
SIGNALS

Rockwell
Collins **Amateur Radio Club**

Monthly Newsletter of the

Volume 36 Issue 1

Web Site <http://www.w5rok.us>

October 2014

RCARC Membership Meeting

Tuesday 28 October 2014
1700 Social 1730 Meeting
1800 Program

Methodist Richardson Medical Center
At Bush/Renner/Shiloh Intersection
Second Floor Conference Room 200

Subject:
Program TBD

their time and vehicles to patrol their neighborhoods and report all suspicious activities to the Police Department. Many members also patrol on foot or bicycle. This program is to observe and report activity only.

From Frank Krizan KR1ZAN

I attended the ARRL National Centennial Convention at Hartford, CT this past July, and, while touring the ARRL Labs, I noted this inside the "Screen Room". Sort of like the WW-II slogan: Kilroy was here! (Contributed by Frank KR1ZAN)



Local Club News

Meeting Notice

The program for this month was not finalized when the newsletter was ready for publication, but the meetings are always great, so see you on the 28th.

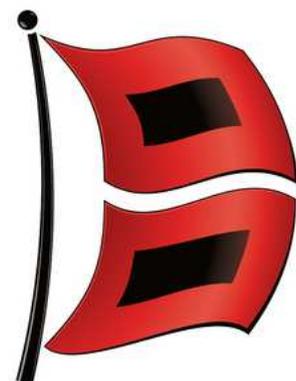
RCARC Community Service Activities

Siren Testing Dennis Cobb WA8ZBT, Chris Havenridge KF5GUN, John McFadden K5TIP and Jim Skinner WB0UNI participated in the Richardson emergency siren testing on 1 October 2014. The testing was cancelled shortly before noon, reportedly due to lack of personnel qualified to operate the sirens. The siren testing is performed on the first Wednesday of each month. The sirens are monitored by amateur radio operators and reports made using the Richardson Wireless Klub (RWK) repeater at 147.120 MHz.

Crime Watch Patrol Jim Skinner WB0UNI participated in Richardson Duck Creek Crime Watch Patrol (CWP) each Tuesday of September. CWP members, after successful completion of mandatory Crime Watch Patrol Training, conducted by the Richardson Police Department, volunteer

Radio Amateurs Play a Role in Separate Storm Responses

Amateur Radio volunteers activated on opposite ends of the US late last week and over the weekend as separate hurricanes struck Bermuda and Hawaii. Both regions were prepared and fared well with no deaths, serious injuries, or major property damage reported. (Continued on page 5)



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461-290

Beltline Rd. Testing begins at 1900 hrs in room 12. Enter through the Northern most door on the east side of the church building. For further information contact Dave Russell W2DMR, at 972.690.9894 or E-mail warhog4@tx.rr.com.

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President's Message

VE SESSIONS

Dallas tests are held 4th Sat of each month at 1000 hrs. 13350 Floyd Rd. (Old Credit Union) Contact Bob West, WA8YCD 972.917.6362

Irving tests are held 3rd Sat of each month at 0900. Fifth and Main St. Contact Bill Revis, KF5BL 252-8015

McKinney VE test sessions are held at the Heard Museum the first Sunday of the month. The address is 1 Nature Place, McKinney TX. The time of the testing is 1430, ending no later than 1645. **Note: no tests given on holiday weekends.**

Garland testing is held on the fourth Thursday of each month, excluding November, and begins at 1930 sharp. Location is Freeman Heights Baptist Church, 1120 N Garland Ave, Garland (between W Walnut and Buckingham Rd). Enter via the north driveway. A HUGE parking lot is located behind the church. Both the parking lot and the Fellowship Hall are located on the east side of the church building, with big signs by the entrance door. Contact Janet Crenshaw, WB9ZPH at 972.302.9992.

Plano testing is on the third Saturday of each month, 1300 hrs at Williams High School, 1717 17th St. East Plano. Check Repeater 147.180+ for announcements.

Greenville testing is on the Saturday after 3rd Thursday, 1000 hrs at site TBA, contact N5KA, 903.364.5306. Sponsor is Sabine Valley ARA. Repeater 146.780(-) with 118.8 tone.

Richardson The Richardson Wireless Klub (RWK) VE team hold license testing on the third Thursday of each month at St. Barnabas Presbyterian Church, 1220 West

THIS SPACE RESERVED FOR PRESIDENT'S AND/OR VICE-PRESIDENT'S MESSAGE

Secretary's Report

23 September 2014

The meeting was called to order by Vice President Mike Schmit WA9WCC at 1732.

The following members and guests were present at the meeting:

Jim Brown	AF5MA
George Huling	K5GH
Dave Jaksa	W0VX
Judi Jaksa	W0JJ
John McFadden	K5TIP
Steve Phillips	K6JT
Mike Schmit	WA9WCC
Jim Skinner	WB0UNI

Officers and Committee Reports:

President's Report: There was no formal President's Report.

Vice-President's Report: There was no formal Vice President's Report.

Secretary's Report: The Secretary's Report is in this newsletter.

Treasurer's Report: There was no formal Treasurer's Report.

Website Manager's Report: There was no Website Manager's Report.

Station Trustee's Report: There was no Station Trustee's Report.

Database Manager's Report: There was no Database Manager's Report.

Old Business:

Mike Schmit reported that Dennis Cobb WA8ZBT will get the Elecraft K-3 repaired using funds approved at last month's meeting.

New Business:

RCARC officers for the new club year were nominated and elected. Nominations were:

- Mike Schmit WA9WCC for President
- Jim Brown AF5MA for Secretary
- Mike Montgomery WD5TX for Treasurer

There were no nominations for Vice President. The slate of candidates was accepted and all nominees were elected by unanimous vote of members present.

Jim Skinner WB0UNI volunteered to investigate the requirements for the annual submittal to Rockwell Collins to maintain club funding.

Adjournment:

The meeting was adjourned at 1744 and followed by a program from member Dave Jaksa W0VX on "The Why and How of CW Operating."

The next meeting will be at 1730 on Tuesday, 28 October 2014.

Understanding Antennas For The Non-Technical Ham - Part 2

Each month for the next year or so, we are including in **SIGNALS** excerpts of a book by Jim Abercrombie – N4JA (SK) on antenna design. This series is being published in the **Majors Field Amateur Radio Club newsletter**, "Airwaves," by our ham radio brother, Michael Ketchum, K5MDK. We are following his lead. The book is available online for free and can be located at <http://www.hamuniverse.com/basicantennas.pdf>. Now, part 2...

Understanding Antennas for the Non-Technical Ham

A Book By Jim Abercrombie, N4JA (SK)

Illustrations by Frank Wamsley, K4EFW

Edited by Judy Haynes, KC4NOR

Copyright July 2005. Second Edition

Edited for the web , N4UJW

The dipole antenna is made of a wire broken in the center and where broken, each half of the wire connects to an insulator that divides the wire in two. Two wires from the voltage source, which is the transmitter, are connected across the insulator. On one side of the dipole, the current in the form of moving electrons flows first from the voltage source toward one end of the dipole. At the end, it reflects toward the voltage source. The same thing occurs on the other half of the wire on the other half cycle of alternating current. An antenna that is the right length for the current to reach the far end of the wire just as the polarity changes is said to be resonant. Because electricity travels at 95% the speed of light in a wire, the number of times the polarity changes in one second (frequency) determines how long the wire has to be in order to be resonant.

III. POLARIZATION OF ELECTROMAGNETIC WAVES

Electromagnetic waves travel away from the wire in horizontal, vertical, slanted, or circular waves. If the antenna wire runs horizontal or parallel to the earth, the radiation will be horizontally polarized. A wire or conductor that runs at right angles to the earth produces vertical radiation. A slanted wire has components of both horizontal and vertical radiation. Crossed wires connected by proper phasing lines that shift the phase from one wire to the other wire by 90 degrees will produce circular polarization. Amateurs working orbiting satellites at VHF, UHF, and microwave frequencies use circular polarization.

When your high frequency signals are reflecting off the ionosphere, it isn't important if the other stations antenna

has the opposite polarization from yours (the polarization does matter for line of sight communication). The reflected polarized waves passing through the ionosphere are slowly rotated causing fading signals (QSB). The reason the polarization of antennas is most important is that it determines the angle of radiation. Horizontally polarized antennas at ordinary heights used by hams produce mostly high angle radiation and weaker low angle radiation, but this doesn't mean there is no low angle radiation. It is there but is weaker than high angle radiation. However, you must put a horizontally polarized antenna up more than one-wavelength high to get a strong low angle radiation. One wavelength is 280 feet on 80 meters, 140 feet on 40 meters, and 70 feet on 20 meters. High angle radiation works nearby stations best and low angle radiation works distant stations (DX) best. A vertically polarized antenna produces mostly low angle radiation, with its high angle radiation being weak. For this reason, vertical antennas do not work as well as horizontal antennas do at ordinary heights for working stations less than about 500 miles away.

IV. FREQUENCY

The number of times the polarity of an AC voltage changes per second determines its frequency. Frequency is measured in cycles per second or Hertz (Hz). A thousand cycles per second is a kilohertz (kHz). One million Hertz is a Megahertz (MHz). The only difference between the 60 Hz electric power in your house and radio frequencies (RF) is the frequency, but 60 Hz electricity in a wire also produces electromagnetic radiation just like radio waves. Useful radio waves start at 30 kHz and go upward in frequency until you reach the infrared light waves. Light is the same kind of waves as RF except light is at a much higher frequency. Light waves are used like radio waves when they are confined inside fiber optic cable. Above the frequencies of light are found x-rays and gamma rays. The radio bands: The Long Wave Band (LW) starts at 30 kHz and goes to 300 kHz. The Medium Wave Band (MW) is from 300 kHz to 3000 kHz or 3 MHz. The High Frequency Band (HF) is from 3 MHz to 30 MHz. The Very High Frequency Band (VHF) is from 30 MHz to 300 MHz. The Ultra-High Frequency Band (UHF) is from 300 MHz to 3000 MHz or 3 GHz. Above these frequencies are several microwave bands which are defined as the Super High Frequency Band (SHF).

V. THE IONOSPHERE AND MODES OF HF PROPAGATION

The Ionosphere

In the upper air around fifty miles and higher where the air molecules are far apart, radiation from the sun strips electrons from oxygen molecules causing the molecules to become ionized forming the ionosphere. The ionized oxygen molecules and its free electrons float in space forming radio-reflecting layers. Ionization of the ionosphere varies by the time of day, seasons of the year, and the sunspot cycle. The strength of ionization also varies from day to

day and hour to hour. Since the height of the ionosphere varies, the higher the ionized layer becomes, the farther the skip will be. We will define skip in section 5 of part V.

The part of the earth's atmosphere called the ionosphere is divided into three layers. The three layers are, from lowest to highest, the D layer, the E layer, and the F layer. Each layer has a different effect on HF radio propagation.

Being at a lower altitude, the D layer molecules are squeezed closer together by gravity than those in higher layers, and the free electrons reattach to the molecules easily. The D layer requires constant radiation from the sun to maintain its ionization. Radio waves at lower frequencies such as the frequencies of the AM broadcast band cannot penetrate this layer and are absorbed. The higher frequency signals are able to pass through the D layer. The D layer disappears at night causing AM broadcast stations to reflect from the higher layers. This is why AM broadcast signals only propagate by ground wave in the daytime and they can be received from great distances at night. Like the broadcast band, the D layer absorbs signals on 160 and to a lesser extent 80 meters during the day making those bands go dead. During solar flares, the D layer becomes ionized so strongly that all high frequency radio waves are absorbed, causing a radio blackout.

E-layer propagation is not well understood. Being at a lower altitude than F layer, the E layer is responsible for summertime short skip propagation on the higher high frequency bands. The skip zone is around 1000 miles, but at times when the E-cloud covers a wide area in the summer, double hops can be seen. A double hop occurs when the signal reflects from the ionosphere, then returns to the ground, reflects from the ground back to the ionosphere where it is reflected back to the ground. A double hop can propagate the signal 2000 miles or more. The E-layer forms mostly during the day, and it has the highest degree of ionization at noon. The E layer like the D layer disappears at night. Even so, sporadic-E propagation can and does form at night. There is a minor occurrence of sporadic E propagation during the wintertime. On rare occasions, sporadic E propagation can surprise you by occurring anytime regardless of the sunspot cycle or the season of the year.

The F layer is the highest layer and it is divided into two levels: F1 and F2. At night the F1 and F2 merge into one layer. During the day, the F1 layer doesn't play a part in radio propagation, but F2 does. It is responsible for most high-frequency long distance propagation on 20 meters and above. However, the F layer makes it possible for you to work DX on the lower bands at night. Sunspots are responsible for the ionization layers and in years with high sunspot numbers, worldwide contacts can be made easily on 10-20 meters by F2 layer propagation. In years of low sunspot numbers, working distant stations is difficult on those bands. Consequently, ten and fifteen meters will be completely dead most days and twenty meters will go

dead at night. In years of low sunspot numbers DX contacts are easily made at night on 160, 80, and 40 meters. The sunspot numbers increase and decrease in 11-year average cycles.

Since the curvature of the earth averages about 16 feet every 5 miles, an object 5 miles from you on perfectly flat earth will be 16 feet below the horizon. Because light travels in straight lines, you cannot see objects beyond the horizon. Radio waves travel in straight lines, but there are ways to get them beyond the horizon. This is referred to as propagation.

Radio Amateurs Play a Role in Separate Storm Responses

Hurricane Gonzalo

Hurricane Gonzalo, the stronger of the two storms, was a Category 3 hurricane when it made a near-direct hit on Bermuda on Friday, October 17. The Hurricane Watch Net (HWN) and the VoIP Hurricane Net (VoIPWX) gathered ground-level weather information from the island and funneling it to the National Hurricane Center's WX4NHC. Forecasters use these reports to better predict a storm's path or intensity. Hurricane Specialist Stacey Stewart used several Amateur Radio reports in NHC advisories, statements, and discussions, Assistant WX4NHC Coordinator Julio Ripoll, WD4R, said.

The HWN opened on Thursday, October 16, and stayed up for some 41 hours. The net used a primary frequency of 14.325 MHz and switched to 7.268 MHz as conditions warranted.

"It was a report from John [Stevens], VP9NI, that let us know the eye had made landfall on Bermuda," HWN Manager Bobby Graves, KB5HAV, reported. "His report made the 9 PM AST Tropical Cyclone Update." Graves said VP9NI's reports confirmed barometric pressure observations by Hurricane Hunter aircraft, and the NHC mentioned his call sign in its update. VP9NI's battery finally gave out just before midnight on Saturday, he added.



Only a weekend earlier, Tropical Storm Fay had hit Bermuda, and Graves said he learned during the Gonzalo activation that Fay had dealt Bermuda a bigger blow than he'd first heard. "Many hams had lost their antennas," he said, while other hams' antennas were seriously damaged. Some radio amateurs on Bermuda

quickly constructed makeshift antennas in preparation for Gonzalo.

"Craig [Nikolai], VP9NL, was able to give us reports in the evening, as he only had a 40 meter dipole with one leg

barely off the ground," Graves recounted. "John, VP9NI, gave us many reports on 20 meters until losing commercial power. With only a 20 meter NVIS antenna about 5 feet off the ground and using the battery from a computer UPS, John was able to continue feeding us reports hourly on 20 and 40 meters while running about 12 W." Other stations checking into the HWN included Glen Cuoco, VP9ID, and Ed Kelly, VP9GE. "Giving stations in the affected area advance notice of activation plans and gathering data as to what type of antenna and power output to expect really paid off," Graves added.

At WX4NHC, Julio Ripoll, WD4R, and Paul Hunt, K1MJS. [Julio Ripoll, WD4R, photo]

Nearly all of Bermuda's residents lost power, dozens of roads were blocked by downed trees and limbs, and some damage to structures was also reported.



Rob Macedo, KD1CY, Director of Operations for the VoIP Hurricane Net, which also activated for Gonzalo, said that while its key Amateur Radio contact was not on Bermuda, it was able to gather many reports from storm bloggers on the Caribbean Hurricane Network, social media outlets, and Weather Underground personal weather stations.

"We had constant contact with Marion Dyer in Pembroke, Hamilton, Bermuda, through the WhatsApp software via cell phone, and Cell One Bermuda service did remain up throughout the hurricane," Macedo said. Macedo said the VoIP Hurricane Net also received post-hurricane reports and photos from Dyer from around Bermuda.

Hurricane Ana

In Hawaii, the passage of Category 1 Hurricane Ana over the weekend was less dramatic, and the storm skipped the most-populated island of Oahu for the most part. ARRL Pacific Section Manager Bob Schneider, AH6J, reported that ham radio volunteers supported shelter communications as Ana passed by Hawaii, causing heavy rain, large waves, and some minor flooding.

"A request came from American Red Cross to deploy to the shelter at Ka'u High School in Pahala," Schneider said. The school is in the southeastern edge of the Big Island. "Sean Fendt, KH6SF, and I drove 45 miles and set up HF and VHF communications." (Sean Fendt's wife Kimberly, WH6KIM, is the East Hawaii DEC.)



Sean Fendt, KH6SF, at the Kau High School shelter. [Photo courtesy of Bob Schneider, AH6J]

"The shelter manager

was very happy to see us, because in the last [weather] event they lost power and communications and had a full house. This time it was almost a non-event with the hurricane staying offshore to the south and west. There was quite a bit of rain and one road closure due to flooding. One couple that stayed in the shelter last night had been through several typhoons in Japan and didn't want to take any chances, even though later forecasts showed tracks well offshore."

Schneider said those later forecast tracks did not reveal the large amount of rain the storm brought along. The ARES volunteers primarily used HF on 40 meters, although they also made use of a VHF repeater that was linked to the Big Island Wide Area Repeater Network (BIWARN).

"We sent a couple of voice messages to SKYWARN headquarters located at NWS in Honolulu," Schneider recounted. "Other weather spotters were using mostly Fldigi for messages to NWS. We were happy that there were no serious problems and power stayed up." Read more. -- Thanks to the Hurricane Watch Net, the VoIP Hurricane Net, ARRL Pacific SM Bob Schneider, AH6J, and The Daily DX.

(Reprinted from The ARRL Letter for October 23, 2014)

Two interesting Daily 40 Meter HF Nets

Central States Traffic Net 7.253.5 MHz 12:30 PM local. Pre-Net starts at noon.

7290 Traffic Net Meets M-F, 7.290 MHz 10AM-12 Noon local & 1 PM to 2PM local and on Saturday 10AM-12 Noon. <http://www.7290trafficnet.org/> *(This is a correction from the September 2014 issue)*

Want to Listen to Spy Broadcasts? Here's How

The strange transmissions of shortwave numbers stations



Hidden among the squelch and whine of the little used shortwave radio band, mysterious stations broadcast unbreakable code.

Yosemite Sam threatens to blow the listener to smithereens before switching to a different frequency. An upbeat woman delivers nonsensical strings of numbers in Mandarin. A repeating broadcast of a nursery rhyme breaks only for a child to read numbers in German.

These are the numbers stations—a radio station on shortwave that broadcasts some sort of repetitive noise followed by strings of numbers. Amateur tech geeks first identified the stations after World War II. No one is sure *what* their purpose is.

That hasn't stopped anyone from speculating. The most popular theory is that the broadcasts are used to transmit coded messages to spies and the military. Shortwave is easy to broadcast globally, hard to trace and free of commercial traffic.

Spies or military personnel tune into the frequency at an appointed time and use a [one-time pad](#) to decrypt the message. The spy then destroys the pad and goes about their mission. Anyone else listening hears a random string of numbers with no context.

Listening to numbers stations was once the hobby of a small margin of the population. Only those with shortwave radios and patience to tune them reaped the benefits of the strange broadcasts.

Now—thanks to the Internet—anyone can listen.

The University of Twente in the Netherlands maintains web-based shortwave radio [anyone can access here](#). The interface is simple. Just input the frequency you want in the box below the graphic.

To get an idea of what frequencies to check out, head over to [Priyom.org](#)—an international group researching intelligence and military communications via shortwave radio. The site maintains a schedule of active shortwave stations and catalogs interesting activity.

If you find an interesting broadcast, post it to [our Facebook page](#). To get you started, here are two of War is Boring's favorite numbers stations.

The Buzzer

Tune the dial to 4625 kHz and you'll hear a repetitive buzzing noise. This obnoxious station goes by the call sign UVB-76, but shortwave aficionados call it The Buzzer. The Buzzer has been blaring that tone since the early 1980s.

On occasion, the buzzing stops. A voice comes on and reads [numbers and letters in Russian](#). The speculation is that the The Buzzer has something to do with Russian military operations or intelligence, but that's never been confirmed.

Yosemite Sam

The cranky gunslinger from old Bugs Bunny cartoons began screaming across the shortwave band around 2004. He's hard to pinpoint because he *moves*. But you can typically find him at 3700 kHz or 6500 kHz.

Every broadcast begins with a millisecond-long [compressed data burst](#) followed by a sound clip of Yosemite Sam. The data burst and sound clip then moves to a higher frequency. This broadcast is repeated over a two minute period before receding back into the darkness.

To date, no one has decoded the data burst. Estimates trace the signal's origin to somewhere in the deserts of New Mexico. Here's a [clip of the oddity](#).



Cold War legacy

It's tempting to think of the numbers stations as a relic of the past. The image of a forgotten radio transmitter blaring out strange messages for no one is a romantic one.

But that's false. Yosemite Sam didn't get started until 2004. The Buzzer's most recently coded broadcast occurred on July 10.

These numbers stations are still very much in use. Just ask Cuba.

In the late 1990s, the FBI busted a [group of Cuban spies](#) known as the Wasp's Network. The five Cuban intelligence officers received messages from back home via a short-wave radio station transmitting numbers. The coded messages were a large part of the FBI's court case.

It was the *only* time a government publicly acknowledged the existence and purpose of the numbers stations.

So remember as you're listening to the repetitive buzz out of Russia or a woman reading numbers in a foreign language—these messages are meant for *someone*. You aren't the only one listening.

You can follow Matthew Gault on Twitter at [@mjgault](#). Sign up for a daily War is Boring email update [here](#). Subscribe to WIB's RSS feed [here](#) and follow the main page [here](#).

(Reprinted courtesy of War is Boring website <https://medium.com/war-is-boring>)

Upcoming Events

NOVEMBER

1-2 Nov Sweepstakes—CW Objective: For stations in the United States and Canada (including territories and possessions) to exchange QSO information with as many other US and Canadian stations as possible on 160, 80, 40, 20, 15 and 10 meter bands. Contest Period: 2100 UTC Saturday through 0259 UTC Monday. Details at <http://www.arl.org/sweepstakes>.

8-9 EME—50 to 1296 MHz Objective: To work as many amateur stations as possible via the earth-moon-earth path on any authorized amateur frequency above 50 MHz. Contest Period: 0000 UTC on Saturday through 2359 UTC Sunday. Details at <http://www.arl.org/eme-contest>.

15-17 Nov Sweepstakes—Phone Objective: For stations in the United States and Canada (including territories and possessions) to exchange QSO information with as many other US and Canadian stations as possible on 160, 80, 40, 20, 15 and 10 meter bands. Contest Period: 2100 UTC Saturday through 0259 UTC Monday. Details at <http://www.arl.org/sweepstakes>.

DECEMBER

5-7 160 Meter Contest Objective: For Amateurs worldwide to exchange information with W/VE amateurs on 160-meter CW. DX-to-DX QSOs do not count. Stations located in overseas and non-contiguous U.S. Territories may be worked by DX stations. This includes Alaska KL7, Caribbean US possessions KP1-KP5, and all Pacific Ocean territories KH0-KH9, including Hawaii KH6. These stations can work BOTH domestic stations (US and VE) and DX stations around the world. Contest Period: 2200 UTC Friday through 1600 UTC Sunday. Details at <http://www.arl.org/160-meter>.

6-7 EME—50 to 1296 MHz Objective: To work as many amateur stations as possible via the earth-moon-earth path on any authorized amateur frequency above 50 MHz. Contest Period: 0000 UTC on Saturday through 2359 UTC Sunday. Details at <http://www.arl.org/eme-contest>.

REGULAR ACTIVITIES

- Daily** DFW Early Traffic Net (NTS) at 6:30pm 146.88 – PL 110.9Hz
- Daily** DFW Late Traffic Net (NTS) at 10:30pm 146.72 – PL 110.9Hz
- Daily** Texas CW Traffic Net (NTS) at 7:00pm and at 10pm on 3541 KHz www.k6jt.com
- 1st Wednesday** Richardson Emergency Siren Test. At noon using the Richardson Wireless Klub (RWK) repeater at 147.120 MHz.
- 2nd Wednesday** ARES North Texas HF Net Every month—3860 KHz at 830 pm—930pm

Rockwell-Collins

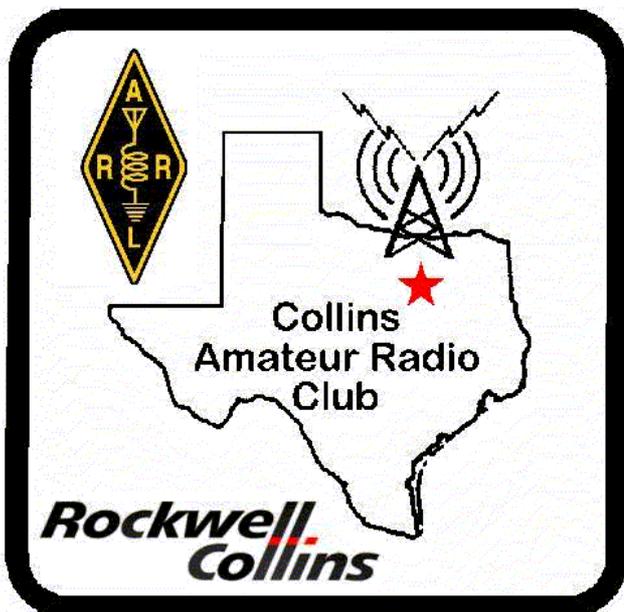
Amateur Radio Club

Mail Station 461-290

P.O. Box 833807

Richardson, TX 75083-3807

TO:



CLUB STATIONS

(972) 705-1349

W5ROK REPEATER

441.875 MHz +5 MHz Input

131.8 Hz PL - RX and TX

W5ROK-1 PACKET BBS ROK Node

145.05 MHz

W5ROK-N1, W5ROK-N2 & W5ROK-N3 HSMM-MESHNET Nodes 2.4 GHz

Tuesday 28 October 2014

1700 Social

1730 Meeting

Methodist Richardson Medical Ctr
At Bush/Renner/Shiloh Intersection

Second Floor Conference Room 200

NEXT SIGNALS INPUTS DEADLINE:

→→→ 14 November 2014 ←←←