

# D\*Star 101



# What is D\*Star

- D\*Star stands for “Digital Smart Technology for Amateur Radio
- Developed by Japanese Amateur Radio League (JARL) and is an open standard.
- Icom is currently the only manufacturer of commercial radios
- Kenwood does have a rebadged ID800 mobile in Japan but not US
- D\*Star is an open standard, anyone who wants to can build equipment meeting the standard.
- Non-Icom Hardware been available for some time-- DV Dongle, D-Star Node Adapter.
- Dstar is a 100% digital voice and data standard-- signals are digital from microphone to speaker, end to end.

# D\*Star Air Protocol

- Dstar uses a GMSK codec ( Gaussian Mean Shift Keying encoder/decoder) at 4800 bits per second in Digital Voice Mode (DV)
- This codec is called AMBE (Advanced Multi-Band Excitation).
- AMBE is a product of Digital Voice Systems Incorporated (DVSI)
- AMBE is similar to (but not the same as) the P-25 (IMBE) digital voice used by Public Safety, they are cousins and are not interoperable
- Trivia question: Dstar is actually used for public safety communications in Japan.

# D\*Star Modes

- Digital Voice(DV) – 4800 bits per second
  - 2400 bps GMSK voice data
  - 1200 bps forward error correction (FEC) data
  - 1200 bps serial data (packet replacement/D\*PRS)
  - Available on all D-star radios
- Digital Data(DD) -- 128kbps
  - 1.2 gig with ID-1 Only
  - Effective rate ~90 kbps (feels like a fast dialup)
  - Can be used point-to-point or through repeater module.
  - Provided as an Ethernet connection to the computer.

# All Bits and Bytes Now...

- Low-speed data on all bands
  - Use to transmit position data like APRS (called D\*PRS)
  - Use for similar applications as packet (keyboard to keyboard chat, transfer small files)
  - Not error corrected, application must handle any error correction necessary.
- High-Speed data on 1.2
  - ID-1 connects to computer with USB and Ethernet cables
  - USB used for radio control, Ethernet for data
  - Works similar to 802.11 cards
  - Can use point-to-point or with repeater access point

# • D-Star vs FM Operations

- In FM world, you need 3 settings in radio
  - Frequency, Offset, Tone ==> save to mem
- D-star adds 2 more programming variables to the mix
  - Frequency, Offset, DV Mode, Call sign settings ==> save to memory slot
- Radios have much more capabilities than we are going to cover today (D\*PRS, data operation)
- Keep the manuals handy for a while. Things do get easier with time and experience!

# Call Sign Routing

- D\*Star is call-sign routed
- Station can be local or remote, system routes calls intelligently.
- Call sign entries are 8 characters.
- The 8th character of a callsign is reserved for the Station sub-id or the repeater ID.
- Convention is that \* is used to represent a blank space in examples.
- - W5NGU\*\*A is actually entered in radio as “W5NGU blank blank A”

# Dstar Needs to Know

- Need to tell Dstar system 4 things
  - Who you are (MyCall)
  - Who you want to talk to (URCall)
  - How are you coming in to the system (RPT1)
  - How are you going out of the system (RPT2)
- How you set up your call sign entries tells the system where to route your transmission.
  - Locally on same repeater module
  - Multiple repeater modules (Cross band)
  - To another repeater module via the internet gateway server



# Call sign entries

- 4 different call signs to enter
  - MyCall (MyC on 1st gen- V/U82, IC2200)
    - Your call sign
  - UrCall (YuC on 1st gen)
- URCall Can be one of 4 things:
  - A specific callsign you are calling
  - CQCQCQ for a general call
  - /RPTCALL to route to a specific remote repeater module
  - A Dplus Command
- MYCALL and URCall are the only two things needing to be set for simplex operation.

# Call signs Continued

- RPT1 (R1C on 1st gen)
  - This is the repeater callsign you are coming into the Dstar network on.
  - Must be set to the correct callsign for the repeater you are using or you will not be repeated!
- RPT2 (R2C on 1st gen)
  - Repeater callsign you are leaving the repeater stack on
  - This can be another repeater port in the stack for X-band operation, or the gateway server.
  - Normally you will want to leave RPT2 as W5NGU\*\*G

# Repeater Module Standards

- Not all systems will have all bands available.
- Letter identifying the band goes into 8<sup>th</sup> position on call sign memories.
- US Repeater module standards (also for reflectors)
  - A == 1.2g voice / 1.2 data
  - B == 70cm voice
  - C == 2m voice
  - G == Internet gateway server (not used on reflectors)
- Japanese systems use different standard
  - A == 70CM
  - B == 1.2 voice/data
  - No 2m module on Japanese systems

# Some Usage Examples

- Placing a CQ call on the repeater, same band
  - MyCall KD5WYU
  - UrCall CQCQCQ
  - RPT1 W5NGU\*\*C
  - RPT2 NOT USE
- Placing a local call, cross band (2m to 1.2)
  - MyCall KD5WYU
  - UrCall K5TCP
  - RPT1 W5NGU\*\*C
  - RPT2 W5NGU\*\*A

# Icom Style Gateway Voice Usage

- Calling another station via gateway; gateway routes audio to last place rec'd
  - MyCall KD5WYU
  - UrCall K5TCP
  - RPT1 W5NGU\*\*C
  - RPT2 W5NGU\*\*G
- Remote station has to register on their local repeater first (simple kerchunk)
- Directed Call to other repeater via Gateway (Icom calls this a Zone Call)
  - MyCall KD5WYU
  - UrCall /K5TIT\*C
  - RPT1 W5NGU\*\*C
  - RPT2 W5NGU \*\*G

# Dplus Linking

- Dplus is a third-party program running on gateway that enables Echo Test, Simulcasting, DV Dongles, Reflectors, and Echolink/IRLP style repeater Linking in Dstar
- Dplus created by Robin Cutshaw AA4RC in Atlanta.
- Dplus commanded through the URCall field in your radio.
- Set Mycall, RPT1 and RPT appropriately with command in URCall, then kerchunk to send the command.
- Gateway will play back a voice file with results
  - “Remote System Linked/Unlinked/Already Linked”
  - If not connected, you will get repeater ID track.

# Dplus Reflectors

- Currently 20 reflectors worldwide, more added all the time.
- List of reflectors on [dstarinfo.com](http://dstarinfo.com) Reflectors tab
- Reflectors have an independent A, B, and C port
- Can link each RF module to a different place.
- Please DO NOT link more than 1 RF module to the same reflector or remote repeater.
  - Doing this causes bad things to happen to gateway and will get the administrators angry with you.

# Dplus Dashboard

- All gateways and reflectors provide a Dashboard web page showing recent activity and current linking status of the repeater modules
- W5NGU Dashboard at <https://dstargateway.dcara.net/status.html>
- Currently no way to determine where you are linked from RF, need to use the Dashboard.



# OK, so how do I use Dplus

- Dplus commanded through URCall field
- Set Mycall appropriately, RPT1 to correct RF port, RPT2 to W5NGU\*\*G, set URCall then Kerchunk
- Linking accomplished by callsign with L in the magic 8<sup>th</sup> position in URCall.
- Unlinking accomplished by \*\*\*\*\*U (7 blank spaces and the letter U)
- Once command sent and acknowledged, set URCall back to CQCQCQ
- If you forget last step, you will not make it through to destination.
- Some radios have shortcut button to do this (91AD, 92AD)

# Some examples

- Link 2m module to San Antonio 70CM module
  - MYCall KD5WYU
  - URCall WD5STRBL
  - RPT1 W5NGU\*\*C
  - RPT2 W5NGU\*\*G
- Link 2m module to Reflector 1C Megareflector
  - MYCall KD5WYU
  - URCall REF001CL
  - RPT1 W5NGU\*\*C
  - RPT2 W5NGU\*\*G

# Some Examples, Cont'd

- Unlink 2m module
  - Mycall KD5WYU
  - URCall \*\*\*\*\*U
  - RPT1 W5NGU\*\*C
  - RPT2 W5NGU\*\*G

# Other Dplus Functions

- Dplus also gives you Echo Test & ID track
- Echo Test is called with W5NGU\*\*E in URCall
  - Key up, talk a bit, then unkey, repeater will play audio back to you.
- ID Track called with W5NGU\*\*I in URCall
  - If you get my ID, no link established
  - If you get Remote System Linked, you are linked someplace! Unlink or Check Dashboard.

# Gear For Dstar

- Icom currently the only radio manufacturer
  - Handhelds
    - IC-V82/U82 single band VHF/UHF radio (based on IC-V8 HT) 1<sup>st</sup> Generation
      - Work fine but has serious memory limitations
    - IC91AD dual band/dual receive
    - IC92AD dual band/Dual receive
    - IC80AD dual band/Single Receive

# Gear for Dstar, Cont'd

- Mobile Radios
  - IC2200h 2m only (1<sup>st</sup> gen, memory limitations)
  - ID800h 2m/440 single receive. Discontinued.
  - ID880h 2m/440. Single receive- repl'd ID800h
  - IC2820 2m/440. Dualband dual receive + GPS module for DPRS.
  - ID-1 1.2 Ghz DV/DD radio
    - Need an ID1 for highspeed data
- DV Dongle
  - Allows you to connect from PC over internet

# Registration

- Repeaters are open locally.
- Must register with one Dstar system to get out through gateway.
- Registration is web based, takes 5 minutes.
- Must be approved by admin then complete set up to add terminal information.
- Once registered, can use any Dstar system without registering again, subject to local policy of that system.
- Detailed Instructions on the club site on Dstar page

# A word about Call Suffixes

Certain letters are not permitted as they are recognised as they are reserved for special purposes within the D-Star system. The following letters are not permitted:

<b>Callsign Extension:</b>	<b>Reserved For:</b>
A	23cm D-Star Repeater
B	70cm D-Star Repeater
C	2m D-Star Repeater
E	D-Star Repeater Echo Test
G	D-Star Repeater Gateway
I	D-Star Repeater Information
L	D-Star Repeater Gateway Linking
S	D-Star Repeater Internal System
U	D-Star Repeater Gateway Unlinking
C0	D-Star Reserved for future use
R0	D-Star Reserved for future use
S0	D-Star Reserved for future use
1, 2, 3,... 0	Not permitted

**Examples of appropriate callsign extensions:**

<b>Callsign with Extension:</b>	<b>Suggested Usage:</b>
VK1ABC	VK1ABC Home Station
VK1ABC D	VK1ABC DV Dongle User
VK1ABC M	VK1ABC Mobile Radio
VK1ABC P	VK1ABC Portable / Hand Held Radio



# Repeater Operating Tips

- Must wait until repeater stops transmitting to transmit again.
- Doubles will not be repeated (R2D2 or nasty popping noise)
- packet collisions won't be decoded by repeater
- Be extra patient, especially calling through gateway-- takes time to set up call sign lists
- Data Operation (Internet Access)
  - G-Rated
  - No Encrypted data (SSL, SSH sessions)
  - No Business Content.

# Gateway DD mode setup

- Requires an ID-1 in DD mode
  - MYCALL KD5WYU, URCALL W5NGU
  - RPT1 W5NGU\*\*A, RPT2 W5NGU\*\*G
- Setup PC or router as follows:
  - IP is private class A static IP assigned to you by system at registration time (10.x.x.x)
  - Subnet mask 255.0.0.0
  - Default Gateway 10.0.0.1
  - DNS Servers 10.0.0.1, 10.0.0.2
- Remember channel shared amongst all users so disable any automatic updates.
- Router between ID-1 and PC is OK to share connection.

# Dstar Myths/Misconceptions

- Gateway registration is not required to use repeaters locally
  - If not registered just can't use gateway or data access with ID-1
- Not required to register with each system
  - Registered on one system, can use all gateways on the Dstar network
- Conversations are private???
  - Scanners can't decode Dstar, but anyone on the frequency with a Dstar radio can hear you.

# Programming Templates

- DCARA has available standard templates to assist you in programming radios
- Memory files are available on club site
- Members will program radios on request

# W5NGU Dstar Repeater

- Located at Denton Co EOC 420 feet
  - 1.2g Voice 1293.400- (20 mhz down) (A)
  - 1.2g Data 1253.600 simplex (ID1 calls RPS mode) (AD)
  - 70cm Voice 442.925+ (B)
  - 2m Voice 147.450 out / 146.450 in (1mhz odd split!) (C)
- Future full stack at Rosston Tower (**KE5YAP**)

# Local Dstar Repeaters

- K5TIT Repeater(Green Building Downtown)
  - 1.2g Voice 1293.000- (A)
  - 1.2g Data 1253.000 simplex (AD)
  - 70cm voice 442.000+ (B)
  - 2m voice 147.360+(C)
- K5TIT is used as a test bed for development and Gateway access is restricted.

# Local Dstar Repeaters

- Mesquite (NT5RN, Eiffel Tower)
  - 1.2 voice 1293.50000MHz -20.000 NT5RN A
  - 1.2 data 1253.80000MHz Simplex NT5RN A
  - VHF - 145.150 -600 kHz NT5RN C
  - UHF - 443.025 +5.00 MHz NT5RN B
- Plano (K5PRK, Central Collin Co)
  - 1.2 Voice 1295.000MHz -20.000(DV) K5PRK A
  - 1.2 Data 1255.000MHz Simplex K5PRK A
  - 70cm, 441.575MHz +5.0000 K5PRK B
  - NO 2M repeater planned

# Other Texas repeaters

- KC5OLO Abilene
- W5ZDN Waco
- W5HAT Bruceville/Eddy
- K5CTX Temple (Belton hamfest)
- W5LM Killeen
- KE5RCS Georgetown
- W5KA Austin (not on gateway yet)
- WD5STR/WA5UNH San Antonio
- N5MDS Magnolia
- W5HDT/W5HDR/N5HDS Houston
- K5PLD Pearland
- KE5WFB Laredo



# Web Resources

- Icom has product manuals available on their site in PDF format
- Dstarusers.org: repeater directory, recent activity, forums, links to 3<sup>rd</sup> party applications
- Wikipedia Dstar Article is kept up to date and has links
- Dstarinfo.com: Great info site, reflector lists, Dstar calculator programming aid
- Ladstar.org: Good basic tutorials
- NJ6N Dplus Monitor: See who is talking where in real time

# Other Resources

- Yahoo Groups
  - dstar\_digital, Dstar-Gateway, individual radio groups
- Experienced Users
  - Several users here in the room know Dstar very well and will be glad to help you out.

# Nifty Accessories Book

- Nifty Accessories, the folks that make the guide books for radios and “cheat cards” for portables now have a 104 page book available about Dstar that covers everything discussed here and more.
- This is available from Nifty directly and also from the various ham radio dealers.

# Go Explore

- Dstar is a taste of the future of the radio world.
- Learning curve is daunting but results are worth it.
- Gateway system is world-wide.
- As was passed along to me the day W5NGU came on line as part of the network:  
“Welcome to the future, and welcome to the FUN!”

# WHEW!

- Holy cow man, this is a TON OF STUFF!!!!!!!
- Any questions?

# THANK YOU FOR YOUR TIME!