 29301 Hawthorne Blvd., Rancho Palos Verdes.

Confirm your attendance to Walt, K1DFO at waltordway@juno.com

No fee for either course; taking the FCC Test is \$15. Optional Material (sold at cost):

Gordon West book with all the FCC test questions,
 \$22 for the Technician, \$26 for the General;

- Copy of PowerPoint charts: \$20 for the Technician, \$20 for the General.

For courses sponsored by the Palos Verdes Amateur Radio Club, students thru grade 12 who also pass their examination at a PVARC test session will, upon application to the Club, be eligible for reimbursement up to a maximum of \$50 to cover the cost of materials and the examination fee.

Everyone who obtains their first ham radio license through a PVARC test session, regardless of age, will receive a free membership in the Palos Verdes Amateur Radio Club for the remainder of the current calendar year.

For more information contact Walt, K1DFO, at waltordway@juno.com