
W6VIO Calling

JPL



Jet Propulsion Laboratory Amateur Radio Club
PO Box 842, La Canada CA 91012-0842

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Upcoming Events:

- **Emergency Communications Net:** Every Monday at Noon, on WR6JPL 224.08/(-)/156.7 & 445.20/(-)/103.5, or WR6AZN 223.96/(-)/156.7 on Table Mountain.
- **JPLARC Regular Membership meeting:** Second working Friday every month from Noon to 1pm in 180-703C. Call-in: 818-354-4044 ID-number: **997 183 539** (without the spaces). Slides (if any) broadcast via JPL WebEx (same ID-number). Next is **April 22nd: Nancy Darling K8NBD, "Altadena's ALERT team."**
- **JPLARC Board of Directors (BOD) meeting:** Normally, the first working Friday, every month, from Noon to 1pm in 180-703C. The next BOD meeting will be **May 6th**. Call-in: 818-354-4044 ID-number: **997 183 539** (without the spaces).
- For more upcoming events, including upcoming licensing classes, see the ARRL Los Angeles Section website: <http://www.areslax.org>

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- Congrat's to our new Extra Class Licensees!
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Raising an HF Antenna at the new shack

By Jim Marr AA6QI

Jonathan Cameron led a work party on March 18th to put the Cushcraft R-7000 40m-10m trap-vertical back up on the roof of B329 following the repairs of the roof leak (Figure 1). Jonathan brought aircraft cable guy wires that he had premade of the right lengths for the planned position of the antenna and a wooden base to keep the mast from producing another leak in the roof (Figure 2). After putting up the antenna and stringing the coax over



Figure 1: Putting up the R-7000 antenna (picture credit: Lew Soloway KK6QJE)

to the new feed box (Figure 3), the group put the FT-1000D on the air to test the antenna with the help of Walt Mushagian K6DNS. Thanks to all who participated: Jonathan Cameron KF6RTA, Chris Carson KD6ABQ, Bob Cesarone WA6JIB, Steve Townes WB5ILW, Jim Marr AA6QI, Lew Soloway KK6QJE and Bill Weber N6CI (Figure 4).



Figure 2: R7k antenna tripod base on the roof of B329 (upper right- Bill Weber tightening a guy wire)

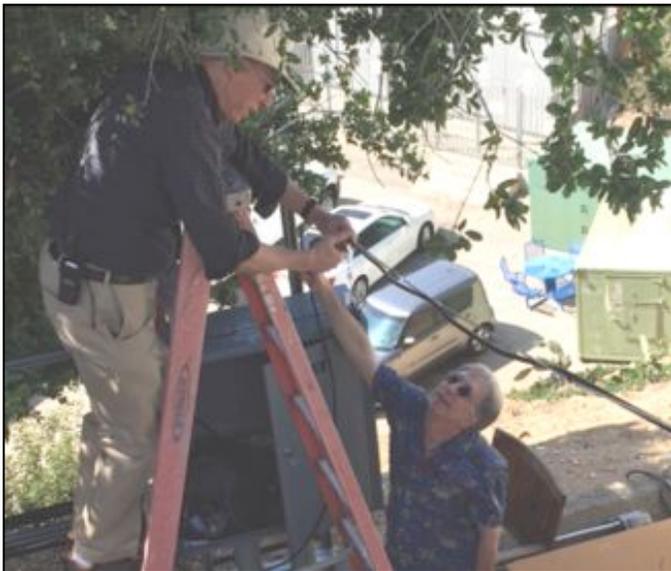


Figure 3: Bill Weber & Bob Cesarone stringing the coax from the R7k antenna to the coax junction box.

After the antenna party at B329, a number of us went up to the Mesa to take another look at the HF antenna farm, noting that there needs to be a general cleanup work party in the near future to prepare for the work of restoring the antenna farm to working order.



Figure 4: R7000 work party (left to right: Chris Carson, Lew Soloway, Jonathan Cameron, Steve Townes, Bob Cesarone, Bill Weber; photo by Jim Marr).

Congrat's to our New Extra Class Licensees!

By Jim Lux W6RMK

Six New Extra Licensees.

JPLARC has 6 new Extra Class licensees. After going through a few weeks of reviews at lunch time, they've all passed their Element 4 exam can start transmitting immediately in new spectrum (with /E) and, after FCC posting, can begin being trustee, or signing up to be a Volunteer Examiner (VE). Five passed their Element 4 exam on Wednesday, March 23rd in the 167 Special Events Room. Elliot Liggett (W7QED) passed his a couple of weeks prior. Congratulations to Jonathan Cameron (KF6RTA), Chris Gaylord (W6YTB), Josh Miller (KB3UUS), Nasrat Raouf (K1NAR), and Lew Soloway (KK6QJE).

The VE session was organized by Jan Tarsala (WB6VRN) with the examiner team of Alex Carver (KF6LVZ), Jim Marr (AA6QI), and Rob Smith (W6GRV). Maybe some of the new extras will get their VE credentials, and we

can do this again.

Regular Membership Meeting Mar 25th

By Chris Gaylord W6YTB & Jim Marr AA6QI

Present were: Parker Abercrombie KK6ZKW, Matt Bennett KF6RTB, Gary Block† KJ6IZX, Jonathan Cameron* KF6RTA, Stephen Canell WD6FIL, Bob Dengler NO6B, Chris Gaylord†* W6YTB, Jim Lux W6RMK, Josh Miller* KB3UUS, Steve Noland† WA6KLC, Mike Roche N6XLK, Rob Smith† W6GRV, Lew Soloway† KK6QJE, Steve Townes* WB4ILW. On the Phone/JPLWebex: Chris Carson* KB6ABQ, Jim Marr† AA6QI, Walt Mushagian† K6DNS, Stan Sander† N6MP, Chuck Sarture*† KG6NF,

Note: † indicates a 2015 or 2016 regular voting member (i.e., JPL/Caltech/Retiree & 2015 or 2016 dues paid), and * Indicates a 2016 BOD member. For a regular meeting quorum, the JPLARC Bylaws require a majority of the BOD (four or more) and at least five other regular members. We had all six BOD members, seven other regular members and six non-member (total of 19 attendees), so we **did** have a quorum.

The meeting was called to order at 12:00 PM with 19 participants in attendance.

General Updates

Six Club members/JPLers recently passed the Amateur Extra licensing exam. Jonathan Cameron KF6RTA, Chris Gaylord W6YTB, Josh Miller KB3UUS, Nasrat Raouf K1NAR, and Lew Soloway KK6QJE all sat for and passed the licensing exam offered on-Lab on Wednesday, March 23. Elliot Liggett W7QED sat for the exam elsewhere and also passed. Many thanks to Jim Lux W6RMK for leading the weekly prep class over the last two months and to the JPL ARC VE team consisting of Alexander Carver KF4LVZ, Jim Marr AA6QI, Rob Smith W6GRV, Jan Tarsala WB6VRN.

B329 is operational. The roof leak has been repaired and the HF multi-band antenna has been mounted on the non-penetrating tripod mount on the roof pending the long-term antenna-mounting pole being finalized. The FT-1000 is operational but needs some tune up work. The work continues to complete the connections from B329 to the Mesa antenna farm as well. We will need to think about how to handle logging of contacts or maybe just an engineering log to be kept by those using the station that can be used to keep track of how much the station gets used and equipment anomalies that need to be addressed. The phone should be installed in B329 soon, as well.

The Repeater Committee met on March 15. Work is underway to move the 224.08 and 445.20 MHz repeater antennas at 35A to the top of a telephone pole for better coverage. Work also continues exploring a return of our repeaters to Cerro Negro or another off-Lab site. Work also continues towards restoring ISS audio to the 147.15 MHz repeater.

Jonathan Cameron KF6RTA distributed the new final club frequencies reference card that has been under development (see the card for specific examples). The numbering scheme for tactical channel identifiers was modified based on discussions at the last Board meeting based on suggestions from Charles Rhoades WB6KZE. The general channel-naming scheme is a 4-character name as follows:

- First character is "J" for JPL or "T" for Table Mountain ("C" reserved for future use if Caltech frequencies are added).
- Second character is 1 for 2m, 2 for 1.25m, or 4 for 70cm frequencies.
- Third character is 0-4 for repeaters or 5 for simplex frequencies. 6-9 reserved for temporary additional frequencies as needed during an incident.
- Fourth character is 0 for repeaters or 1-9 for simplex frequency.

The schedule for upcoming meeting topics was discussed (see list at the end of this issue of W6VIO Calling). Two additional presentations are currently in the process of being finalized – so this schedule is subject to change.

Guest Presentation: Josh Miller KB3UUS "JPL CubeSat Communications."

Josh Miller KB3UUS provided an overview of JPL CubeSat operations including the tracking antennas located on B125 and B238. He provided a general overview of the CubeSat program as well as other amateur radio CubeSats that are in orbit and discussed the challenges with operating on the commercial bands including the need to spec custom antennas for the program. He also discussed how software-defined radios are utilized and general plans for upgrading the infrastructure.

What is a CubeSat? A type of miniature satellite for space research that is made up of multiples of 10x10x11.35cm cubic units," with mass of no more than 1.33 kg/unit. Often uses commercial off-the-shelf (COTS) components for electronics and structure. Most commonly put in orbit by deployers on the ISS or launched as secondary payloads on a launch vehicle.

JPL Cubesats: LMRST - "Low Mass Radio Science Transponder"; launched Oct 2015; 3U CubeSat; mostly

COTS hardware; UHF uplink/downlink for TT&C (telemetry, tracking & control) with X-band science transmitter; never heard from after launch. **ISARA** - "Integrated Solar Array & Reflectarray Antenna"; delayed Nov 2015 launch; 3U CubeSat; Ka band xmt with 10Mbps downlink; tech demo to raise the technology readiness level of the Ka band antenna. **ASTERIA** - "Arcsecond Space Telescope Enabling Research in Astrophysics"; planned launch summer 2016; 6U CubeSat (10x20x30); to demo CubeSat capabilities for astrophysical measurements; goal to achieve arcsecond-level line of sight pointing error and stable focal plane temperature control. **MarCO** - "Mars Cube One"; launch TBD; 6U CubeSat (10x20x30); First interplanetary CubeSat; Radio relay for InSight lander going to Mars; software defined radio (SDR) with UHF and X-band capabilities; new antenna technology for X-band phase array.

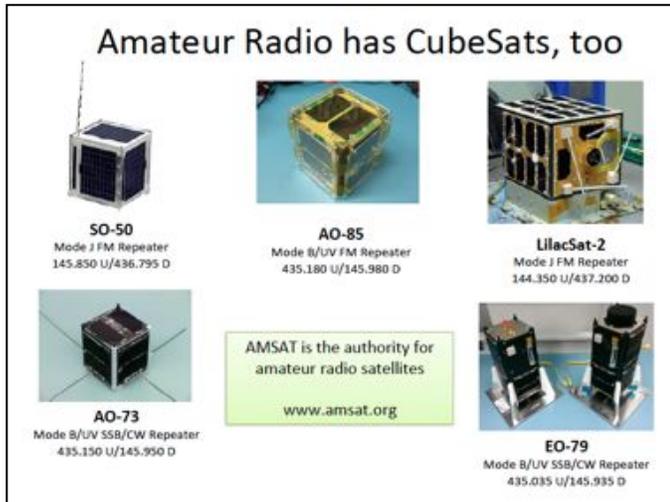


Figure 5: Some amateur radio CubeSats

Amateur Radio also has cubesats (Figure 5). Some of these include: **SO-50** V/U FM repeater; **AO-85** U/V FM repeater; **LilacSt-2** V/U FM repeater; **AO-73** U/V SSB/CW linear transponder repeater; **EO-79** U/V SSB/CW SSB/CW linear transponder repeater; and more coming soon. AMSAT is the authority for amateur radio satellites (www.amsat.org).

JPL CubeSat Infrastructure, UHF-band Tracking Station:

Consists of antennas, antenna rotator & controller, tracking software, RF components, and signal processing.

The UHF tracking antenna consists of a quad stacked array (Figure 6) for circular polarization, consisting of four custom 456CP34 M2 Antenna Systems Yagi antennas, having a total gain of ~21 dBi over a frequency range of 435-470 MHz. The primary mission for these antennas was LMRSAT support.



Figure 6: JPL CubeSat UHF tracking antenna system

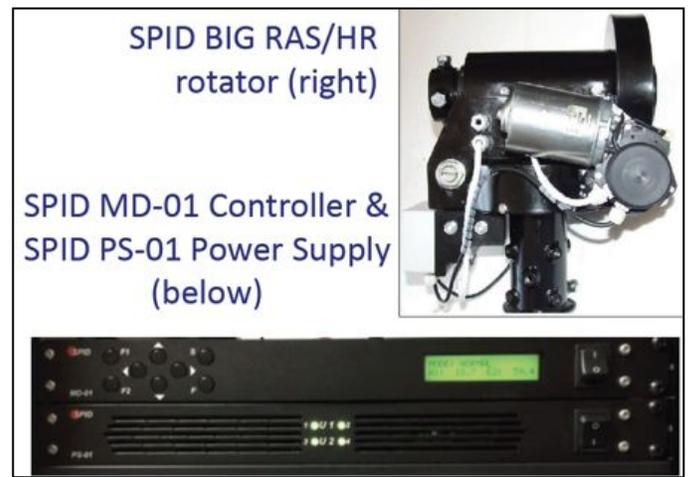


Figure 7: JPL CubeSat UHF tracking station rotator & controller

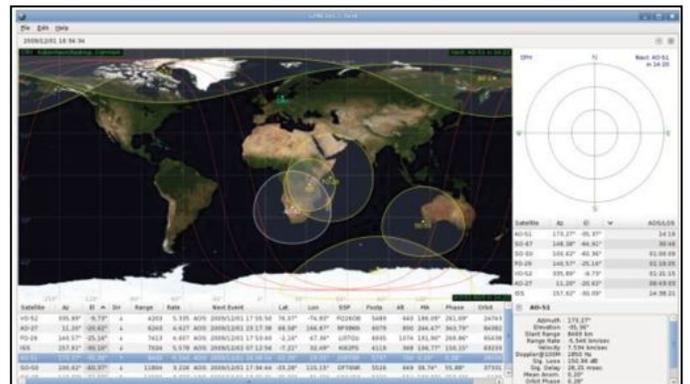


Figure 8: JPL CubeSat UHF tracking software - Gpredict running under Linux.

The UHF tracking station antenna rotator is an SPID BIG RAS/Hr rotator (Figure 7) that has 0.1° resolution and 720° elevation range and 180° azimuth range, with an SPID MD-01 Controller that has serial RS-232, USB &

Ethernet interfaces for automated PC control using the Hamlib suite on Linux.

The UHF tracking station uses open-source Gpredict running under Linux (Figure 8) for satellite pass predictions and antenna control, with Hamlib providing back-end software interface between Gpredict and the antenna rotator.

Total UHF receive gain is 42.2 dBi (21 dBi antenna gain plus 22 dB LNA minus 0.8 dB insertion loss). Total EIRP is ~12.5 kW on antenna boresight (100W amplifier plus 21 dBi antenna gain).

All UHF signal processing, for both uplink and downlink, is handled by GNU Radio (a free, open source software toolkit that provides processing blocks for implementing software radios), and a networked USRP X310 SDR (software defined radio) that provides RF coverage from 50 MHz to 2200 MHz (Figure 9).

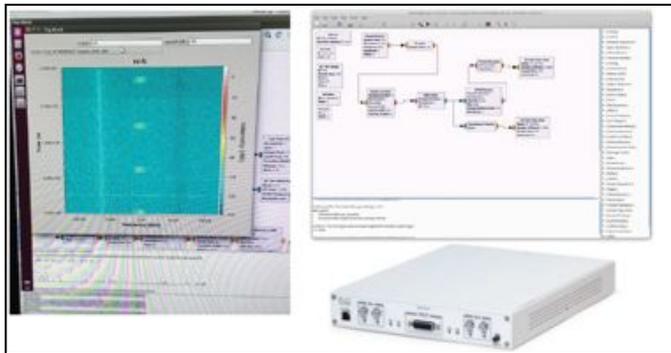


Figure 9: GNU Radio interface (left) and USRP X310 SDR (lower right)

JPL CubeSat Infrastructure, S/X-band Tracking Station (Figure 10): The S/X-band antenna consists of a 10-foot prime focus parabolic mesh antenna inside of a radome, with custom feeds that cover S-band (1.65-2.4 GHz) and X-band (7.1-8.5 GHz) with high gains (35 dBi @ 2 GHz & 46.5 dBi @ 8 GHz), that will be used to support the ASTERIA mission. This antenna has a custom pointing system (still under construction) consisting of COTS (commercial off-the-shelf) servo motors and motor controllers, and uses optical encoders that provide 0.003° accuracy for positioning.

S/X-band signal processing for both uplink and downlink is provided by the GNU Radio software and two networked USRP X310s with frequency coverage from 50 MHz to 6000 MHz. X-band signals down-converted at the antenna feed from X-band to 300 MHz in order to minimize feedline losses. All signaling uses a GPS-referenced 10 MHz clock and 1PPS signals for synchronization and accuracy.

JPL CubeSat Infrastructure, K-band Tracking System (Figure 11): The K-band tracking station uses a 30-inch diameter Cassegrain parabolic dish antenna used for

receive-only from 25.8-26.2 GHz (~62 dBi gain at 26 GHz with the antenna and its low noise amplifier). This station will be used to support the ISARA mission.

K-band receive-only signal processing uses a USRP X310 to capture IF and record data.

The beamwidth of the K-band antenna at 26 GHz is very narrow... about 2° half power beam width so a telescope mounted to the antenna looking at some stars and a local RF reference source are used to calibrate the antenna pointing.

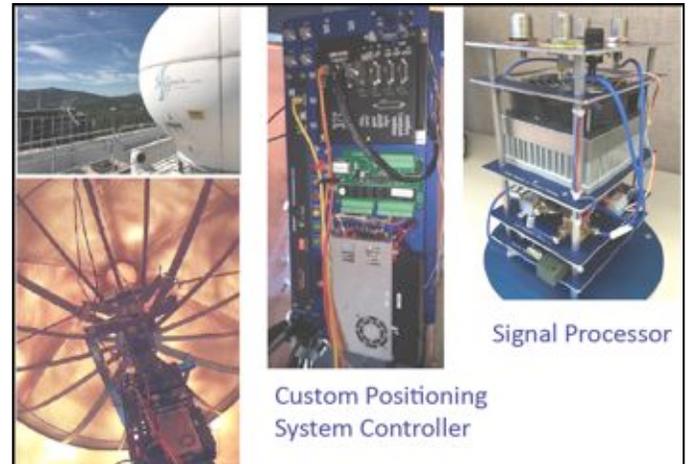


Figure 10: S/X-Band system components (see text)



Figure 11: K-Band tracking components (see text)

JPL CubeSat Ground Station Future Plans: Future plans include more automation (completely automated scheduling and control of RF equipment) that would be web accessible so that operators would no longer need to be physically present at the controls for operations.

These developments could roll over into the JPLARC, featuring the ability to work satellites from your desk at work or from your computer at home (over VPN?).

Adjournment & Upcoming Meetings

The meeting was adjourned at 1:00 PM.

The next Board of Directors meeting will be Friday, April 8 at noon in B180-703C.

The next general membership meeting will be Friday, April 22 at noon in B180-703C. The presentation topic will be on the Altadena Local Emergency Response Team (ALERT).

BOD Meeting April 8th

By Jim Marr AA6QI

Present were: Gary Block† KJ6IZX, Pamela Clark†, Chris Gaylord†* W6YTB, Jim Lux† W6RMK, Josh Miller†* KB3UUS, Rob Smith† W6GRV, Jan Tarsala† WB6VRN. On the Phone: Jonathan Cameron†* KF6RTA, Chris Carson†* KE6ABQ, Jim Marr† AA6QI, Walt Mushagian† K6DNS, Chuck Sarture†* KG6NF.

Note: † indicates a 2016 regular voting member (i.e., JPL/Caltech/Retiree & 2016 dues paid), and * Indicates a 2016 BOD member. For a BOD meeting quorum, the JPLARC Bylaws require a majority of the BOD (four or more) to be present. We had five BOD members present so we **did** have a quorum.

Treasurer's Report: As of March 29, 2016, the treasury balance is \$5,399.02, an increase of \$345.32 over the prior report balance. Income was from memberships (renewals or new) and \$4.00 from ARRL membership commissions. Expenses included \$38.68 for membership cards and \$70.00 for our club PO Box rental.

Secretary's Report: Membership stands at 50 (same as last year), including three who paid at this BOD meeting. ARRL membership stands at 71%.

B329 transmission restrictions: We received a request from Occupational Safety and Pyrolab to restrict radio transmissions from B329 during certain tests at B197 using B329 local antennas (doesn't impact the Mesa antenna farm, once it is connected, or our repeaters). Tests generally occur around 9:30 AM Wednesday's or Thursdays (frequency and exact timing varies). Chris Carson and Chris Gaylord have been added to the notification list for pyro tests so one of them can go up to B329 and put up a notice on the B329 door to restrict transmission from 30 min before to 30 min after. The sign would look like Figure 12.

One potential issue is that the NASA HF net is still on Wednesday mornings, which might require us to transmit from B329 until the Mesa antennas are connected. Chris Gaylord indicated that there is flexibility in the pyro testing schedule so we can negotiate test times when there is an activity that requires transmitting from B329.

VP's report on upcoming presentations: Talks are scheduled through September (see later in this newsletter), with October and November being the only guest speaker slots still open, with a number of potential topics available to fill them.

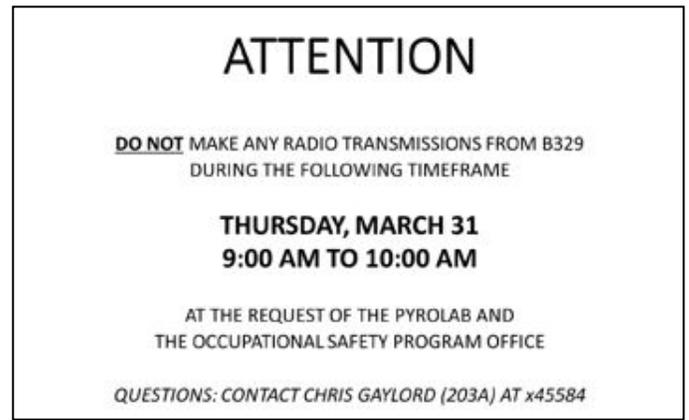


Figure 12: Sign to be posted on the door of B329 during adjacent building pyro testing.

President's Report: B329 roof leak has been fixed and the Cushcraft R-7000 HF antenna is reinstalled on the roof. B329 is cleaned up and ready to use. The phone in B329 may now be working.

One issue is that the Yaesu FT-1000D needs to have it's master oscillator adjusted (it's off frequency). Jan Tarsala, Jim Lux and Courtney Duncan will lead the effort to adjust the oscillator. There was some confusion about which FT-1000D was in B320 so Jonathan will check the S/N's against the equipment inventory to make sure that we know specifically which one has the oscillator issue.

Repeater Committee Meeting: met on March 15th (plan to meet monthly with the next meeting on April 12th). The committee plans to improve current repeater antenna performance by moving the 224.08 and 445.20 repeater antennas to the top of the telephone pole that is adjacent to B35 up on the west end of the Mesa.

Bob Dengler gave an excellent presentation on potential better sites for the repeaters. The committee decided to focus on two options: (1) Mt. Thom or St. Augustine Peak (both city of Glendale) and (2) Cerro Negro (through the EmComm team).

The repeater committee is working towards restoring the capability to rebroadcast the ISS audio on the 147.15 repeater (Jim Lux & Jan Tarsala). The computer is set up and Jan Tarsala has retrieved the audio hardware from Von Karman (installed there on April 18, 1991 and has 219,000 hours of continuous operation & is still going strong). Currently fabricating cables. Should be up in a few weeks.

President's Report: Bill Wood W6FXJ was renewed as the Trustee of the Table Mountain repeaters, WR6AZN, but can no longer go to Table Mountain to make repairs, so we need a volunteer or volunteers to help out. Contact anyone on the Board if you can provide help.

Randy Hammock KC6HUR is willing to help out with

Bill's work on the club web server but will need to be accepted as Guest member by BOD vote. A vote was taken and the BOD approved Guest Membership for Randy.

The JPLARC has been asked to participate in a JPL Fair on JPL Interest and Affinity Groups in the mall sometime in the late Summer or early Fall. We agreed at the last BOD meeting to participate and would staff a table with flyers, demos, etc. Cara Dawn, the organizer, expects a date to be set in the next few weeks. As soon as we get a date, we will get organized. Chris Gaylord said that he ordered a bunch of flyers for JPL Safety Day that we can look at to see if they are relevant for the Fair.

We've been asked to participate in the "Eagle Horizon" Drill at Armstrong Flight Research Center (formerly Edwards) on April 15th (time TBD). The request is from Phil Dolber W6WBT. We have been asked to support 2m contacts via Table Mountain and a 40m contact. We agreed to support this. We plan to arrange coordination/tests on Monday, April 11th. It was pointed out that the link between JPL and Table Mountain is only on 220MHz so linking via 2M would require someone to link the Table Mountain 2M machine with the 220MHz machine (can be done but needs someone to input the proper control codes to the repeater controller).

The leader of the Altadena Emergency Response Team (ALERT), Nancee Darling K8NBD, has applied for a Guest Membership in the JPLARC. The BOD voted to approve her Guest Membership.

Jonathan Cameron is putting together programming files in RT-systems and Chirp formats for programming handhelds for the JPL Emergency frequencies per the card. Frequency cards are available from Jonathan upon request.

Monday Noon net: Going well. On March 28th, had 19 of 23 check-in's coming in through the 224.08 repeater. We plan to do the check-in/check-out procedure on the first Monday of each month. Possible plans for future nets include: Simplex net (at a different time) and Nets during fire drills.

Related Radio Activities: The Pasadena Radio Club (PRC) has a 7pm net on Tuesdays on the W6MPH repeater (145.18; minus offset; 156.7 PL). They also have a regular club meeting on the 4th Tuesday of each Month in the Kaiser building 393 E Walnut St. in Pasadena (see the PRC web site for directions: <http://w6ka.net/monthlymtgs.php>).

The Altadena Local Emergency Radio Team (ALERT) holds a net on Monday's at 8pm (for Altadena and surrounding areas) on the W6MPH repeater, followed by a simplex net on ALTA1 [147.480 MHz]. See <http://altadenaradio.com>.

ARRL Membership:

By Jim Marr AA6QI

As an ARRL affiliated club, we need to maintain at least 51% ARRL membership among our voting members.

While there are no requirements to maintain ARRL membership, there are some clear advantages to having ARRL membership. Some of these are:

- Receiving the monthly QST magazine and having access to all back issues electronically.
- Being able to subscribe to weekly ARRL news, propagation forecasts, and satellite ephemeris notifications.
- Being able to subscribe to the electronic monthly Amateur Radio Emergency Service (ARES) newsletter that may be of interest to members who wish to stay current on emergency communications.
- Member discounts on materials and training. For example, the ARRL Introduction to Emergency Communication Course is \$85 for non-members but only \$50 for members.
- You support ARRL, the only significant amateur radio advocacy organization in the U.S. that is fighting to protect our access to the airwaves.

Should those of you who are not already members and may wish to join, please do so through the Club rather than joining directly through ARRL. Why? If you join through the Club (new members), the Club retains \$15 of your membership fee to support Club activities. From your point of view, the amount you pay is the same either way. Even if you are a member who is just renewing, doing so through the Club nets the Club \$2, again without changing your costs at all.

To renew through the Club, see Secretary Chris Gaylord who will help you with the paperwork (don't worry, it's really simple!).

Thanks in advance for considering joining ARRL or for maintaining your membership.

Equipment For Sale

By Jim Marr AA6QI

The JPLARC Board has approved the sale of the following items and recently approved reducing the asking price by 50%. Please make your best offer to Club Treasurer Chuck Sarture. All equipment is sold as-is with a receipt from the JPLARC.

- ICOM IC-27H 25W 2m FM transceiver, asking \$40, **reduced to \$20.**

- Kenwood TR-9130 all-mode 25W 2m transceiver, asking \$60, **reduced to \$30.**

- ICOM IC-471A all-mode 70cm 25W transceiver with external PS-30 power supply, asking \$100, **reduced to \$50.**
- ICOM IC-471H all-mode 70cm 75W transceiver with internal power supply, asking \$150, **reduced to \$75.**

Future Meetings

By Jim Marr AA6QI

All JPLARC meetings are being held on non-RDO Friday's from Noon to 1 PM in 180-703C. Upcoming talks (subject to change, as always):

May 20th: Jim Marr AA6QI, "Making and using quadrifilar helicoidal antennas for working amateur satellites."

June 17th: Bob Dengler NO6B, "IRLP node on a Raspberry PI."

July 15th: Gary Wong W6GSW, "Winlink Radio Messaging."

August 26th: Chris Gaylord W6YTB, "Great Shakeout Planning."

September 23rd: AMSAT's Patrick Stoddard WD9EWK, "AMSAT Future" (Patrick may be coming out to Pasadena to give this talk).

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2016 JPLARC Organization:

