Digital

The Future of Communications

The Digital Future

- **More powerful DSP**
  - Faster processors, better algorithms, better filters and more features
- **Software Defined Radio (SDR)**
  - Download the latest filters, features and modes to your radio/computer
- **Digital Voice and Data**
  - Already implemented in every cell phone, satellite radio/TV, DRM shortwave and many commercial radios

Digital Voice/Data = DSTAR

- Digital Smart Technology for Amateur Radio
- Joint venture between Japanese government and Japanese Amateur Radio League (JARL)
- Open specification
- Icom is the only current vendor although Kenwood announced products coming
- Radio products all offer analog mode for backward compatibility

DSTAR Modes

- ## Digital Voice
  - 3600 baud AMBE encoded

- ## Low-speed Digital Data
  - 1200 baud available simultaneously on "voice" channel or 4800 baud as data-only
  - 3-wire "com port" interface via submini jack
  - VHF/UHF

- ## High-speed Digital Data
  - 128K baud through RJ-45 Ethernet jack
  - Available at 1.2 GHz

DSTAR Topologies

- Radio to Radio (RF)
  - Voice
  - Data
  - Voice with Data
- Radio to Repeater (RF)
  - Same modes as above
- Repeater to Repeater Gateway
  - 10 GHz Microwave link (10 Mbs)
  - Internet

Why use Digital Voice?

- ## Spectral efficiency
  - Same reason as cellular service providers
  - Digital voice has a 6 kHz bandwidth
  - FM voice is 15-20 kHz bandwidth
  - TWICE as many repeaters in the same spectrum!
- ## Shares spectrum with data
  - Callsigns, DPRS position data and messages can transmit WITH voice signal, unlike APRS
- ## Voice QSOs are "routable"
  - Voice can be directed to another radio, repeater or gateway

What does this mean to me?

- Call *Anyone*
  - Radio knows your callsign
  - Your callsign appears on other radios when receiving
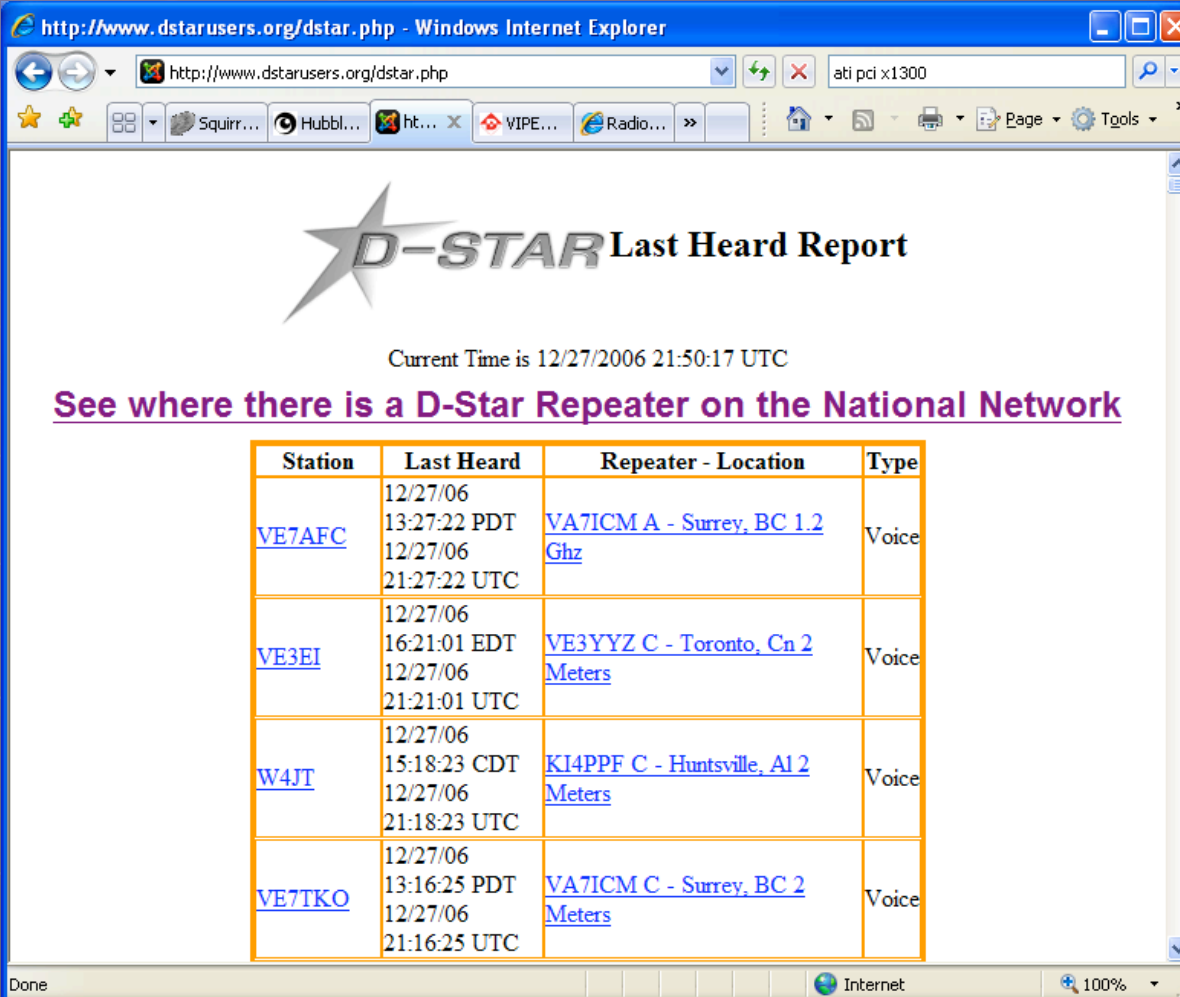 - Can enter other callsign for "callsign squelch"
- Call *Anywhere*
  - Voice can be sent through repeater or routed through a gateway via RF or the Internet
  - DSTAR users are registered with local repeaters for cellular-like service
- Call *Anytime*
  - Some even include an answering system

DSTAR User Registry

Why not IRLP?

- No "callsign squelch"
- Cannot call individual user – only links repeaters
- Call routing is not automatic
- Node names are numeric rather than callsigns
- Requires activation via DTMF code sequence
  - DSTAR call information can be stored in memory
- Cannot send callsign/messages/position or other data to remote users
- DSTAR offers some level of secure transmission

Why Digital Data?

- DPRS position reports and messages like APRS
- Transfer any type of data (text, photos, email, spreadsheets, etc)
- Interface as COM port (low speed) or Ethernet port (high speed)
- Routable to other radio anywhere in the system or gateway to Internet
- 128K baud at 1.2GHz and 10M baud at 10GHz!
- Plug and play – no extra TNC or radio cabling

Why not packet or Winlink?

- Packet is a routing nightmare
  - Roaming IP is available for packet but not used
- Packet protocols are unique to ham radio
  - DSTAR is either a COM port (low speed) or TCP/IP network (high speed)
- Winlink is only Email (with small attachments)
- Winlink is supported over DSTAR
- Off the shelf, single-box solutions for 1200 baud, 4800 baud and 128K baud!

What do I need?

- Full line of products currently available with more coming from Icom and Kenwood
    - 2m HT – V82 with UT-118
    - 70cm HT – U82 with UT-118
    - Dual band HT with Dual VFOs – IC-91A/D
    - 2m Mobile – IC-2200 with UT-118
    - Dual band mobile – ID-800 and IC-2820 (soon)
    - 1.2Ghz mobile – ID-1 (supports high speed data)
    - VHF, UHF and microwave repeaters and controllers

Handheld DSTAR Radios

IC-V82 / IC-U82

IC-91A/D

Mobile DSTAR Radios
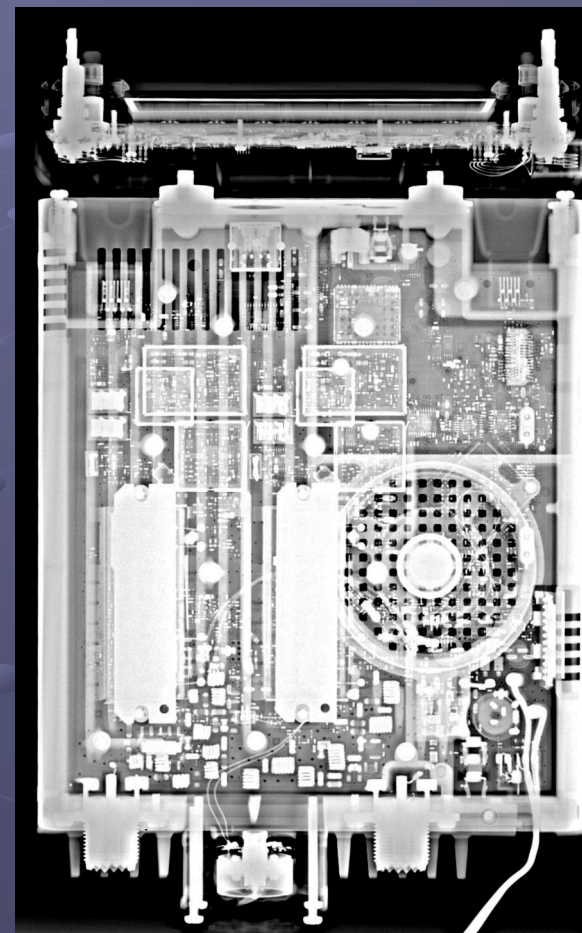
IC-2200 2m Mobile

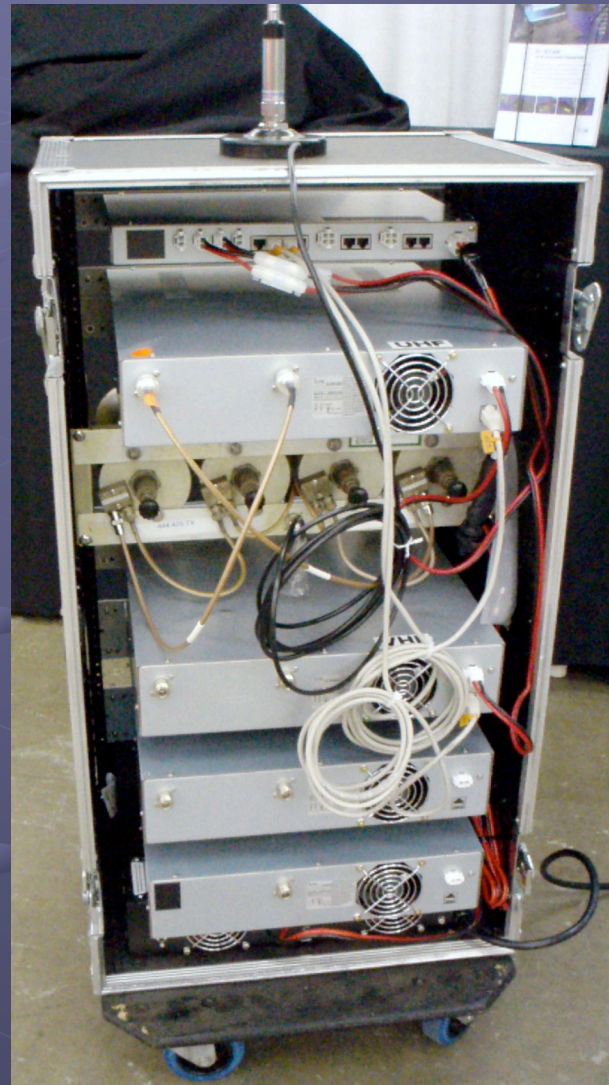ID-800 Dual-Bander

ID-1 1.2Ghz Mobile

Latest DSTAR Radio

- Dual VFO dual-bander
- Internal GPS with DSTAR option
- Diversity antennas on receive
- Magnetically mounted head

Portable UHF/1.2Ghz Repeater

How much does it cost?

- IC-V82 / IC-U82, IC-2200 accepts UT-118 Digital Voice Module at $199.95 (HRO Price)
  - Compare Kantronics KPC-3+ at $189.95 (HRO Price)
- IC-91A - $329.95, IC-91AD - $449.95
- ID-800H – $629.99
- ID-1 – $999.99 (128K baud Data!)

It's a Digital World After All

- "Embrace and Extend" Internet Technologies
  - The Internet is NOT killing ham radio
  - The Internet is ENABLING ham radio
- Most media is now digital
  - Documents, spreadsheets, databases, pictures, etc.
- "Interoperability" is the new buzz word
  - Digital information makes interoperability possible
- Served agencies will demand more than voice
  - They expect email, live video, web interfaces, etc.

References

- Icom America
  - http://www.icomamerica.com/amateur/dstar/
- DSTAR User/Repeater Registry
  - http://www.dstarusers.org/
- Texas Interconnect Team – K5TIT
  - http://www.k5tit.org/forum/
- Wikipedia
  - http://en.wikipedia.org/wiki/D-STAR