WAVELENGTH

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PARTICIPATE – LEARN – ENJOY

April 2010   Volume 4 Issue 4

SARC Nets

President:	Bernadine Dinnard-Williams VE3YDB	Sunday	28.730 Mhz

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                   VE3YDB
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Treasurer:
Archives: Gord Hogarth VE3CNA
                   Audrey Little VA3YD
Elmer: Rod Long VE3SOY
                   Nick Blacklock VE3EBC

Sunday   28.730 Mhz
                   CW 10:00 AM
                   SSB 10:30 AM
Tuesday   147.060 MHz (VE3RPT)
                   7:30 PM
                   Alternate frequency
                   146.520 MHz simplex
Thursday   28.730 MHz
                   SSB 7:00 PM

Everyone is invited to check in on CW before the nets start.

These are open nets. All licensed hams are welcome. Come and join us.

We also want to emphasize that 28.730 MHz is our calling frequency. Please monitor and/or call your friends. 7:00 PM is a good time.

SARC 64th Anniversary Night

April 26, 2010

Important Notice

The Scarborough Amateur Radio Club does **not** currently own or operate any repeaters. We do have a repeater committee which is exploring the possibility of setting up one or more repeaters. For any inquiries, please contact Vice-President Ralph Muecke VE3VXY.

Editorial

- Eric Meth VE3EI, who works with Icom Canada, spoke at our April 12 meeting. He gave an informative presentation on D-STAR (see article from Icom later in this issue).

- Several members of SARC and Toronto ARES worked together to provide communications for the Scarborough MS Walk on April 18 in Thomson Park.

- SARC celebrates its 64th anniversary on April 26, 2010. Come out and join the party. We start at 7 PM at the Don Montgomery Community Recreation Centre, 2467 Eglinton Ave E, Toronto (near Kennedy subway).

- Field Day is fast approaching. If you are interested in participating come out to one of our meetings or contact our Field Day Coordinator, Rod Long VE3SOY.

CANWARN Training

by Geoff Coulson, Environment Canada

Folks…please find following a reminder of the CANWARN training dates this spring across Ontario. Only change has been the addition of a training session in Napanee on Saturday, May 29th. I have still not firmed up the dates/venues for the Northwestern Ontario training sessions during the week of June 7th but hope to have that done by the middle of April. For all of you that have taken the time to send me an RSVP with your chosen training date and location…thank you…the response has been great and will go a long way towards ensuring proper seating at all of the venues. For those of you who intend to come out to a session but haven't had a chance to send me an email yet…please do so in the coming days if you get a chance. You can send your RSVP to the canwarn.ontarioregion@ec.gc.ca email address or directly to me. Based on the responses to date, this spring's sessions could be amongst the best attended ever.

On a sadder note, CANWARN and Amateur Radio lost an energetic and tireless supporter with the passing earlier [in March] of Paul Chantree. Paul was a strong proponent of public safety initiatives and was an integral part of the Dufferin County CANWARN group since its inception a number of years ago. He was well-known to a number of Environment Canada staff including CANWARN's founder Randy Mawson and Phil Chadwick, meteorologist and a dynamic CANWARN trainer for a number of years. He will be greatly missed and on behalf of everyone here at Environment Canada I wanted to express my deepest condolences to his widow, Rita.

Once again, here is the current list of training dates/venues…

[…]

Hamilton - Saturday, April 17th 9 AM - Nash Auditorium, Wilcox Building, Chedoke Hospital, Sanitorium Road

Sarnia - Tuesday, April 20th 7 PM - Kinsmen Centre (Oakroom Room) 656 Lakeshore Road

Peterborough - Tuesday, April 20th 7 PM - Canadian Canoe Museum 910 Monaghan Road

Kitchener - Wednesday April 21st 7 PM - Bingemans Conference Centre - 425 Bingemans Centre Drive

Orillia - Saturday, April 24th 9 AM - Highwayman Inn - 201 Woodside Drive

Toronto - Saturday, May 1st 9 AM - Environment Canada Headquarters 4905 Dufferin St (Dufferin south of Steeles Avenue)

Cornwall - Saturday, May 1st 9 AM - Cornwall Legion 415 Second St. W.

Ottawa - Saturday, May 8th 9 AM - Kanata Legion 70 Hines Road

Sudbury - Saturday, May 15th 9:30 AM - Lionel E. Lalonde Centre 239 Montee Principale, Azilda

Sault Ste Marie - Sunday, May 16th 7 PM - Waterfront Inn - 208 St. Mary's Drive

Timmins - Monday, May 17th 7 PM - Days Inn - 14 Mountjoy St. South

North Bay - Wednesday, May 19th 7 PM - Ontario Provincial Police Communication Centre - 877 Gormanville Road

Napanee - Saturday May 29th 9 AM - Legion Hall - 26 Mill St E

Northwestern Ontario - week of June 7th - exact dates/locations to be determined in the coming weeks

A Beginner's Guide to Making CW Contacts (Part 4)

by Jack Wagoner WB8FSV

Reproduced with permission

Editor's note: This guide was written several years ago, so some references may be out of date, but the general principles are the same. This month – some tips about operating procedure.

Standard Operating Techniques

Correctly Reporting RST

Here I am including a few useful topics that didn't fit in elsewhere. For example, what is this RST thing? It is a method of giving another ham a signal report and stands for readability, signal strength, and tone. R is on a scale of 1 to 5, and both S and T on a scale of 1 to 9. An RST of 599 would be the strongest cleanest report possible. For really incredibly strong signals some hams will refer to a 20 or 30 over S9, reflecting an S-meter reading. Readability is self-explanatory, R5 is normal, R4 to me means you copy more than half of what is sent, and R3 to me means you only hear a word or two. I have never given another ham an R of 2 or 1. Signal strength is pretty subjective, just use your ears to judge. Some new hams use their rig's S-meter to determine the S they report. I don't think this is a good idea. Tone is the most misunderstood and misused report. Only rarely will I give a report less than T9, and then never lower than T8. For example, if someone has a bad AC hum on their signal, key clicks, chirp, or is drifting badly in frequency, I may give them a T8. Giving a tone report of less than T9 may really get the other ham worried about the quality of their transmitted signal, so be prepared to explain what you mean.

The RST report that one ham gives to another often influences the RST report that is received in return. If, at the beginning of a QSO, the other ham first gives me a good 599 report, I find myself more likely to send them back a good report also. I believe we do this subconsciously, it is human nature. As an optimist, my RST reports generally tend towards the positive. Even if it is a contact during which I send the first RST, I may well add an S point or two to the other ham's RST. An S point or so above what I might give if I were brutally honest. I want to begin the QSO on the right foot and make the other ham feel good about continuing the contact.

Not uncommonly when you hear a ham send an RST report, for example 599, they will send the letter "N" in place of the number "9". Or 5NN in this case. This number code is another time saving device used on CW. Or you may hear the letter "T" sent in place of the number zero, "MY POWER IS 2TT WATTS". Each "T" is usually sent several times in length longer than the actual letter T to distinguish it from a T. There is a number code for almost every number, even though the N and T codes are virtually the only ones you will ever hear. Although during the 1998 CQ WW DX Contest I heard many European CW stations report their zones as "a4" or "a5" instead of sending "14" or "15". It saved them several milliseconds of time I suppose. Here is the entire number code, for the interest of those old timers reading this. Its use probably dates back half a century in CW.

1 = a		6 = 6	
2 = u		7 = b	
3 = v		8 = d	
4 = 4		9 = n	
5 = e		0 = t	

How to Zero Beat Another Station

CW stations should always try to zero beat each other. That means to adjust your rig's transmit frequency to exactly match the transmit frequency of the other ham you would like to talk to. Hearing two CW stations conduct a conversation a few hundred cycles apart is a waste of frequency space, and is inviting QRM. How does one zero beat another station? Easy to do on phone or SSB, just tune so that the other fellow's voice sounds normal. But trickier on CW because when you put your receiver exactly on a CW station's transmit frequency, you hear nothing, zero. In modern transceivers, in the CW mode, the receiver's BFO is offset from the displayed, transmit frequency in order to produce an audible tone. In other words, the transmit and receive frequencies are far enough apart for you to hear a pleasantly pitched tone when your transmitter frequency is tuned to exactly that of the ham you are listening to. This frequency offset is frequently about 600 Hz or Hertz.

Here is how I zero beat another CW station with my own rig, a Kenwood TS 450. I tune into, or sweep through, the other CW signal, the pitch going from high to low, until the other ham's CW signal disappears. Now my receiver is zero beat with the other ham's transmit frequency. But I want my transmit frequency to be zero beat with the other ham's transmit frequency. So then I tune again, with the other ham's pitch going from low to high, until I am 600 Hz away. For example, if the other ham's transmit frequency is 7137.90 kHz, I would tune my transceiver to 7137.30 (7137.90 minus .60 equals 7137.30.) to transmit exactly on his transmit frequency. The direction you tune or sweep, the pitch going either from high to low or going from low to high, is rig dependent. On Kenwood ham radios you would tune the pitch from high to low as you tune higher in frequency, to reach the 600 Hz offset and be zero beat with the others ham's transmit frequency.

I wrote the above paragraph several years ago, and currently I zero beat using a different method. I still have my Kenwood TS-450, but now as I tune around looking for a station to contact, I leave my RIT(receiver incremental tuning) turned on. Leaving your RIT on while tuning goes against convential wisdom, but I find it works for me. I leave my RIT on about 500 to 600 Hz up. When I discover another station I wish to zero beat, I tune by ear so that their CW tone drops down in tone to almost nothing, meaning that my transmit frequency is now approximately zero beat with theirs. Then I reset my RIT back up a few Hertz so that I can hear the other station.   Takes me one or two seconds. Tuning by ear for an approximately 600 Hz tone just comes with experience. I have found that this method of zero beating works best for me. Recently I have become a DXing nut, and I find this new method faster for me. There is no one best method for zero beating. Whatever works best for you and for your rig.

This zero beat frequency stuff is pretty weird, it confuses me at times, and I hope I explained it correctly. The frequency offset for CW in most transceivers explains why when you are listening to a CW signal in the transceiver's "CW" mode, and you switch to phone, to "LSB" or "USB," you loose the CW signal and have to go search a bit for it again.

Using CW Abbreviations and Q Signals

Abbreviations are very commonly used in CW. They save time and are, I think, one reason why CW is so cool. Once you have learned many of the abbreviations as well as CW operating techniques, you are "in", you're a member of the CW using fraternity. Knowing and using CW correctly is kinda like belonging to an exclusive club. Anbody can pick up a microphone and talk on the ham bands; doing CW requires skill and finesse.

Lists of abbreviations and Q signals used on CW are available many places, I will just mention a few of the most commonly used.

ADR	address	GN	good night	RIG	station equipment
AGN	again	GND	ground	RPT	repeat
BK	break	GUD	good	SK	end of transmission
BN	been	HI	the telegraphic laugh	SRI	sorry
C	yes	HR	here	SSB	single side band
CL	closing	HV	have	TMW	tomorrow
CUL	see you later	HW	how	TNX-TKS	thanks
DE	from (French)	N	no	TU	thank you
DX	distance	NR	number	UR	your
ES	and (French)	NW	now	VY	very
FB	fine business	OM	old man	WX	weather
GA	go ahead	PSE	please	XYL	wife
GB	good bye	PWR	power	YL	young lady
GE	good evening	R	received as transmitted	73	best regards
GM	good morning	RCVR	receiver	88	love and kisses

And the International "Q" signals, recognizable in any language:

QRL	Is the frequency busy?	QRT	stop sending
QRM	interference	QRX	wait, standby
QRN	noise, static	QSB	fading
QRO	increase power	QSL	acknowledge receipt
QRP	decrease power	QSY	change frequency
QRS	send slower	QTH	location

Don't get worried about using abbreviations when you are starting out with CW. It is perfectly OK to spell out every word during a QSO. It's just easier using abbreviations. There are many more CW abbreviations and Q signals, but those should keep you busy. There are also a whole series of QN_ signals for use on CW traffic nets. Also used commonly on CW are punctuation marks; the period, comma, question mark and BT being the most common. To separate thoughts or topics during a CW contact a period or a BT (dah dit dit dit dah) are commonly used. You'll hear the slash symbol sometimes (dah dit dit dah dit) to note portable or QRP operation for example. Like WB8FSV/9 or WB8FSV/QRP.

The "K" letter used at the end of each CW transmission indicates, "end of transmission - go ahead". When two hams engaged in a CW conversation do not wish to be disturbed by anyone else breaking in, they may send "KN" instead of "K" at the end of each transmission. Or if a ham wants to limit the extent of his CQ, he may also use KN. For example, "CQ VT CQ VT de N1XYZ KN" says this ham would like to be answered only by hams in the state of Vermont.

Here are a few other commonly heard CW expressions that are actually combinations of letters sent as a single character. You will encounter these CW symbols on the air.

Wait, stand by (AS)	dit dah dit dit dit
Slash (DN)	dah dit dit dah dit
End of message (AR)	dit dah dit dah dit
End of contact (SK)	dit dit dit dah dit dah
and of course, Break (BT)	dah dit dit dit dah

At the very end of a CW contact you may hear the two stations sending dits at each other, this derives from the old expression, "shave and a haircut, two bits". It sounds like dit dit-dit dit dit, dit-dit. The first station will send the dit dit-dit dit dit and wait for the second station to send dit-dit in return. This was more popular on CW years ago, but you will still hear it today. Today it may be shortened to sending just the final dit-dit, as in "73 N1XYZ de WB8FSV GN dit-dit". New hams more frequently use the full dit dit-dit dit dit, dit dit expression than more experienced hams. Not uncommonly when I end a QSO on the novice bands and trade dit dits with the other ham, I may hear a third, or even a fourth station add their own dit dit. They were listening along in silence to our QSO, and decided to add their two bits as well. This is an unprofessional operating habit. If the eavesdropping station wants to make their presence known with a few dits, I believe they should go ahead and tailend one of us, and start a legitimate QSO. Just goes to show that as you transmit on the ham bands, there are likely more than just a few folks listening.

Obscure, Rarely Used CW Characters

To be honest, I have never heard any of these CW characters in 29 years on CW, but it is still fun to know they exist. Do not use them on the air, other hams will not have any idea what you are sending.

Colon	[:]	dah dah dah dit dit dit	Underline	[_]	dit dit dah dah dit dah
Semicolon	[;]	dah dit dah dit dah dit	Paragraph	[ ]	dit dah dit dah dit dit
Hyphen	[-]	dah dit dit dit dit dah	Dollar sign	[$]	dit dit dit dah dit dit dah
Double hyphen	[=]	dah dit dit dit dah	Multiplication sign	[x]	dah dit dit dah
Quotation	["]	dit dah dit dit dah dit	Addition sign	[+]	dit dah dit dah dit
Apostrophe	[']	dit dah dah dah dah dit	Understood	[ ]	dit dit dit dah dit
Left-handed bracket	[(]	dah dit dah dah dit	Attention	[ ]	dah dit dah dit dah
Right-handed bracket	[)]	dah dit dah dah dit dah	Underline	[_]	dit dit dah dah dit dah

To transmit a fractional number in CW, send a slash[/](dah dit dit dah dit) between the numbers in the fraction. One half is transmitted as 1/2. To send a number that includes a fraction, transmit a hyphen between the whole number and the fraction itself. 5 2/3 is sent as 5-2/3. To indicate the percentage sign, transmit the figure zero followed by the slash and the figure zero again. Similar to the fraction, a hyphen is used to transmit a whole number, or a fraction, followed by a percentage sign. For example 2 % is transmitted as 2-0/0. To send the minute sign['] or the second sign["] used in latitude and longitude coordinates, use the apostrophe once or twice as appropriate. There are also 12 or more Morse Code characters for letters used in certain European languages which use the Latin alphabet. Thanks again to L. Peter Carron, JR., and his book, Morse Code:The Essential Language, The American Radio Relay League, 1991, for these obscure CW characters.

Here are a few of the auxiliary CW characters used with some European languages, thanks to Chuck, KB2E, in his letter to the FISTS Keynote newsletter. "...the German A with two dots over it, Ä, (dit dah dit dah); the Spanish-Scandinavian A with an accent mark, or a dot, over it, Å, (dit dah dah dit dah); the German-Spanish CH (dah dah dah dah); the French E with an accent over it, É, (dit dit dah dit dit); the Spanish N with that wavy line over it that we all know now because of the infamous El Nino, ñ, (dah dah dit dah dah); the German O with two dots over it, Ö, (dah dah dah dit); and the German U with two dots over it, Ü, (dit dit dah dah)." I am uncertain of the precise linguistic terms attached to each of these diacritical marks, whether they be grave, umlaut, or circumflex, but you get the idea. I have never heard them used in CW, but then again I don't work very many Europeans on 40 and 80 meters.

Taking Notes During a QSO, Logging, Using GMT/UTC Time

While I am in contact with another station CW station, I take notes. In fact I write down every word sent by the other ham. Mainly this is because I have a memory like a screendoor in a submarine! But I recommend at least noting the main points made by the other station, so that you will remember what to comment on during your next transmission. I circle with my pen those items I want to remember to bring up next go around.

I am kind of strange in that I save all these notes I've taken during my QSOs, going back 30 years. Really. It is absolutely fascinating to go back through my notes and read, word for word, what I talked about when I was a novice 29 years ago. Kinda like a ham diary. By FCC regulations we are no longer required to keep a log of the radio contacts we make, but I highly recommend it. Not only for QSLing purposes, but so that you can look up when in the past you worked a familiar callsign. And looking through your old logbooks will bring back lots of pleasant memories of QSOs gone by. I keep copious notes in my logbook, beyond the standard date/time/frequency/callsign/RST/name/location, to help me remember what was special about each contact.

I fill out as much information as I can in my logbook at the very beginning of each QSO. This saves me time and, if I accidently bump the VFO dial during the QSO and change frequency, I can use my logbook to look up my original frequency. Or you can use your frequency lock control if your rig is so equipped. My cat Rasta has been known to jump up on my desk while I am QSOing and rub against my VFO before I can stop him. Perhaps my cat did not like the other ham's fist. HI.

After you have been on the air a while, another ham will someday surprise you during a QSO by using your name before you give to them, or asking if your old Heath DX 60B transmitter is still running. How did they know your name or about your rig? Turns out you have worked this ham before but forgotten, and they either have a very good memory, or they keep their log on a computer. I would love to put all 29 years of my ham contacts in a computer database, but whew! The data entry would take months. If you are just beginning your ham career and have a computer, then get some logging software.

Hams should always use GMT or UTC time when logging and keeping records. Try to keep a schedule set up for 8 pm with another ham who lives in a different time zone. Do you meet at 8 pm your local time or 8 pm their time? No problem if you both use UTC time. Always fill out QSL cards using UTC time. Do not use 24 hour military time. Confusion often arises when you make a ham contact close to 0000 hours UTC. Because in UTC the date changes at 0000 or midnight UTC. What date do you put on your QSL card? Use the UTC date. I frequently receive QSL cards from new hams with the correct UTC time but the wrong date. They have grown up accustomed to the date changing at midnight their own local time.

Keeping track of the current time in UTC takes practice. You could tune your receiver to a time standard station like WWV or CHU to determine the current UTC. Clocks are available that tell time in UTC format. Or you could, like me, just memorize your local/UTC equivalents. You can make a little chart with your local/UTC equivalents. You will need to make two such charts since local/UTC equivalents change twice a year, with the switch between daylight time and daylight savings time. This twice yearly switch pretty much takes place all over the world, not just in the United States.

For a basic explanation of what GMT/UTC time is, visit my Radio Fundamentals Homepage.
http://www.netwalk.com/%7Efsv/homepage2.htm#UTC-%20Universal%20Coordinated

Identifying as per FCC Regulations

Speaking of FCC regulations, amateur radio operators are required to identify themselves on the air by transmitting their callsigns. At least every ten minutes. I believe it is also a good idea to identify at the beginning and end of each of your transmissions as well, even if less than ten minutes has passed. You will hear some experienced CW operators taking turns transmitting during a QSO without IDing. For example:

first station "WHATS UR WX LIKE? BK"

second station "SUNNY ES COOL. HW ABT U? BK"

first station "MONSOON HR, RAIN ES 70 DEGS..."

No problem as long as they ID every ten minutes. If band conditions are poor or there is lots of QRM, IDing at the beginning and end of each transmission is wise, or the other station may not realize you turned it over to them. Easy way to completely loose one another. To save time I will sometimes end my transmissions with only my own callsign, like "HW COPY? de WB8FSV K". Cool, as long as every ten minutes I start or end one of my transmissions with something like, "WHAT SAY FRED? N1XYZ de WB8FSV K"

What is D-STAR?

Content courtesy of Icom America

The History

D-STAR, a standard published in 2001, is the result of three years of research funded by the Japanese government and administered by the JARL to investigate digital technologies for amateur radio. The research involved Japanese radio manufacturers and other observers. Icom provided the equipment used for development and testing. D-STAR radios and repeaters have been tested extensively and are now ready for public use.

An Overview

D-STAR is an open protocol – although it is published by JARL, it is available to be implemented by anyone. (For definitions and explanations of terms, there is a glossary on page 6.) While Icom is the only company to date that manufactures D-STAR-compatible radios, any equipment or software that supports the D-STAR protocol will work with a D-STAR system. D-STAR systems can be built using both commercial and homebrew equipment and software.

In a D-STAR system, the air link portion of the protocol applies to signals travelling between radios or between a radio and a repeater. D-STAR radios can talk directly to each other without any intermediate equipment or through a repeater using D-STAR voice or data transceivers. The gateway portion of the protocol applies to the digital interface between D-STAR repeaters (see figure 1). D-STAR also specifies how a voice signal is converted to and from streams of digital data, a function called a codec. The D-STAR codec is known as AMBE® (Advanced Multi-Band Excitation) and the voice signal is transmitted in the D-STAR system at 3600 bits/second (3.6 kbps).

D-STAR Digital Voice (DV) and Digital Data

The D-STAR system supports two types of digital data streams. The Digital Voice (DV) stream used on 144 and 440 MHz contains both digitized voice (3600 bps including error correction) and digital data (1200 bps). Using a DV radio is like having both a packet link and FM voice operating simultaneously. The Digital Data (DD) stream, used only on 1.2 GHz, is entirely data with a bit rate of 128k bps. The data connection to a radio that uses DV is via an RS-232 interface or USB 1.0. An Ethernet connection is used for high-speed DD D-STAR data. Ordinary terminal emulation software (DV) or a Web browser (DD) will do just fine for exchanging data (see figure 2).
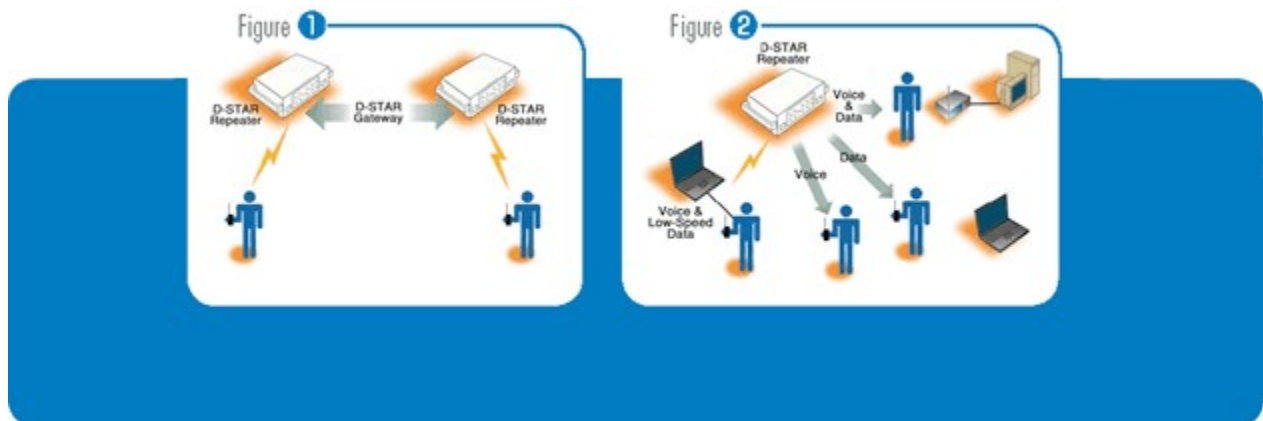
D-STAR Features

Handheld and mobile radios

Worldwide connections

For voice conversations, D-STAR repeaters act just like familiar analog repeaters – everyone listening can hear your transmissions. Because your call sign is incorporated into every transmission, the D-STAR repeater "registers" your call sign and shares it around the D-STAR system. If you travel into a new D-STAR repeater's coverage area, register with a short transmission and your location will be quickly updated around the D-STAR network. This allows you to call someone registered with any other D-STAR repeater, no matter where that may be. If you call someone registered elsewhere, your voice will be routed to the appropriate repeater in digital form, where it is then heard just as you would expect if you were both using the same repeater!

Low-speed data

Many data communications needs don't require high-speeds, particularly for emergency communications. Status reports, damage assessment, shift changes, resource requests – all they take are a few keystrokes. D-STAR combines voice and low-speed data into a single channel simultaneously. There's no need for a separate TNC and radio. Just connect your laptop or PDA and go.

High-speed data

A high-speed D-STAR connection looks just like an Ethernet connection to your laptop or other network device. Why run cables for a temporary or portable installation when mobile rigs will do the job? Connect across miles instead of meters! If a D-STAR repeater offers a broadband Internet connection, you have worldwide connectivity through your radio.

Emergency communications managers can put D-STAR's high-speed data capabilities to work building systems that support their "served agency" with IT tools they understand and expect; email, file transfer, and Web browsing. Spreadsheets, graphics, maps, lists, Web pages – all flow easily through the D-STAR system (see figure 3).

If a picture is worth a thousand words, why not use D-STAR to paint the image? Weather and traffic information from the Internet are available via a D-STAR repeater's broadband connection. Add a digital camera to a laptop and your D-STAR radio becomes a Web cam. Emergency management is greatly enhanced when images are available. The next time your group helps out on race day, D-STAR can make it possible to send photos at the finish line, on the course – anywhere your operators are.
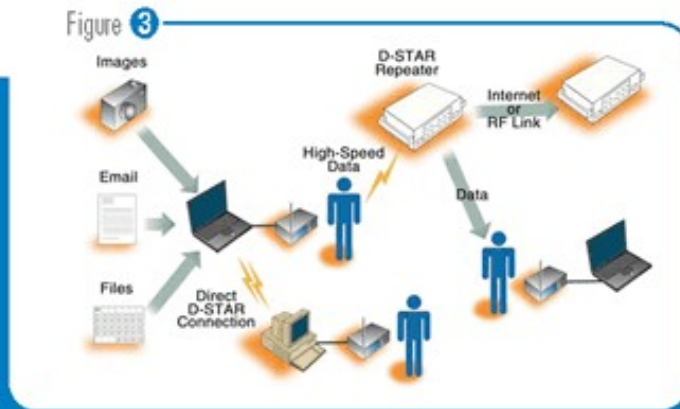
The D-STAR repeater

Repeaters and repeater systems

Repeater links and groups

D-STAR gateway protocols and software support linking repeater systems over a few miles or around the world. A regional group of repeaters create a D-STAR zone, shown in figure 4, working together and addressable in the D-STAR system as a unit. Whether you live in the wide-open spaces or a densely populated area, D-STAR repeaters can be tied together to make up the repeater system you want using either Internet or microwave links.

## Repeater system management

Repeaters linked with D-STAR can also share information using the same D-STAR link. This information includes repeater operating information and statistics. System designers can add entirely new functions, sharing weather and control information, for example. Another possibility is "smart systems" that track interference or user location.

D-STAR channel spacing = more repeaters

If you've tried to coordinate a repeater channel on 2-meters or 440 MHz in any metropolitan area, you know how crowded the bands are! The D-STAR voice and low-speed data signal offers a significant improvement in spectrum efficiency, requiring only a 6 kHz channel instead of the 20, 25, or even 30 kHz of analog wide-band FM. As shown in figure 5, D-STAR repeaters can be interleaved between existing channels or multiple repeaters deployed in the spectrum of only one analog FM repeater.

D-STAR registry

As authorized users make their initial transmission to a D-STAR system, the call sign information attached to the digitized voice packets is recorded by the repeater controller. The controller then shares the information with other D-STAR systems through the D-STAR gateway registry. The registry is maintained on gateway servers located around the world as shown in figure 6 -- currently Japan, the United States, and the UK. When an authorized D-STAR user makes a call to a call sign not currently registered on that repeater system, the registry allows the repeater controller to route the call to the repeater on which the targeted user was last registered.
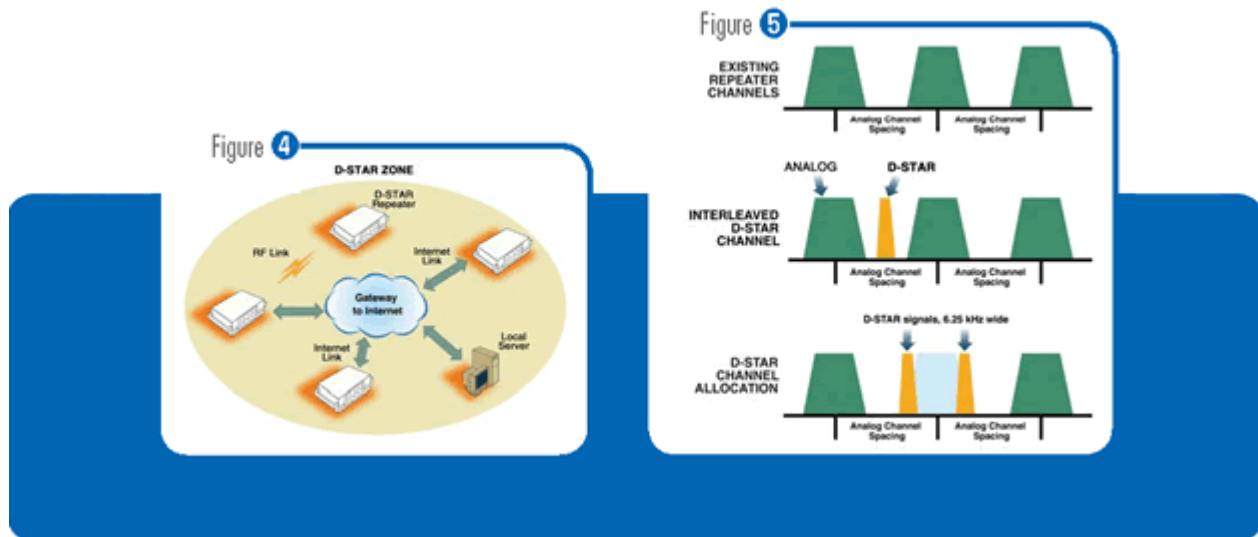
What can D-STAR do for me?

New services and system examples

Information and services – the D-STAR kiosk

Imagine arriving in town as a visitor or on business. Connect a laptop or PDA to your D-STAR handheld, key in a few simple characters, and request a "what's happening" report from a local D-STAR kiosk server. In seconds, you're viewing text listing meetings, clubs, electronics stores, and events. Need a weather check? A few more characters and the screen fills with the current report.

D-PRS

The low-speed data ports of D-STAR handheld radios are compatible with the GPS NMEA data interface. With GPS data integrated into the D-STAR digital data stream, your location data is forwarded to the D-PRS server where gateway software connects you to the APRS® reporting system. The interface is built-in to D-STAR radios – no separate TNC and transceiver required!

IRLP and EchoLink

It's only natural that D-STAR's digital voice capabilities will be linked up with the most popular repeater sharing applications, EchoLink® and IRLP. Since your voice is already digitized within the D-STAR system, third party bridges and converters to and from other digital voice systems an obvious and expected future addition.

Remote control and monitoring

Since D-STAR's data looks just like any other Internet data to a browser or Web application, why not use D-STAR's high-speed data to build a link to your club's HF station? Want to control your electronics at home? Either high-speed or low-speed D-STAR data can do the job. D-STAR is built to support 21st century tools - the Web, networking, Ethernet, TCP/IP - so free your imagination!

Application developers

The open D-STAR protocol provides a rich, exciting set of tools with which hams can experiment and build. Icom supports developers with the D-STAR forums at http://www.icomamerica.com/en/support/forums/default.asp – please join this growing community. In addition, Icom is preparing technical support documentation for the developer, such as protocols and interface descriptions.
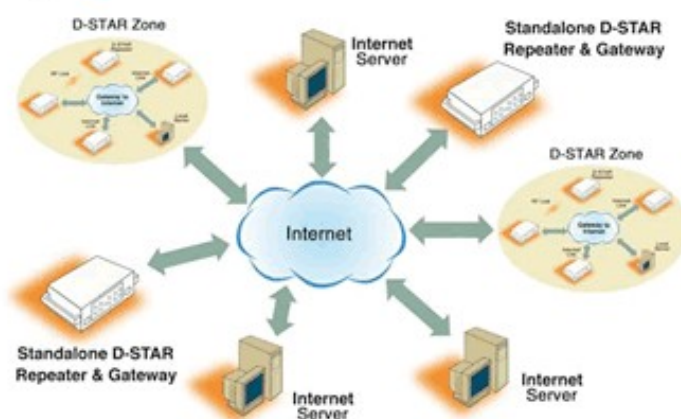
Glossary

Air Link:
The portion of data transmission that takes place as a radio signal. The D-STAR air link includes both modulation methods and data packet construction.

Area:
The geographical region served by one D-STAR repeater.

Authorization:
Adding a user to the D-STAR registry.

Bridge:
A connection between just two devices, such as between two ID-1 transceivers.

Client:
A program that requests data (programs, Web pages, documents, etc.) from servers.

Codec:
Code/Decode, a circuit or program that translates an analog signal to and from digital form, usually refers to an audio signal, such as voice or music. Different codecs, such as AMBE or MP3, have different rules for the translation between analog and digital.

Controller:
The part of a D-STAR repeater that handles and routes the voice and data streams either between modules or between modules and the gateway.

DD (Digital Data):
The D-STAR high-speed digital data signal.

DV (Digital Voice):
The D-STAR digital voice + low-speed data signal.

EchoLink®:
(www.echolink.org)and IRLP (Internet Relay Linking Project - www.irlp.net), systems that allow repeaters to share digitized voice signals using Voice-Over-Internet Protocol (VOIP) technology.

Encapsulate:
To incorporate data packets from one protocol inside the data packets of another.

Ethernet:
The set of protocols that control local area network (LAN) connections, described by the IEEE 802.3 standard.

FEC:
Forward Error Correction, the process of adding information to data so that the receiver can correct errors caused by the transmission process.

Gateway:
The part of a D-STAR repeater that connects the controller to other gateways via the Internet.

IP:
Internet Protocol, the protocol that controls how data packets are exchanged on the Internet.

Module:
A D-STAR module is the part of a D-STAR repeater that implements voice or data communication over the air.

Register:
Capture the call sign of a received signal and post it to the system registry for other D-STAR repeaters to use for the purposes of routing calls.

Registry:
A shared data base of authorized user call signs and gateways.

Route:
To direct data packets to specific destinations.

Server:
A computer that supplies data (programs, Web pages, documents, etc.) to clients when requested.

Zone:
A group of D-STAR repeaters linked together and connected to other D-STAR systems by a single gateway.