JANUARY 2001

THE MONTHLY NEWSLETTER of the SANTA CRUZ COUNTY AMATEUR RADIO CLUB

SHORT SKIP

COMMITTEE HELP WANTED

Following is a description of the committees that help make SCCARC a successful club. Please contact Tom, KQ6DV, to volunteer your service. Many of these positions do not require an extraordinary commitment of time and energy.For example, perhaps you could sign up with the Refreshment Committee and volunteer to provide refreshments for just one of our Club meetings. The more volunteers we have in each area, the less work needs to be done by any one individual.

— 73, KQ6DV

1. TRAINING

Responsible for providing leadership in improving member's knowledge of, skills in, and attitudes toward, amateur radio.

2. PROGRAM & DEVELOPEMENT

Responsible for obtaining demonstrations, exhibits, drills, and other such events which will contribute to the object of the club.

3. EMERGENCY COORDINATION

Provided by Santa Cruz ARES and Watsonville ARES. Each of these two groups is an affiliate of SCCARC and is responsible, within its service area for: a) designating and training both individual members and teams equipped and ready to provide radio communications in a wide range of emergencies, and b) establishing and maintaining cooperative planning and effective liaison with all appropriate local government and government emergency agencies.

While membership in ARES is not a requirement for membership in SCCARC, the club does strongly support ARES, offers priority use of the K6BJ and KI6EH repeaters to ARES whenever needed to facilitate their communications, and encourages its members to participate in ARES events.

4. REPEATER

Responsible for operating and maintaining the Club's repeaters.

5. TVI

Responsible for assisting members in resolving problems of electronic interference.

6. GREETERS

Seeking out newcomers to Club meetings, welcoming them, introducing them to members with like interests, introducing them to the Club membership, and providing them with information packets about the Club.

7. MEMBERSHIP

Responsible for maintaining and increasing membership.

8. PUBLICITY

Responsible for preparing and distributing news and features about the Club to area media.

9. NEWSLETTER

Responsible for preparing and distributing to members a monthly newsletter.

10. REFRESHMENT

Responsible for providing food and drink for the club meetings, socials, and operating events.

Club History Revisited

Hank KG6EE, Dave W6TUW and Cap KE6AFE celebrate the new millennium by bring the ARRL Charter (dated 1930) out of the SCCARC vault for it's annual inspection.

11. NOMINATING

Responsible for submitting to the members nominations for the various offices for which elections are held.

Digital Signal Processing for Beginners (Like Me)

This is a very gentle introduction to digital signal processing (DSP) in 3 parts.

Part 1. The Origins of DSP —the Fourier Transform (816 words)

Part 2. Now—The Short Time Fourier Transform (497 words)

Part 3. The DSP Future — the Wavelet Transforms (804 words)

Part 1. The Fourier Transform

There is barely a new rig these days that doesn't sport DSP functions of some kind or another. Even for digital modes radios have traditionally dealt with analog waveforms so what's going on? To answer that question for myself I had to refresh old memories of names like Fourier and Nyquist and seek out some current information. I came up with some insights that I hope my refresher course will interest a few members. Math has been avoided here but I still hope to convey some essentials, it being understood this is the tip of the tip of the iceberg..

If we watch a complex waveform on an oscillosope we see a trace of amplitude information and time, ie. amplitude in the time domain. This plot does not tell us how much of each frequency exists in our waveform and in many cases key information is hidden in this frequency content.

To find details of the frequency content of an analog waveform it has first to be converted to digital data through an analog to digital (A/D) process followed by a mathematical transform. These conversions or transformations are essential

Continued of page 4

CLUB MEETING FRIDAY JANUARY 19, 7:30P.M.

SHORT SKIP

Published 12 times per year.
Free to members.
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A TIME FOR RENEWAL

Time to renew your club membership again. Dues for the 2001 calendar year are payable as of December 1. Regular memberships are $25, memberships for additional family members at the same address are $6 each, and full time students under the age of 18 can become members for $10. We look forward to having you as a member again in the coming year.

Make out your check to: SCCARC

Send it to SCCARC, PO BOX 238, SANTA CRUZ CA 95061-0238

Postal Rates for DXers

The cost of an international Reply Coupon (IRC) will increase from $1.05 to $1.75 on January 7. A one-ounce letter sent via air mail to anywhere in the world (except Canada and Mexico) will cost 80 cents. A two-ounce air mail letter will cost anywhere from $1.55 to $1.70, depending on where it's going. The complete rate schedule is available on the USPS Web site,

http://www.usps.gov/news/2001rate.htm.

—Dennis Egan, NB1B

Well, here we are in 2001 already and it's time to plan for our future. Last year I discovered it's good to be the President - so long as you have good people working for you. My New Year's radio resolution is to work harder this year at appointing chair people for all of the committees established in the bylaws of SCCARC. Please look over the descriptions of the committees in the "Help Wanted" section of this month's Short Skip, and consider volunteering in whatever area you think you can best contribute. Many of these jobs are quite simple and not very time consuming, yet they are very important to the health of our club nevertheless. If we all do a little, we can accomplish a lot. If we end up with only a few trying to do everything we won't accomplish much at all. Last year we saw what fun we could have when people stepped up to the plate and participated in club sponsored events such as Field Day, the BBQ, and our Holiday Brunch. This year I expect to be even better: we're off to a great start with our new club officers and board members in place. These people are enthusiastic and committed to making SCCARC better than ever. Please join us!

— 73, KQ6DV

AMSAT OSCAR 40

Greetings,

Since my report from late December, command stations have implemented the strategy which I had outlined. The first priority was to determine which command-uplink channels were available. This work was difficult, very time consuming (and for the satellite) somewhat dangerous due to the unknowns. The command stations did a magnificent job! Due to their combined efforts I can report the following findings:

1. After some blind transmissions to test the omni-antennas around apogee (that failed to produce a response), the scheduler was activated and programmed in such a way as to prevent lock-out. This strategy turned out to be very prudent and the scheduler-operation went smoothly and resulted in no additional anomalies.

2. The scheduler then took AO-40 through a number of modes, which allowed the P3D team to determine the following:

a. V, U and L-1 receivers work

b. V, U and L high-gain antennas work

c. U and L low-gain antennas do not work

d. the status of the V-band low-gain antenna has not

been finally determined. Apogee blinds tests are in progress as I write this to accurately determine the status of this antenna

3. The V-band transmitter was operated for one MA-unit. It demonstrated a marked temperature increase, but no signal was heard. This was a quick-look test and this result should not be considered final. Furthertests will be necessary (including the need to determine if the matrix was set properly). These tests will have to wait until the spin rate is reduced to ensure that the satellites heat-pipes will be able to handle the dissipation or extended periods.

4. Magnetorquing was started to reduce spin and the first indications are a loss of around 0.5 rpm - roughly consistent with theoretical predictions. We can conclude that the system works. In order to use Earth-sensing data, asmall additional program needs to be installed which stores data at apogee for later recovery when telemetry reception becomes available.

What's next?

During the next days the attitude control system should be returned to full functionality. It will be used to reduce the spin to a value consistent with heat-pipe operation and also with the requirements to change attitude.

These changes are necessary for sun-angle constraints, communication access and also to reduce the effect of our ongoing mass-loss on perigee altitude. Newer model calculations show that the mass loss could be largerthan my previous estimates; thus it would be prudent to use the resulting

thrust to increase perigee altitude (right now it is decreasing it).

Once the spin/attitude situation is under control, we will continue the check-out of other systems (such as):

1. Determine the status of the V-band transmitter (controlled experiments)

2. Determine the status of the U-band transmitter

3. Determine the serviceability of the ATOS (Arcjet) to determine if it can be planned on for a strategy toward an improved orbit

4. Test the momentum wheels to determine if AO-40 can be put into athree-axis mode which would greatly reduce the impact of the loss of the omni-antennas

Present data so far indicates that although we have lost some systems in AO-40, there has been no further deterioration after the second incident.

In particular, if ATOS and three-axis stabilization are still serviceable, AO-40 will still be able to produce a large fraction of the Amateur Radioservice expected from it.

Personally, I am optimistic and I believe that the command-and engineering team stand a good chance of turning AO-40 into anextremely useful Amateur Radio satellite.

— 73, Dr. Karl Meinzer, DJ4ZC

TRADE or SELL TABLE at JANUARY MEETING

Bring your surplus radio gear to sell or trade. The table will be set up before the club meeting. Put a price on your goodie and have fun trading or selling: mics, connectors, handhelds and related equipment, receivers, transmitters, etc. Let's have fun!
—Dan AA6GD

NATIONAL QUIET ZONE

The National Radio Quiet Zone was established to protect the radio telescopes at Green Bank, WVA and nearby Navy/U.S. Naval Observatory facilities. These are huge dish antenna's with extreme sensitivity for which very little radio frequency interference (RFI) can contaminate the science.

What's the background on the creation of the Quiet Zone?

As stated above, to protect the very sensitive radio telescopes at Green Bank, WVA. Radio astronomy works in two basic ways ... continuum and spectral line.

Continuum is where the powers over a broad frequency range is measured.

From this, absolute temperatures, black body radiation parameters, etc.

of the source is determined. If ANY signal crops up in the wide pass band used in continuum, the science is contaminated.

Spectral line is where you listen at a specific frequency related to where molecules are resonant, such as hydrogen. From this, the detailed maps rivaling optical astronomy are made. Any signal near the spectral line frequency totally contaminates the phasing between the different dish antennas and contaminates the science. Like having a hetrodyne on the frequency of your QSO!

So the quiet zone was established to protect these sciences.

All transmitters operating within the quiet zone must be specifically licensed and approved in writting by the NRAO and the FCC.

Does this mean I've got to steer my QRP signals around the Quiet Zone hihi?

In this day of personal communications, to be honest, it is hard as heck to control this quiet zone. Too many cell phones, etc. whose harmonics fall within the protected radio astronomy bands. It's hard to enforce and hard to find the culprit when only flying through on the highway. You have no idea how much your cooperation is appreciated though!

When we built the VLA in the mid-70's, the NRAO applied for this area in New Mexico to also be designated a National Quiet Zone. The FCC declined, stating it has an enormous task to administer the ONE quiet zone, and would never establish another one. Since it couldn't be enforced, is one reason why the VLA got built out in the middle of the NM desert to limit out RFI exposure. And even we are now getting wiped out by the cell phones!

Enough trivia for one night -hi.

There is better information than what I offered on our website at:

www.nrao.edu Probably click on Green Bank

— 72, Paul NA5N

By Art Lee WF6P

CHATTER

A week or so ago, my XYL Donna, AB6XJ, received a call from Jamie Finch, WI6F, alerting me to a TV program whose topic was of high historical interest to me. The program was about early CW maritime operators in the era of spark gap transmitters. Ship sinkings in the days when communications were practically non-existent, were costly in terms of lives lost. These days, for a few hundred bucks, even a canoe operator can have an Emergency radio beacon (EPIRB) on board for rapid rescue from vessels anywhere in the world. Thanks Jamie, I enjoyed the program.

Iím on the air daily on the Baja Maritime Mobile net (7.238 0800-0900). Nets are fun and there are many that fit almost any interest. These true ìchat roomsî put you in touch with ìliveî people. For me, it is kinda nice to chat with friends at sea. Terry Parks, N6NUN, and I get together often when he is on his boat in southern Californian waters. This week he and another crewman were at anchor off the Channel Islands. He came on with, ìI just put the coffee on, Art, and we are getting ready to hoist anchor, so canít talk long.î He was having difficulty with his electric-drive anchor windlass. It operated only intermittently. With 120 feet of chain out, Iíll bet they wished they had some power other than bringing it and the 80 pound anchor up hand-over- hand.

Last week my computer was down (donítcha just hate that!). Not only could I not get any printing done, but I lost email connection. Bummer. It was a software problem that I had caused while erasing files. An editor wanted additional info on my article he has scheduled for the December issue of Vietnam Magazine. He wanted me to email it to him! In desperation, I called a pal who worked with me for an hour on the phone, untangling the knots I had tied in my paths and COM ports. DavidLewis Lawrence has infinite patience. How does the saying go? ìA friend in need ...î

During our last rain period, I awoke with heart pounding. A low rumble across the atmosphere was telling me that a thunder storm was upon us. In the pre-dawn black of morning, I dashed to my shack to ground my antennas. Yes, itís that time of the year again. Was I too late? Had my rig innards been fried? Nope, not this time. The rumble I heard was our trash collector making his pickup rounds and dumping cans. Whew! Hams from back east are more careful than we are here in California. Lightning storms in their part of the country are not to be treated lightly. I recall one story told by Norm Peterson, N6DAC. They used to disconnect their antennas and throw the lead-ins to the rig and tuner to the basement floor. This was done AFTER the antennas were grounded. Mother nature really means business during electrical storm activity.

Cathy Baker, N6TGL, spent Christmas with her daughters and families in Alaska. Bet it was chilly up there. The year Donna and I were married, I spent our first Christmas in Nome standing on a snow bank working on an engine of a Navy C-54. I remember how cold my hands were and thawed them by putting them in a thermos jug of hot coffee. The coffee tasted a bit oily after that. (Nahhh, I really just poured the coffee over them. But it felt good.)

Oh, our annual club Christmas party was great. A nice touch was that performed by Elaine Pennell, KE6FRA, who greeted everyone at the main entrance and directed us to the party room. The room we had was packed with tables full of club members. The food was superb. Later, I attended a New Yearís party where the band was led by my friend Ron Deeter, K6FSB. He plays a mean clarinet and is often net control on the Western Public Service Net on 80 meters.

DSP Continued

steps in digital signal processing (DSP) and typically take place within the radio or in a PC sound card or both. The grandfather of all transformation techniques is the Fourier Transform (FT). Fourier you may recall showed that complex waveforms can be decomposed into discrete frequency components.

Once the FT of a waveform is taken, the frequency-amplitude data of that waveform is obtained. In other words, we can now have a plot with one axis being the frequency and the other being amplitude. This is the frequency domain view we get on a spectrum analyzer. For example, if we take the FT of the electric current that we use in our houses, we will have one spike at 60 Hz, and nothing elsewhere, since that waveform has only a 60 Hz frequency component (neglecting harmonics and transients and such).

Many waveforms contain more than one frequency component. Suppose we tune in a weak radio signal and look at the output on an oscilloscope (or PC using software program designed for the purpose) what we will see is mostly noise and the presence of a voice or CW message might not be obvious. A FT helps us identify the specific frequencies where the information resides. What makes FT useful is that once identified the information can be filtered, compressed or processed in other ways. The information can remain in digital form in the case of digital modes such as PSK and MFSK or by reverse processes returned to analog form— for example in the case of voice.

Although FT is probably the most popular transform being used (especially in radio communications), it is not the only one. There are many other transforms and every transformation technique has its own area of application, with advantages and disadvantages.

In our AC example the same 60 Hz frequency and perhaps some harmonics are present all the time. In such cases we usually do not need to know at what times the frequency components exist because they are there all the time. Any waveform that has the same frequency content all the time is called "stationary".

Many waveforms contain frequencies that come and go over time and are called "non stationary"— most radio signals are of this kind. Stationarity concepts are of paramount importance in DSP.

Consider two very different waveforms. The first is stationary with 4 component frequencies present all the time. Here a FT display will show 4 spikes corresponding to the frequencies and amplitudes of the components. Now a second waveform has exactly the same frequency components but each frequency is only present for part of the time, therefore it is non-stationary. The FTs in each case will be essentially identical while the waveforms are quite different—so how come? Recall that a FT recognizes only that a component was there and cares not when.

FT is well suited to stationary waveforms but if we want to know what spectral components occur at what points in time, then FT is not the right transform to use. In almost all forms of data communications, knowledge of the timing of the spectral components is useful and sometimes essential.

Once again please note that a FT yields what frequency components (spectral components) exist in the waveform and nothing more, nothing less. When the time localization of the spectral components is needed, a transform giving the Time-Frequency representation of the waveform must be used.

Limitations of the basic FT has given rise to a modified FTs such as the Short Time FT (STFT) and mathematical solutions called Wavelet Transforms (WT). I will cover those concepts in the next parts of this article.

Part 2. The Short Time Fourier Transform

Recall that in Part 1 we were left with a dilemma that the basic Fourier Transform (FT) used in DSP provides frequency - amplitude information and does not provide us with time-frequency information. In many forms of data communications including simple Morse code it is helpful or essential to extract time information in the waveform.

What was wrong with FT? It worked for stationary but not for non-stationary waveforms. We can treat some portion of a non-stationary waveform as stationary if we look through a window narrow enough such that the portion of the waveform seen in the window is indeed stationary (a form of divide and conquer).

In FT a waveform is treated as a whole but in short time FT (STFT), it is divided into small time segments or windows such that the waveform selected by the window can be assumed to be stationary. The width of the window function must be chosen to resolve a valid set of stationary waveforms that represents the whole non-stationary waveform.

So far so good but there is a problem that brings into play another famous scientist Heisenberg and his principle of uncertainty. This applies to our subject as follows:

We cannot know what spectral component exists at any given time instant. The best we can do is to investigate what spectral components exist at any given interval of time. This is a problem of resolution and means that a certain high frequency component can be located better in time (with less relative error) than a low frequency component. In contrast, a low frequency component can be located better in frequency.

Anyone who would like to use STFT is faced with this problem of resolution and hence

what kind of a window to use? Narrow windows give good time resolution, but poor frequency resolution. Wide windows give good frequency resolution, but poor time resolution; furthermore, wide windows may violate the condition of stationarity. The problem is a result of choosing a window function, once and for all, and using that window in the entire analysis. If the frequency components are well separated from each other in the original waveform, then we may sacrifice some frequency resolution and go for good time resolution. However, if this is not the case, then a good window function, could be more difficult than finding a good stock to invest in.

In summary with STFT we are faced withthe following dilemma:

Narrow window ===> good time resolution, poor frequency resolution.

Wide window ===> good frequency resolution, poor time resolution.

Wavelet transforms are mathematical functions capable of providing improved time amplitude and frequency information simultaneously. STFT gives a fixed resolution at all times, whereas WT gives a variable resolution and it is the main reason why researchers are intensely interested.

Wavelet transforms (WT) solve the dilemma of resolution to a certain extent, as we will see in the next part.

Part 3. Wavelet Transforms

ecall from Part 2 the limitations of Short Time Fourier Transforms have to do with selecting a window function that works well to resolve both the high and low frequency components of a complex waveform

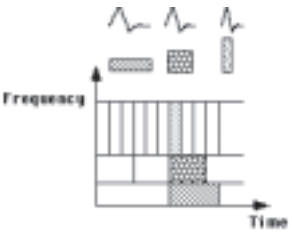
Although the time and frequency resolution problems are results of a physical phenomenon (the Heisenberg uncertainty principle) and exist regardless of the transform used, it is possible to use wavelet transforms (WT) that analyze the waveform at different frequencies with different resolutions. Every spectral component is not resolved equally as was the case in the STFT.

Wavelet transforms are mathematical windowing functions designed to give good time resolution and poor frequency resolution at high frequencies and good frequency resolution and poor time resolution at low frequencies. This approach makes sense especially when the waveform at hand has high frequency components for short durations and low frequency components for long durations. Waveforms that are encountered in many practical radio applications are often of this type

The first wavelet transform was developed about ten years ago as an alternative approach to the Short Time Fourier Transform to overcome the resolution problem. The wavelet analysis is done in a similar way to the STFT analysis, in the sense that the waveform is multiplied with a function, and the transform is computed separately for different segments of the time-domain waveform. However the width of the window is changed as the transform is computed for every single spectral component, which is probably the most significant characteristic of a wavelet transform.

Let's take a closer look at the time-frequency resolution properties of the wavelet transform. Remember that the resolution problem was the main reason why we switched from STFT to WT. The following illustration (called a Spectrum Density Plot) is commonly used to explain how time and frequency resolutions should be interpreted. Depicted here are 3 waveform components at different frequencies. Every box in the figure corresponds to a wavelet transform in the time-frequency plane and the shading represents the signal strength.

Note that the value of the low frequency component, shown in the lowest level corresponds to the finest frequency resolution and the coarsest time resolution. The highest frequency has the finest time resolution and the coarsest frequency resolution.

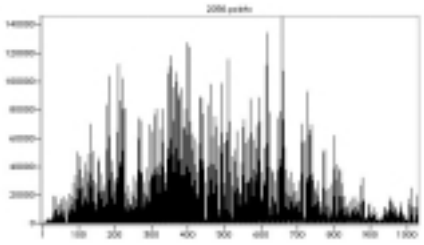


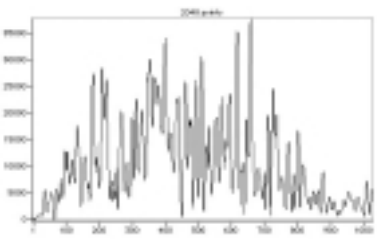
In wavelet analysis, the scale that one uses in looking at data plays a special role. Wavelet algorithms process data at different scales or resolutions. If we look at a signal with a large "window," we would notice gross features. Similarly, if we look at a signal with a small "window," we would notice small discontinuities. The result in wavelet analysis is to "see the forest and the trees."

The scale used in in the wavelet analysis is similar to the scale used in maps. As in the case of maps, high scales correspond to a non-detailed global view (of the waveform), and low scales correspond to a detailed view. Similarly, in terms of frequency, low frequencies (high scales) correspond to a global information of a waveform (that usually spans the entire waveform), whereas high frequencies (low scales) correspond to a detailed information of a hidden pattern in the waveform (that usually lasts a relatively short time).

Can you see why these features make wavelets interesting and useful? For many decades, scientists have wanted more appropriate functions to approximate choppy signals than the sines and cosines that comprise the bases of Fourier analysis. By their definition, these FT functions are non-local (stretch out to infinity), and therefore do a very poor job in approximating sharp spikes. Wavelets are well suited for approximating data with sharp discontinuities.

Because the original signal can be represented in terms of a wavelet coefficients, data operations such as noise reduction can be performed. Here is a before and after comparison illustrating a step in recovering a weak CW signal by reducing the noise surrounding it.





The technique is a significant step forward in handling noisy data because the denoising is carried out without smoothing out the sharp structures. The result is cleaned-up signal that still shows important details.

There are very many choices of wavelets and they are excellent tools in the field of data interpretation or compression, the challenge is to choose the best wavelet adapted to your data.

The mathematics have been worked out in excruciating detail and wavelet theory is now in the refinement stage. The future of wavelets lies in the territory of applications such as practical data analysis of data communications. Somewhat surprisingly wavelets do not seem to have become part of the Ham Radio vocabulary but I would bet that it will not be long before they do.

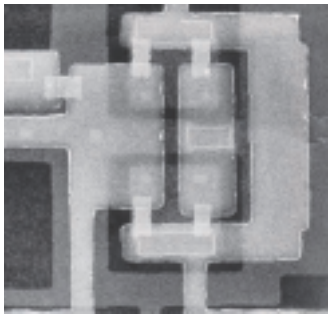
I acknowledge the wonderful collection of tutorials, demos and references and especially like http://www.bores.com/courses/intro/time/2_auto.htm and much more can be found at Amara's site <http://www.amara.com>

— Ron Skelton W6WO

Mystery Item

Mystery Item Winner Jim W6CF

The mystery item in last months issue of Short Skip was correctly identified by Jim W6CF as a clandestine receiver built by British POWs during WW II. Their ingenuity was remarkable. Casting a metal flywheel for a generator, making capacitors from scrap metal and resistors from tree bark, all in secret. The picture showed how a radio receiver was hidden beneath the floorboards of a hut and operated by knitting needles through cracks in the floor. 18 years after the war ended such a hidden receiver was discovered in Colditz Castle.



Here is this month's challenge

As most of you will know this is a highly magnified image of part of a semiconductor. The challenge is to suggest what frequency it might operate at and how it might radically alter Ham Radio in the future. The clue is that the dimension of the picture is about 10 x 10 microns. Email me your best guess and see who will take over the reigns of Grand Guess Master from Jim.

— Ron W6WO

SCCARC Officers - 2001

President	Tom Johnson	KQ6DV	464-3120
Vice President	Richard Trebbien	KG6AXD	426-0169
Secretary	Cap Pennell	KE6AFE	429-1290
Treasurer	Elaine Pennell	KE6FRA	429-1290
Board	Bruce Hawkins	AC6DN	
	Bill Walters	W6PAD	688-0557
	Allen Fugelseth	WB6RWU	475-8846
	Mike Doern	KF6UXB	477-1161
	Ron Skelton	W6WO	477-1021
K6BJ Trustee	Royce Krilanovich	AC6Z	475-4798

MONTEREY BAY ACTIVITY

K6BJ / KI6EH (Linked) /147.945-	• SCCARC Net Monday 7:30 PM 146.79- /147.945- 146.79-
K6BJ / UHF	• SCCARC Net Monday 8:30 PM440.925 (PL 123)
	• SC ARES Net Monday 8:30 PM 146.835-(PL 94.8)
	• Watsonville ARES Net Thursday 8:30 PM 147.945-
K6LY (Monterey)	• Monterey ARES Net Wednesday 7:30 PM
146.97- (PL 94.8)	• NPSARC Net Wednesday 8:00 PM
444.700+ (PL 123)	• Monterey Bay Traffic Net Nightly 9:00 PM
(Linked)	• Monterey Bay Swap Net Wednesday 8:15 PM
	• Newsline (Ham News) Broadcast Wednesday 8:30 PM
N6IYA (Felton)	• SLVRC Net Thursday 7:30 PM
146.745- (PL 94.8)	• SLV ARES Net Monday 7:30 PM
	• Newsline (Ham News) Broadcast Sunday 9:00 PM

6 Meter Local Net 52.8 MHz (PL-114.8) Sunday 8:00 PM
SCCARC 10 Meter Net 28.308 MHz USB Monday 7:00 PM
Mont. Bay Chapter 191 QCWA :Tuesday, 7:30PM, AA6T repeater, 146.700-(NO PL).

SCCARC Calendar of Events

SCCARC Board Meeting 6:30	Friday	Jan. 19
SCCARC Meeting	Friday	Jan 19
SHORT SKIP deadline	Tuesday	Feb 5
Santa Cruz ARES	Tuesday	Feb 13
SCCARC Meeting	Friday	Feb 16

MONTHLY MEETINGS

The SCCARC Meets at 7:30 PM, on the THIRD FRIDAY of the each month (except December). Meeting are at Dominican Hospital, 1515 Soquel Drive, Santa Cruz.

Visit the SCCARC Website at -

www.k6bj.org

NEW! — CLUB E-MAIL: yourcall@k6bj.org

NET CONTROL SCHEDULE (Subject to Change)

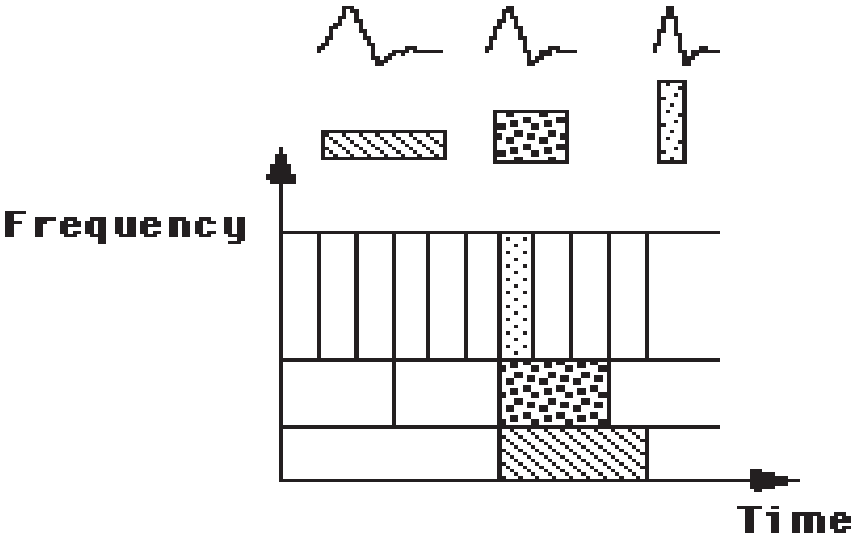
1/15	Ron W6WO
1/22	Dave W6TUW
1/29	Tom K6TG
2/5	Jeff KF6BKG
2/12	Allen WB6RWU
2/19	Phil KE6UWH

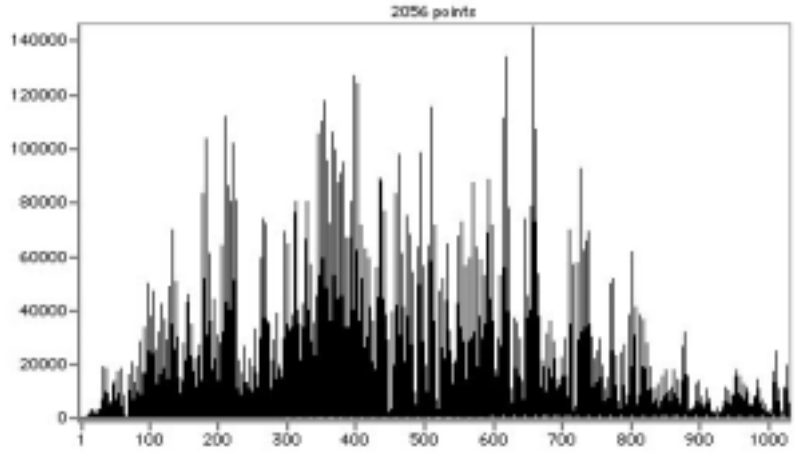
SHORT SKiP

SANTA CRUZ COUNTY AMATEUR RADIO CLUB
P.O. BOX 238
SANTA CRUZ, CA 95061-0238

Next Meeting Jan 19th

First Class


Frequency
Time


2056 points
140000
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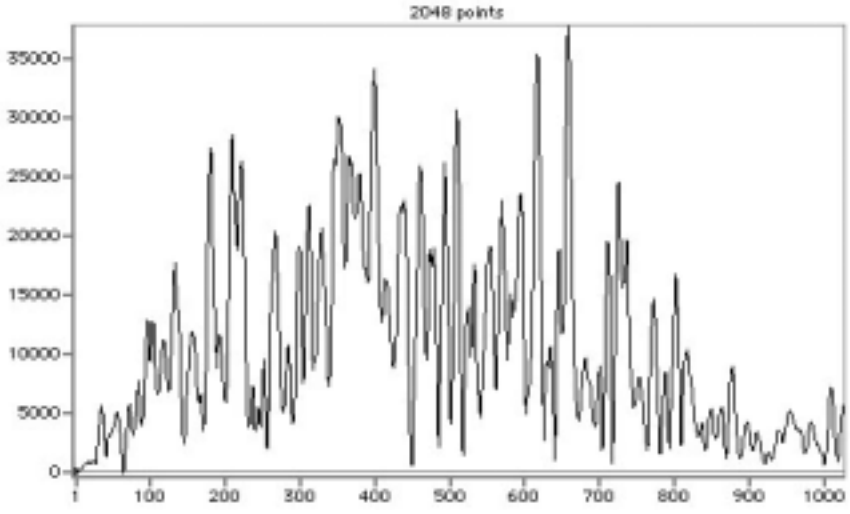
900
1000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30000
25000
20000
15000
10000
5000
0
1
100
200
300
400
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600
700
800
900
1000