NVARC
Nashoba Valley
Amateur Radio Club

SIGNAL

SPECIAL SERVICE CLUB

February 1998 Volume 7 Number 2

ARES, RACES, SKYWARN Meeting

Ralph KD1SM, Joseph N1QDZ, Jeanine N1QIT and I attended an ARES, RACES, SKYWARN meeting at Area One Headquarters in Tewksbury February eighth. There were presentations by Terry KA8SCP on RACES, Steve W3EVE on ARES, and Rob KD1CY on SKYWARN. The presenters emphasized cooperation between the services and are holding regular meetings to share information toward that goal.

Terry covered the RACES orgainization as it is now set up. He also mentioned that they are working on converting to the NTS format for messages.

Steve talked about getting the ARES organization active again and stressed the desire that people hold dual membership in ARES/RACES. They were working on putting together an equipment list for a "ready kit" in order to be better prepared for emergencies. They were also working on organizing several "emergency radio teams".

Rob gave a presentation on why SKYWARN existed and how to become a NWS Spotter. There was also some talk about APRS since the NWS station is now APRS not regular packet.

At the end of the meeting there was a reminder of the APRS meeting at W1ON February 28th to discuss the frequency change from 145.79 to 144.39. Anyone having input on this change should attend the meeting.

Stan

This Month's Meeting

For February we will be doing the hands-on DSP theme with a number of DSP's to try out against various recorded signals. We will start with a short introduction on the subject and then demonstrate some of the units we have hooked up. After this you will be able to try them out yourself. To make for a better test we are producing the input on cassette tapes. If there is a particular signal or noise problem that you think might be addressed using this technology make a recording of it and we can try it out. Also in this months newsletter we have the second installment of FAQ's on DSP. You might want to check these out to pick up some of the jargon. Bob W1XP has also written an article that is in this issue that covers the basics of a DSP system. Some other sources of information are; DSP- An Intuitive Approach, by Dave Hershberger, W9GR, QST February 1996 and recent editions of The ARRL Handbook. We also have a QST Article Bibliography that we will make available at the meeting.

Then for March Don KA1T will be here for a QSL card sort. Don, who was the ARRL New England Vice Director, has moved to Wisconsin, but should be back for our meeting. The ARRL Board of Directors meeting has taken place, so if you have any questions he may be able to answer them.

Last Month's Meeting

Last months speaker was Dennis Blanchard K1YPP. His presentation was A QRP Arctic DXpedition On A Motorcycle. While many might have thought this was a misplaced April fools day program, it was not. Dennis took us on a slide tour of his trip to the Arctic Circle on motorcycles. Due to limited space and power he ran QRP with a Heathkit HW-9.

Advanced License Ham Classes

Tom WA1RHP is running an Advanced license class. The classes should have started in January. He plans to hold the class at the Shirley Library on Monday nights. For more information contact Tom Sefranik WA1RHP.

VE Sessions

In case anyone needs a deadline to get them going. There will be a VE Session in Nashua on February 28th at 9:00 AM. The exam will be held at the First Church of Nashua. All elements are given at these exam.

Stan

Important Future Items

April is election month/meeting. We need candidates to run for the club offices of President, Vice President, Secretary, Treasurer, and one Board of Directors position. I haven't spoken to any of the current officers about their intentions, but it would be best to think ahead as if all spots were open.

Assuming we get through elections in April, Field Day is the next project to think about. June will roll around quickly, being only four meetings from this one. One thing we had talked about making for Field Day is a set of band pass filters to reduce station to station interference. I have two articles on the subject. The first one using tuned circuits of capacitors and inductors and the other using coaxial stubs. Is anyone interested in pursuing this project?

Note From The NVARC Bureau

Having just recently sorted the cards going to the ARRL Bureau I thought I'd make one comment. Neatness counts. Particularly for those interested in awards. Organizations that sponsor or check for awards will not recognize cards with corrections or changes. If you want your cards to be valued or even usable try not to have errors. If someone gets a card from you that they cannot use why should they send a QSL back? Personally I throw out cards on which I make a mistake.

I haven't sent the cards to the bureau since the DXCC Countries List I have is several years old. I will pick up a new list this week and go through the cards to make sure everything is OK. So if you have any more cards I will take them at the meeting and slip them into the stacks I have already sorted.

Stan

From The ARRL Letter

RAFT CARRYING HAM RADIO LOST AT SEA

Tragic news from the Far East this week: Word from South Korea is that all hands aboard a research raft carrying ham radio station HL0JQT/mm (see "Raft/mm station active," The ARRL Letter, Vol 17, No 4) were lost January 24 in heavy seas off the coast of Japan. Japanese Maritime Safety Agency authorities had responded to a distress call that the crew was extremely exhausted. It's not clear if the distress call went out on Amateur Radio frequencies, however. Bodies of three of the crew members had been recovered, but a fourth was still missing in the frigid waters and presumed drowned.

The 23-foot research raft, which had a sail but no engine, was attempting a voyage from Vladivostok, Russia, to Pusan, South Korea, when it capsized in stormy seas. News reports from South Korea said the four-man crew, led by 48-year-old skipper Lee Duk-young, was attempting to retrace the sea route linking Palhae, an ancient Korean dynasty that originated in northeast China, to the Korean Peninsula.--Vernon Eubanks, K0LVS/HL9VE

Outgoing QSL Service stats: Propagation must be looking up. The ARRL Outgoing QSL Service handled 1,378,240 QSL cards to DX stations during 1997--that's 9,200 pounds, or more than 4-1/2 tons, of cards. The number represents an increase from 1996 of more than 78,000 cards handled.

Digital Signal Processing For Beginners

What is it, how it works, and what it can do for you?

By W1XP

Digital Signal Processing (DSP) has been around for a good while. In only the last few years has the performance and cost of the digital processing hardware reached levels that have brought DSP into the ham shack. This is

only the beginning of the DSP era. In the years to come, more and more of our amateur equipment will contain DSP. Up until now the use of DSP has been limited to two basic areas. They are add on after market audio processing boxes connected to the audio output of transceivers and receivers, and some of the high-end radio transceivers have used internal audio digital signal processors to provide filtering of both transmit and receive audio. Additionally some of the top end transceivers actually process a low intermediate frequency. There is at least one HF amateur transceiver on the market (the Kenwood TS-870) that does all of the IF filtering, modulation/demodulation and audio processing with DSP. Just how these various DSP units function and what they can do will be covered in this article. We will try to keep the explanations simple and I hope informative.

DSP is carried out in three basic steps. We will briefly cover these three steps, and then describe some of the functions that DSP can do for us. Whether the DSP is done in a box connected to the output and/or input of your transceiver, or if it is built into the transceiver itself, the three basic functions are the same. They are:

- Analog to digital conversion
- Digital processing
- Digital to Analog conversion

In the analog to digital conversion process the varying voltage of the signal we wish to process is converted to a string of digital numbers. These numbers represent the instantaneous value of the voltage. This function is performed by a device called an Analog to Digital Converter (A to D). This device measures the amplitude of our varying signal at specific time intervals. Think of it as someone with a watch, a voltmeter, and a pad of paper and a pencil. At specific time intervals the person reads the voltmeter that is connected to the signal and writes down the value of the voltage. He then passes the paper to the Digital Processing person. When his watch indicates the next sample time has arrived, he repeats the voltmeter reading and passes the paper with this reading to the Digital Processing person again. The A to D person has to be quick because most of the current DSP is done at sampling rates of 10,000 to 100,000 times a second. Each reading of the signal voltage is called, strangely enough, a Sample.

Now to continue with our analogy of how the processing is accomplished. The person that is doing the digital processing has the hardest job. At least he has lots of things to do and data to record. First of all he will take the Sample from the A to D converter person. We will call it sample N. He will then multiply it by a predetermined number called a coefficient. They are part of the processing program. He then writes down this answer and puts it aside for the moment. He may then repeat the multiplication using a previous sample, we will call it sample N-1, and a different coefficient (Sample N-1 is the sample that preceded Sample N. Sample N-2 is the Sample that preceded sample N-1,…..). The multiplication is continued with Sample N-2 and so on. In some cases this may run into the hundreds of samples (i.e. N-99). At the beginning of a sample period everything gets renamed with N being the current sample. I know it is confusing but that is how the samples are referenced. It's a mathematics thing. The processing is continued by summing up the products of the sample and coefficient multiplication. The values of the coefficients, the sample rate, the number of samples included in the calculations, and how they are combined is what gives the DSP the intended characteristics. In the implementation of some complex DSP functions, not only are the current samples used in the calculation, but the results of previous sample periods are combined with the current result in the total output. The design of these DSP algorithms is way beyond the scope of this article (and its editor), because it can get very complicated (as if it wasn't all ready). When the processing person has completed his processing task he will have a number. This number is the output of the DSP at that instant. He has to accomplish all of this before the A to D guy hands him another slip of paper with the next sample on it. This is the period between the samples. It is obvious that the processor is operating much faster than the sample rate. He has to do all the multiplication, storing of intermediate results and the addition of all the samples required for the intended processing function. For this reason special purpose computer chips are used that only do a few functions (multiply, add, shift and store) but they do them very quickly as compared to general purpose computer chips used for personal computers. The general purpose chips do many more things (have more commands) but take much more time doing the multiply and add functions. For this reason the special digital

signal processor chips were developed and are unique designs. It is the development of theses special purpose processor chips and their low cost that has brought DSP into the ham shack.

Let's continue to the final step of the three step process, the Digital to Analog converter (D to A). Let's think of this as someone with a variable voltage supply. This person reads the calculated (voltage) value on the slip of paper handed to him by the Processing person and sets the variable supply to that value. The supply output is the D to A output (DAC) and the DSP output. In this way the processed signal (which was a string of numbers in a chip) is now a time varying voltage again. At this point we have an analog output signal that has been altered from the input signal by the calculations and coefficients we have assigned in the DSP program.

This completes the three step process of converting the signal into "Samples", operating on the numerical samples with a high speed arithmetic processor, and then converting the processed samples back to a time varying signal. Although this explanation is rather simple it is the essence of all DSP. To change the characteristics of the processing being carried out by the DSP it is only necessary to give the person in the middle a new set of instructions. This is what makes digital signal processing so flexible and versatile. The sample rate, coefficients, number of samples, and the summing of results can all be changed by just changing the instructions to the processor. It is even possible to give the processor the ability to change itself. To match (or adjust) the processing based on the characteristics of the input signal which the processor measures. This adaptability is another real advantage to DSP. In the future this adaptability will be used more and more to provide "Smart DSP Processing".

So with all this versatility, just what can a DSP do for me now? Well, although DSP can be used for a wide variety of signal processing functions including carrier generation, modulation and demodulation including AM, FM, PM and SSB, it is usually used to perform just filtering functions. These include narrow Bandpass filters for CW, Low-pass, High-pass, and Bandpass filters for SSB. A variety of noise and interference canceling filters are also implemented. The unique feature of DSP filters is their adaptability. The ability of the processor to reprogram itself by calculating new coefficients or tracking the center frequency of a tone is very powerful. For example, it is possible to program a DSP filter to adapt to the characteristics of the desired signal and enhance the Signal to Noise ratio. To accomplish this it examines the input and decides what is noise and what is signal and removes the noise leaving only the signal. These presently work with varying degrees of effectiveness. Another adaptive filter can tune a very narrow rejection notch filter through a phone signal and reject a steady tone present in the signal. This will remove the heterodyne tone of the "tuner upper" that can be so annoying to phone operation. In fact several tones can be removed at one time. This is a very useful feature, and it can be automatic. Turn it on and the annoying heterodyne is gone, tuned out by the adaptive notch filter. For CW operation, the main use of DSP is to provide a narrow Bandpass filters. These filters can be very narrow with extremely steep skirts. The proverbial "Brick Wall Filter". One important characteristic of these filters is that they have a very small delay distortion. This reduces the "ringing" effect so common in narrow CW filters. This ringing can make the use of narrow CW filters "uncomfortable". With DSP it is possible to build a 50 Hz wide digital filter that sounds like a 500 Hz wide analog filter. It is also possible to improve the performance of some of the other digital modes with DSP filtering, such as RTTY. The ringing that is annoying to the CW operator is even more of a problem in the digital data modes, so DSP can bring improvements to this area also. One application of DSP that is used in some of the transceivers that include DSP is to process the microphone audio. The transceivers audio response can be tailored to match the characteristics of the operators voice. The voice signal is digitally processed to raise the average to peak power ratio, as the typical HF analog processor does. This can increase the effectiveness of the transceiver in poor signal and noisy band conditions. It can be more effective than the conventional speech processing available in the non-DSP transceiver. It does require a rather complicated process of setting up the processing to get the maximum benefit, but it can provide a worthwhile improvement in effectiveness. At this time there are several transceivers that provide DSP at the IF level. The DSP is not only used to filter the microphone or receiver audio, but to do the modulation/demodulation. On the receive side it is used for IF selectivity, demodulation and audio filter-

ing. On the transmit side it does the audio processing as described above and does the modulation and filtering of the transmit signal. The keying is even processed to control the rise and fall times of the CW signal. These DSP in these transceivers operates at very low IF frequencies. Typically in the low tens of kHz. As these functions are moved from the conventional analog signal processing area to the digital area there is a savings in size and an improvement in reliability. Digital circuits do not drift with age or temperature. They require no costly alignment at manufacture. The same digital processor can do the CW, USB, LSB, AM, FM, RTTY, etc. modulation and demodulation. All you need to do is change the program. This can replace lots of analog circuitry. And now the price and performance are competitive. On the other hand they do have their own set of problems. Dynamic range is one big issue. The amplitude resolution, which is limited by the number of bits in the A to D and D to A converters, determines the ratio of signal amplitudes that can be handled by a DSP system. This and frequency range are the challenges to the DSP designer. But this is only the beginning and more radios will be using DSP for a wider range of functions as the technology matures, the speeds and dynamic range increase, and the costs come down. See the review of the TS-870 I wrote for this newsletter in April 1996.

DSP will be making more and more inroads into the analog portions of radios in the future. I hope I have helped you to have a better understanding of how it functions. If you are interested you might read the article in Feb. 1996 QST by Dave Hershberger. To help demonstrate what DSP Boxes can do, Stan KD1LE will be demonstrating some of the current DSP units at the next meeting. See the announcement elsewhere in this newsletter. Since you now know how the boxes work, come to the meeting and listen for yourself.

73 Bob

DSP FAQ's

What are the disadvantages of DSP?

The main disadvantage or limit of DSP techniques is that they are limited to signals with relatively low bandwidths. The need for an ADC and DAC makes DSP uneconomical for simple applications (e.g. a simple filter) The higher power consumption and size of a DSP can make it unsuitable for simple, very low-power, or small size applications

Why do we need hardware digital signal processors?

While general purpose microprocessors such as Motorola 68000 or Intel 80X86 can be used to process the digital signal in real-time, their design is not optimum to the heavy math orientation of the DSP process. Normal DSP operations rely on multiplication and addition. A 68000 processor requires 10 clock cycles for an add operation and 74 for a multiply. A DSP processor can perform the multiply and add in one clock cycle. Most DSP's have instructions that multiply, add, and save the result in just one cycle. This is a significant improvement over the general purpose processor.

Who are the DSP chip manufacturers?

The four most commonly listed programmable DSP chip manufacturers are;

Texas Instruments, with the TMS320 series, Motorola, with the DSP56nnn, and DSP96nnn series, Lucent Technologies (formerly AT&T), DSP1600 and DSP3200 series, Analog Devices, with the ADSP2100 and ADSP21000 series.

Since processor speed seems to be a big issue, how fast are DSP chips? A quick scan of the literature shows these numbers(I'm sure there are more recent numbers).

Processors vary in gross speed with the trade off being price and power consumption. As of mid 1997 here are some speeds. Analog Devices processors ranged between 10 and 50 MIPS. Lucent Technologies processors ran at up to 120 MIPS. Motorola processors ran up to 20 MIPS. Texas Instruments processors at up to 100 MIPS. Just a note, due to different register sizes (16 to 40 bit) and accumulators (up to 80 bit) the above speed numbers are not an absolute comparison from manufacturer to manufacturer.

What else affects processing speed?

As noted in the previous question, the size of the registers affect the amount of data that can be

handled, and depending on the processor, the resolution of the calculations. The size of the registers also impacts the dynamic range possible. The other factors being the input A/D and the output D/A.

What are some of the applications of the DSP

digital sound recording such as CD and DAT

speech and compression for telecommunication and storage

implementation of wireless and radio modems (including digital filtering, modulation, echo cancelation and other functions)

digital image enhancement and compression

single chip FAX modems

speech synthesis and speech recognition

January VHF Contest

The January 1998 A.R.R.L. VHF contest was held on the weekend of the 17th and 18th. It was my original plan to operate the contest with the W1QK multi-op group in Connecticut, but Mother Nature had some other ideas. The snow storm on Friday required me to plow snow a good part of that night and some more again on Saturday morning. They were also threatening more snow for Saturday night into Sunday. I figured it was best to stay home and operate the contest from there. It would give me a chance to use my station under contest conditions and have some fun.

I put my IC-706 on 6 meters with my 6 element Yagi and my IC-251 with a 160 watt amplifier and 9 element Yagi on 2 meter SSB. There were lots of stations on both bands and the QSO's and multipliers came quickly. Late Saturday afternoon, there was a bonus on 6 meters - a short opening into Florida and several additional multipliers. Another memorable contact was working FN55 in central Maine on 2 meters, off the back of the beam! In addition to some decent DX, I worked lots of local stations including members N1MNX, K1QT, and KB1AWE.

A few days after the contest I got 2 QSL's, on the same day, confirming 6 meter contacts made in the contest. When I looked closer at the cards, I saw that they were both from the same town in Florida, but from 2 different grid squares. I thought that was kind of odd. Had one of the stations made a mistake?? I was curious so, I found the town on the mapping software that I have and found that the dividing line between the two grids runs through that town. One station was on the east side, in EL99 and the other on the west side in EL89.

In total, I made 202 contacts in a total of 26 grids on both bands. The contacts and grids were almost evenly split between the 2 bands. If the opening to Florida hadn't happened, I would have had more grids on 2 than on 6. The score is as good as I've ever done from my own station in any VHF contest and I had a great time operating the contest! Maybe Mother Nature knew better?

73 de N1ABY

QSLing Slow As Molasses?

If you think the DX QSL bureau system is slow, wait until you hear this:

Today, January 28, 1998, I received an envelope from the W1QSL Bureau. There were 5 cards in it. One was from an IK station for a 20-meter contact in August 1997. Two (VE2 and EH7) were for 6-meter contacts in 1995. One was from an LU for a 10-meter contact in 1983. The last and best, was from a ZS for a 15 meter contact in 1982! The ZS operator wrote on the card "Hi - better late than never 73" What more can you say??

73 de N1ABY

NVARC Trading Post

Dave N1MNX has some items available for the asking; 110 VAC to 18 VAC transformers and a Power Supply with an output of 5 V at 45 A, 12 V at 6 A, and -12 V at 6 A.

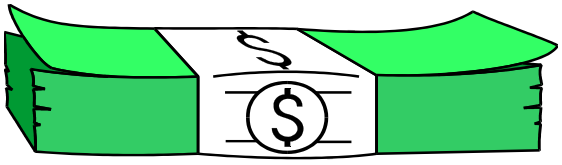
NVARC QSL Bureau

Bring your cards and a QST label to the meeting or to breakfast and the club will take care of the shipping and bureau fee.

$The Feb Treasurer's Report $

Sorry for being late with the January report. For January and February, total income

was $26.00 from ARRL renewals and one membership. Total expenses were $25.60 for newsletter postage for both months. Current account balances are:



General fund	$379.56
Education fund	$573.34

73, -Ralph kd1sm

Computer Stuff, What is AGP?

The Accelerated Graphics Port (AGP) is the new “standard” introduced to provide a high bandwidth direct connection to the system memory for the graphics sub-system. This port removes the graphics accelerator from the bottleneck of the PCI or ISA bus to deliver faster graphics performance.

What are the main differences between PCI and AGP?

The PCI (Peripheral Component Interface) bus' bandwidth is shared by all peripheral devices (ie. SCSI adapters, sound cards, graphics accelerators). The AGP is a dedicated graphics connection used only by the graphics accelerator. AGP has a higher bandwidth than PCI. The AGP bus operates at a minimum clock rate of 66MHz while the PCI bus operates at 33MHz. The AGP architecture also implements special features, such as pipelining, side band signaling and Direct Memory Execute (DIME) designed to increase 3D texture mapping performance with games developed to take advantage of AGP. In addition AGP is a full bus mastering device.

What are the principal benefits of AGP?

The AGP architecture improves overall system performance. Having a dedicated bus connection for graphics means all the PCI bus bandwidth is available for other I/O such as network cards, SCSI Cards, etc.

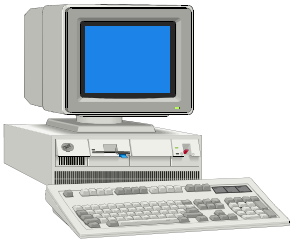
AGP's increased bus bandwidth also allows for faster graphics operations in applications such as 2D design and 3D games. AGP increases 2D and 3D speed by providing the graphics accelerator with higher bandwidth and direct access to system memory. Performance in 2D will mostly benefit from the higher bus bandwidth, which results in faster image loads or other similar operations. Performance in 3D games should improve significantly, allowing applications to use larger or more textures for better graphics quality.

Can my current system be upgrade to an AGP graphics accelerator?

No, since the AGP connector is physically and technically different from PCI, today's PCI systems cannot be upgraded with an AGP graphics accelerator.

What is bus mastering and how does it impact graphics performance?

Bus mastering allows the graphics device to work independently from the CPU, thereby increasing performance. A graphics chip designed as a bus master reduces wait time by fetching information directly from the system memory without having to wait for the CPU. AGP provides full bus mastering capabilities, however it is up to the graphics manufacturer to optimize the use of bus mastering to increase performance.



What is DMA?

DMA stands for Direct Memory Access. It allows direct access to the system memory without involvement of the CPU. DMA can be used to retrieve large or infrequently used textures from system memory and stored them into the local frame buffer for display.

What is DIME?

DIME stands for Direct Memory Execute. DMA is a way to use system memory as extra texture storage space, DIME allows texture transformations to be performed directly from system memory before the texture is mapped to the frame buffer.

What are the advantages of pipelining?

Pipelining allows the AGP device to queue several requests to the CPU without having to wait for actual data to be sent back before making the next request. PCI protocol requires requests to be immediately followed with data from the host.

What does 2x performance mean?

This refers to the capability of hardware to transfer data at both the rising and falling edge of the 66MHz clock cycle. Traditionally, a data transfer only happens at each rising peak

How many AGP devices can I have in my system?

There is only one AGP device on a motherboard. This means if the AGP device is integrated on the motherboard, it cannot be upgraded with another AGP graphics board. The only option for upgrading an AGP motherboard design is through a PCI board. If the AGP device is not integrated on the motherboard, but comes as an add-in card, it can be removed and upgraded with a newer AGP card.

Does AGP offer multiple monitor support?

Yes, AGP supports multiple monitors. However, since there is only one AGP device per motherboard any additional monitors must be driven by add-in PCI cards.

What operating systems offer optimized performance of AGP

There is currently AGP support under Windows 95 using the new VgartD driver and upcoming native support with the new Windows 98 (Memphis) operating system. The current release of Windows NT operating system will support AGP devices but not the AGP-specific performance enhancements.

CW Practice Nets

The NVARC slow speed net meets Tuesday and Thursday at 7:30 p.m. on 28.123 MHz. Except the third Thursday of the month. That being the club meeting night.

Say What?

Worry is a circle of ineffective thoughts whirling about a point of fear. A. Riggs MD.

A Mathematician, a Biologist, and a Physicist were sitting in a street café watching people going in and out of the house across the street. First they see two people going into the house. After a while they notice 3 people coming out of the house. The Physicist says; "the measurement wasn't accurate". The Biologist concludes; "they have reproduced". The Mathematician says; " if one whole person enters the house then the house will be empty".

NVARC

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Meetings are held on the 3rd Thursday of the month - 7:30 p.m. - Pepperell Community Ctr.
Talk-in 146.490 simplex
442.90 + 100Hz Repeater
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