

# W6VIO Calling

# JPL



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

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Director at Large:	Jim Marr, AA6QI	626-794-9805	WR6AZN Trustee:	Bill Wood, W6FXJ	760-256-9576

## 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 was to be Jan 15<sup>th</sup>, Guest speaker: Chris Gaylord W6YTB speaking on plans for JEARS development in 2016.** Additionally, newly elected club officers begin their term.
- **JPLARC Board of Directors (BOD) meeting:** Normally, the first working Friday, every month, from Noon to 1pm in 180-703C. There will be a **Special Board meeting on December 18<sup>th</sup>** with both the 2015 and 2016 Board members present to coordinate the transition to new leadership. **Also since January 1<sup>st</sup> is a holiday, the next subsequent BOD meeting will be January 29<sup>th</sup>.** Call-in: 818-354-4044 ID-number: **997 183 539** (without the spaces).

## In this issue:

Topics in this issue:

- Regular meeting Nov 20<sup>th</sup>.
- BOD meeting: Dec 4<sup>th</sup>
- 2016 dues due by end of January.
- ARRL Membership
- Equipment for sale
- Future membership meetings & speaker topics

## Happy Holidays to all!



## Regular Meeting Nov 20<sup>th</sup>

By Jim Marr AA6QI

Present were: Jonathan Cameron† KF6RTA, Chris Gaylord† W6YTB, Jim Lux W6RMK, Steve Noland†

WA6KLC, Mike Roche† K6XLK, Rob Smith†\* W6GRV, Steve Townes†\* WB4ILW, Bill Weber† N6CI. On the Phone: Chris Carson†\* KE6ABQ, Dayton Jones K6DJ, Jim Marr†\* AA6QI, Chuck Sarture†\* KG6NF, Walt Mushagian† K6DNS.

Note: † indicates a 2015 regular voting member (i.e., JPL/Caltech/Retiree & 2015 dues paid), and \* Indicates a 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 five BOD members, six other regular members and two non-members (total of thirteen attendees), so we **did** have a quorum.

Future guest speakers: Chris Gaylord is scheduled to talk about JEARS at the January regular membership meeting. Jim Lux offered to talk about an HF receiver for CubeSats. It was suggested that perhaps Courtney Duncan could talk about how to work the Fox-1A satellite (AO-85).

2016 Budget: We will need to work up a proposed 2016 budget via email. Some items mentioned were: What to do about our web presence; replacing our old web servers in 180-R6; possibly buying a DSTAR or Fusion repeater (suggested by Jonathan Cameron).

2016 Officer Elections: Nominating Committee chair Jim Lux presented candidates for 2016 offices: President- no current candidate (but still looking for a volunteer); Vice President- Joshua (Josh) A Miller KK6PQZ; Secretary- Chris Gaylord W6YTB; Treasurer- Chuck Sarture KG6NF. Since there is only one candidate for each of the three positions for which we have candidates, the Bylaws allow for a voice vote. A motion was made and seconded to have a voice vote on these three nominations. All present were in favor and there were no 'nays', so these candidates were elected and will be installed at the January 15, 2016 regular meeting. Steve Townes and Jim Lux will work over the next couple of weeks to identify a president candidate who will need to be elected via a ballot sent to all voting members.

Guest Presentation: Mike Roche K6XLK (Figure-1) "HF Digital Modes".



**Figure 1: Guest speaker Mike Roche K6XLK**

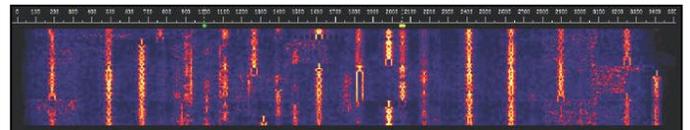
HF digital has perhaps the fastest growing population within amateur radio today and provides opportunities to meet new hams worldwide using stations with only modest power on all bands at all hours of the day. There are lots of digital modes: RTTY, PSK, QPSK, MFSK, Olivia, MT63, JT65, Contestia, Hellschreiber, Throb, Packet, WSPR, SSTV, FreeDV and many, many more! Then there's also CW, the oldest digital mode, that doesn't even require a computer (although computers can do CW).

RTTY (Radio Teletype) is one of the oldest HF digital modes that hams began using after WWII and today is the most popular mode for contests and DX. It can be

heard near 7.040, 14.090 and 21.090 MHz. Originally done using mechanical terminals, now it is virtually always done with computers and sound cards. Hams use 45-baud (the speed) and 170 Hz shift between 'mark' and 'space'. Unlike most digital modes, RTTY is transmitted using LSB (lower sideband).

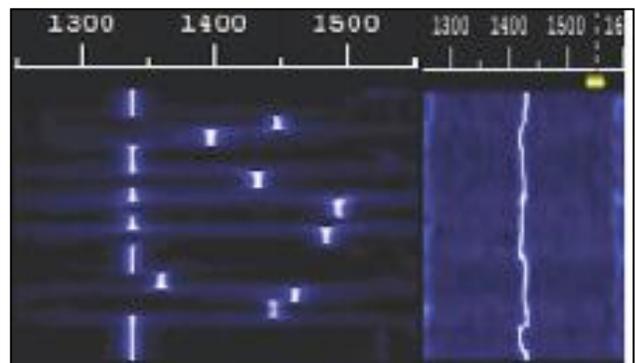
Packet is declining in popularity but can still be heard being used for message forwarding, APRS and live keyboard-to-keyboard QSOs. HF message forwarding can be heard near 14.095 MHz, APRS near 10.150 MHz, and live QSOs near 14.105 MHz. The usual HF baud rate is 300 and 1200 or 9600 baud is used on VHF and UHF. Packet BBS/forwarding can be heard around 14.100 MHz.

PSK31 is the undisputed king of digital modes (PSK stands for Phase Shift Keying). Debuted in 1999, it remains the most popular digital mode and can be heard near 3.580, 7.070, 14.070 and 21.070 MHz. There is a wealth of information on BPSK (binary PSK) and QPSK (Quadrature PSK). Because the bandwidth is only 31 Hz, many signals can fit into the bandwidth of a single SSB signal (~2.4 kHz). It is quite common to see 15 or more signals on a 2.5 kHz waterfall display (Figure-2).



**Figure 2: PSK31 waterfall display.**

JT65/JT9 QRPp (power levels less than 1W) and weak signal mode. JT65 uses 65 shifts in 355 Hz bandwidth. JT9, a fairly new mode, uses 9 shifts in 15.6 Hz bandwidth so sounds like a constant tone. These are very slow modes, taking about 45 seconds to send 72 bits or about 13 characters. Standard messages typically contain two call signs, a grid locator or signal report and the message type.



**Figure 3: JT65 (left) and JT9 (right) waterfall displays**

Tips for getting started in digital modes. Tip-1: Digital modes are typically 100% duty cycle modes, often with long duration transmissions, so keep power levels low to avoid damaging your radio's finals. Tip-2: Overdriven

audio is the most common cause of band splatter and is easy to avoid by reducing audio drive levels to below the level that triggers your transceiver's AGC threshold (i.e., no AGC action). Tip-3: Check your sound card settings in the control panel -- turn off special effects, turn off pass-through or "listen to this device" modes, and set rate to 16 bit 48,000 Hz.

Designing an HF digital station: Most HF amateur modes are sound card based, which has the advantage that once you've wired your station for one HF mode, you can work another just by selecting a different mode in the software. Figure-4 shows an example of an HF digital station.



Figure 4: One possible digital mode HF station.

Software: FLDIGI is good for all modes except JT65.

### JT65

JT65 - What is it? It's a form of digital communication originally developed by Joe Taylor K1JT for moon-bounce applications where signals are extremely weak. JT65 uses sophisticated signal processing with redundancy (sends the information over and over).

JT65 - How does it work? Recall from above that a JT65 message consists of 72 bits comprising 13 characters. These 72 bits are augmented with 306 uniquely defined error-correcting bits and the 378 resulting bits are divided into 63 six-bit symbols. These symbols are interleaved and Gray coded (shuffled) to make them more tolerant of frequency instabilities. Every six-bit symbol is represented as one of 64 audio tones. A 65<sup>th</sup> synchronization tone (1270.5Hz) is also defined. The tones are constant amplitude, sinusoidal and each is comprised of 4096 samples at 11025 samples/second. The tones are sent in 126 contiguous 0.372-second time intervals with phase-continuous tone transitions. The synchronization tone is inserted between the symbol tones at fixed pseudo-random positions and autocorrelation of the synchronization tones provides an accurate time sync pulse.

Timing is everything: Each message takes exactly 46.8 seconds to send and is sent starting at precisely one-second after the UTC minute rollover (requiring station clocks to agree to within about two seconds) and is followed by a 12.2-second gap. As much as 80% of the transmission can be lost and still be decoded.

JT65 - what is sent: Station call sign; station Maidenhead (grid) locator; signal strength report; acknowledgement and goodbye. An example QSO might go something like this: At 0317: CQ N6XLK DM04; at 0318: N6XLK KH6DL BL11; at 0319: KH6DL N6XLK -07; at 0320: N6XLK KH6DL R-04; at 0321: KH6DL N6XLK RRR; at 0322: N6XLK KH6DL 73; at 0323: KH6DL N6XLK 73. JT65 setup procedures can be found at: <http://jt65-hf.com/files/jt65-hf-setup.pdf>. A typical JT65 application window is shown in Figure-5.

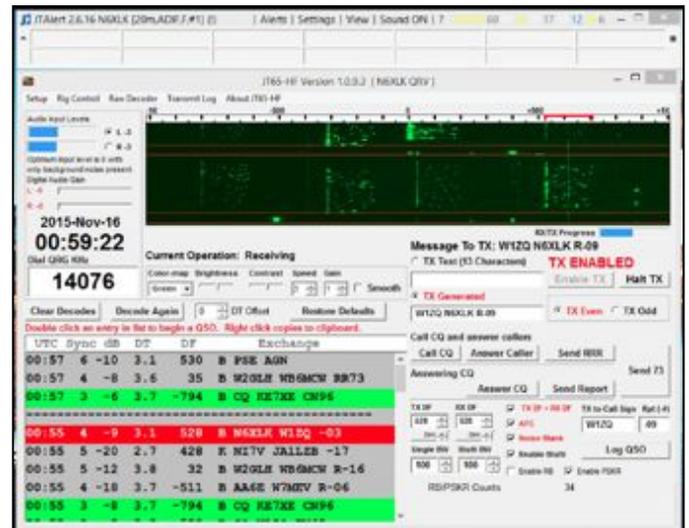


Figure 5: A typical JT65 window showing a QSO in progress.

JT65 Advantages: JT65 is brilliant for working weak stations that you can't even hear, providing 10 to 15dB gain over experienced CW operators, with only 10 to 15-seconds of copy of a message being actually required. QSOs with no language barriers; no conversational skills required. Efficient use of bandwidth: 20 stations in one 3kHz HF channel. Fixed calling frequencies so no need to tune all around the band. Fascinating to watch the activity from all around the world. Augmented by on-line DX maps and clusters.

JT65 Disadvantages: Warning: transmitting continuous tones may damage your transmitter if your transmit power is up too high. Steep learning curve using poorly written documentation makes it tricky at first. Time consuming - like watching cricket in slow motion. Can't rag chew, unless you can in 13 characters or less. Easy to get distracted and miss the action; making a cup of coffee leads to on-air confusion. Time critical, needing accurate computer time from the internet. Frustrating: only 12.2 seconds to make QSO decisions; miss it and you'll have to wait two minutes or longer. Subject to QRM from inexperienced or inconsiderate operators.

JT65 Operating Procedures - Working Stations: Listen for at least four minutes to determine which frequencies and time slots are in use. Check the DT (time delta

relative to your own clock) of received signals: if they are all out, your computer's clock may need synchronization. Only respond to messages received in the last minute; the rest is history. Don't call a station until after the last 73 or a new CQ, whichever comes first. Call a station on a free frequency if he was not using his own frequency. Stop answering a CQ if the other station stops calling CQ or is in a QSO.

JT65 Operating Procedures - Calling CQ: Check the waterfall and history for a free frequency. Only call CQ on a frequency that has been unused for at least four minutes and don't overlap anyone else's frequency. Don't call (or answer) a CQ forever; wait for two minutes to see if your frequency and time slots are in use. To answer a reply to your CQ, send their signal report, get your signal report, send RRR, get 73, send 73; a QSO isn't over until both 73's have been sent. Wait for two minutes before calling CQ again to make sure that the frequency is clear. Don't use free text at all, as it's confusing.

JT65 Hints and Tips: Check your time sync status. Do not use AGC. Use the widest receiver IF bandwidth available. Don't use pass-band tuning (PBT), notch filter, noise blanker, or noise reduction. Test and tune-up during the 12.2-second time gap. Check for doubling if you don't get a response the first time. Call back on a clear frequency if QRM is present or if the original one is still in use. Manually select the next message; don't blindly click on each response. Don't call a station in the middle of a QSO. Call only after a CQ or only after both 73's have been sent.

JT65 frequencies (all USB): 1838kHz, 3576kHz, 7076kHz, 14076kHz, 10139kHz, 18102kHz, 21076kHz, 24920kHz, and 28076kHz.

### PSK31

PSK31 Background: Digital mode designed by Peter Martinez G3PLX. Based upon RTTY mode of operation and intended for keyboard-to-keyboard QSOs. Offers an effective speed of 50 wpm and is exceptionally well suited for QRP (low power operations), although it does not offer error free communications.

PSK31 Concepts Introduction: The 128 ASCII character set is Varicoded. Like Morse Code, Varicode allocates the shorter codes to the more common characters. With an average of 6.5 bits per character, a bit rate of 32 bits per second can transmit at about 50 words per minute. Martinez chose 31.25 bps because it can be easily derived from the 8 kHz sample rate used in many DSP (digital signal processing) systems.

PSK31 Frequencies: 3580kHz, 7040kHz, 14070kHz, 21070kHz, 28120kHz.

### References:

• ARRL HF Digital Handbook, 4th Edition ... Available on-line at ...

<http://www.arrl.org/shop/ARRL-s-HF-Digital-Handbook/>  
 • Digital Technology For Emergency Communications Course ...  
<http://www.arrl.org/shop/ARRL-Digital-Technology-for-Emergency-Communications-Course/>  
 • VHF Digital Handbook ... <http://www.arrl.org/shop/ARRL-s-VHF-Digital-Handbook/>  
 • G4UCJ website ...  
[http://www.hfradio.org.uk/html/digital\\_modes.html](http://www.hfradio.org.uk/html/digital_modes.html)  
 • Steve Ford, WB8IMY ... Inspiration, championing and contributions to this presentation  
 • NUE-PSK Digital Modem ... "We don't need no stinkin' PC!" ...  
<http://www.nue-psk.com> (W8NUE, N2APB, AD7JT)  
 • FLDIGI ... <http://www.w1hjk.com/download.html>

## BOD Meeting Dec 4<sup>th</sup>

By Rob Smith W6GRV

Present were: Jonathan Cameron† KF6RTA, Chris Gaylord† W6YTB, Rob Smith†\* W6GRV. On the Phone: Chris Carson†\* KE6ABQ, Jim Marr†\* AA6QI, Walt Mushagian† K6DNS.

Note: † indicates a 2015 regular voting member (i.e., JPL/Caltech/Retiree & 2015 dues paid), and \* Indicates a BOD member. For a BOD meeting quorum, the JPLARC Bylaws require a majority of the BOD (four or more) to be present. We had three BOD members and three other regular members (total of 5 attendees), so we **did not** have a quorum.

### Discussion:

Nominating committee: We do not have any updates from the nominating committee regarding a club president for 2016.

### Budget:

A new generator was suggested to replace the 19070's vintage 2KW generator. The 2KW Honda model i2000 was proposed. If we do choose to buy one of these, it must be properly maintained in order to remain serviceable.

The club currently has 2 generators. One is a 1980's Honda EM2200X 2KW generator that is really quite noisy (as those who have been at Field Day the last two years know), and the other one is a somewhat newer Honda EX1000 1KW generator (not as noisy). In preparation for the recent field day(s), Jim Marr rebuilt/cleaned-up these generators. If they are not properly put away (i.e., gasoline drained from tank and carburetor) and then left to sit too long (such as a year), the gas will solidify and clog their fuel systems (which happened to both generators prior to the 2014 Field Day).

It was suggested that the club budget for replacing the computer that hosts the club website, reflector, EchoLink, and possibly other capabilities. Bob Dengler is the best contact for the computer and its' software.

Jonathan offered to work with Bob get the computer replaced in the new-year.

Jim Marr will make an initial cut at an updated budget and send it out to the current and in-coming board members for review.

#### General Meeting Presentation:

For the general club meeting in January (1/15/2016), Chris Gaylord will be presenting on JEARS.

Jonathan Cameron suggested we request the Altadena Emergency Response Team present on their "ALERT" response team. Jonathan will contact Nancee Darling K8NBD - a member of the Altadena ALERT team and the Pasadena Radio Club. Potential club meetings for this presentation are Feb, Mar, Apr, or possibly May.

Field Day prep will be either in May or June.

#### Transition of responsibilities from Bill Wood:

Jim Marr offered to pick up the historical material from Bill Wood and deliver it to Jonathan Cameron. Jonathan offered to put the material into the new trailer next to the new shack.

Jim Marr will check with Bill Wood to see if he is interested in continuing at the trustee for the JPLARC WR6AZN repeaters on Table Mountain when the FCC license comes up for renewal in June 2016. Bill is the person who set up the equipment and is the control operator for the repeaters.

The club has a repeater link between the JPL WR6JPL and the JPL WR6AZN repeaters that is located in the sheriff station in the City of Industry. It was discussed that someone should visit the site, make contact with individuals at the site, and verify that a copy of the current license is posted with the equipment. It was mentioned that there have been changes in L.A. County DCS leadership and it would be good to talk with the individuals at this sheriff station regarding the continued hosting of the repeater equipment. Chris Carson mentioned that the last time someone visited the site (in response to a repeater issue), they found a water leak that the station did not know existed and potentially save them some additional equipment damage. This was about 10 years ago.

Chris Gaylord will talk to Bob Dengler about the site.

#### Move out of Bldg. 173:

Most items have been moved out of building 173 and into trailer next to the new shack.

A UHF/VHF antenna is setup at the shack. Need to hook up the dual band antenna to a UHF/VHF radio.

Would like to get the HF radio connected to an antenna. The club currently has two Cushcraft R7000 HF trap vertical antennas (40m thru 10m). One is setup at

building 173 and needs to be moved. The second was behind the filing cabinet (in B.173) but has probably now been moved up to the new trailer. Chuck Sarture knows how to set them up.

The club has two Yaesu FT-1000D HF radios. One is still set up in B.173. The other is in a box that was in B.173 that also has likely been moved up to the new trailer. There is a CAT (computer aided transceiver) cable in the box with this radio that is essential for Field Day so be sure not to lose this cable).

Jonathan has setup a work party for December 5th at 11 AM to possibly move or begin to move the setup Cushcraft R7000 antenna

HF cables to antennas on the mesa: The end at the shack terminates in a connection box. The end up the hill is wrapped in plastic and needs have connectors attached. Someone should check the connectors up the hill to be sure they are wrapped well enough to withstand a storm. Connecting these to the antennas will be a more involved job since there are multiple connectors and the antennas up the hill need to be checked out.

#### Club ARRL Membership:

The JPL ARC is an ARRL affiliated club. Membership information needs to be updated annually with the ARRL. Jim Marr will work with Chris Gaylord (incoming club secretary) to update the club membership info with ARRL.

#### 445.200 repeater

Jonathan mentioned that he was hearing a periodic high static noise burst on the repeater output. With 2 radios in the room, the noise was observed to occur at the same time. Those on the phone did not hear the noise bursts on their equipment at their QTH. It was thought to possibly be a local noise source near the room or somewhere at the laboratory.

#### Board member transition:

In January, the first board meeting falls on a holiday (January 1<sup>st</sup>). The next meeting is the general club meeting on January 15th, where the new board will take the helm. It has typically been that the old board and the new board meet during the first board meeting in January and the new board is installed at the following general club meeting in January. It was suggested that the current board and old board meet on December 18, 2015 to discuss transition of responsibilities.

Additionally, Jim Marr encouraged the new board members to download and read the club bylaws.

Some items for the new board include: Committees and Committee appointments. Appointing the director at large (Traditionally the outgoing president) and the Emergency Communications Manager (has been Chris

Carson for some time now).

## 2016 Dues Due 1/31/16

By Jim Marr AA6QI

Article IV, Section 1 of the JPLARC Bylaws states: The amount of annual dues shall be determined by the Board of Directors and shall be due 1 January and **payable no later than 30 January to the Treasurer**. The Board of Directors has chosen to leave the dues at \$20 for 2016.

To join or renew your membership, fill in the membership application form located at <http://jplarc.ampr.org/applic.pdf> and return it to the club Secretary along with your dues.

Those who are not active JPL or Caltech employees must sign the liability waiver located on the reverse side of the application form. Active JPL or Caltech employees do not need to sign this waiver.

## ARRL Membership:

By Jim Marr AA6QI

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

As of October 19, 2015, of our 50 CY2015 members, 35 (72%) are either Life (7) or Regular (29) ARRL members. Note that 73% of our 45 voting-eligible members (i.e., JPLARC Regular members) are also ARRL 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 Rob Smith 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 sale of the following items of surplus JPLARC equipment was approved by the quorum present at the October 24, 2014 regular membership meeting. Please make your best offer to Club Treasurer Chuck Sarture at JPL. All equipment is sold as-is with a receipt from the JPLARC.

- ICOM IC-27H 25W 2m FM transceiver, asking \$40.
- Kenwood TR-9130 all-mode 25W 2m transceiver, asking \$60.
- ICOM IC-471A all-mode 70cm 25W transceiver with external PS-30 power supply, asking \$100.
- ICOM IC-471H all-mode 70cm 75W transceiver with internal power supply, asking \$150.
- ICOM AG-35 70cm mast mounted preamp, asking \$10.

## 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):

**2016 meeting presentations:** The Board is seeking ideas for 2016 regular membership meeting guest speakers. If you have suggestions or are willing to give a talk yourself, please contact Steve Townes as soon as you can to give the Board time to make arrangements with the speaker(s). Thanks in advance for your help with this.

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