



# Digital Communications 101



What do you need  
for basic digital  
operations???

# Types of Packet Stations



- Home-based Stations
  - Ideal for learning, practicing and staying “brushed up” on packet skills.
  - Few home-based stations needed during emergencies and exercises.
- Portable Packet Stations
  - ALWAYS needed during emergencies and exercises. Represents greatest packet demand.
- Mobile Packet Stations
  - Occasionally needed, generally involves transferring portable packet station to a vehicle.



# Packet for ARES Operators

- So, do I need both a home-based and a portable packet station?!?
- Not necessarily
  - With a little thought, you can configure your home and portable stations so the same TNC can be used for both applications.
  - Build cables for both your home station and your portable station.
  - Quickly unplug your TNC and take it with you during an ARES activation or exercise.

# Equipment



Here are the basic essentials:

- Computer & Terminal Software
- TNC (Terminal Node Controller)
- Radio
- Various Cables

# Computer Options



- Home Station
  - Desktop computer generally preferred
- Portable Station
  - Laptop computer preferred
- Mobile Operation
  - Laptop or handheld computer preferred

# Emergency Power Issues



- Home Desktop Computer
  - Generator
  - Battery Bank with Inverter
- Laptop Computer
  - Spare Batteries
  - 12vdc Adapter
- Handheld Computer
  - Spare Batteries
  - 12vdc Adapter

# Operating Systems



- DOS-based
  - Limited to basic packet operations only
- Windows-based
  - Most common and most supported
    - Most software options
- Other (Linux, Unix, etc.)
  - Limited software options
    - Primarily basic packet terminal programs

# DOS-Based Software



A few years ago, DOS-based software was all you needed for packet operations. Packet is growing increasingly capable and, as a result, complex – far exceeding simple DOS-based capability.

- Limited to basic terminal programs only
- OK for learning basic packet techniques

# Windows-based Software



- Windows 3.1
  - Limited capability, but will run WinPack\*
    - Won't Run Airmail, TelPac, PacLink and many other developing programs
- Windows-95/98, 2000, ME, XP, Vista
  - Will run most current and developing software programs
    - A few of the latest programs require 2000, ME or later
- General Rule of Thumb – newer is better
  - Acquire most recent OS you can reasonably afford

# Other OS Software



- Many die-hard Linux & Unix proponents
- Not the best choice for digital operations
  - Fewer software options
  - “Latest & greatest” software generally developed for windows-based systems first
  - May have to wait for Linux/Unix-based “latest & greatest” – if it is developed at all!

# Software – Terminal Programs



- DOS-based or Linux/Unix
  - Basic terminal programs, like PackCom available
- Windows-based
  - Several good Windows-based terminal programs
  - Most Windows operating systems have a basic Terminal or HyperTerminal communications program built in.
  - **WinPack** – The DDG unanimously recommends this software for it's utility, user-friendliness, file & data management capabilities and many other useful features. NOTE: With the diversity in the DDG, that's a MAJOR endorsement.
- Manufacturer-specific
  - Some TNC manufacturers offer terminal programs designed specifically for their equipment. They range from very good full-featured programs to nothing more than basic terminal programs.

# Software – Terminal Programs



While the DDG unanimously recommends WinPack, we don't care what terminal program an operator elects to use – provided they know how to perform certain basic functions:

- Connect to another station and converse in chat mode.
- Connect using digipeaters or nodes to reach a distant station.
- Compose messages offline, then connect and send those message files. Don't tie up the frequency composing while connected!!!
- Connect to a mailbox and view, send and receive messages.
- Exchange (send/capture) files to/from another station.
- Perform all of the above in the most efficient and effective manner.

# Computer – Sharing Data



Packet operators send and receive messages for agencies, but that's only part of the process. Those messages must be delivered to agency personnel. This can be accomplished several ways:

- **Printer**
  - Operator provided (safest bet)
  - Agency provided (often not available)
- **3 1/2" floppy disk** (requires floppy drive)
- **Flash or Jump drive** (small USB memory stick)
  - Requires USB port on both computers
- **Agency network interface**
  - Generally not practical in a rush situation
- **Hand Transcription**
  - Slow and generally not recommended
  - Readability issues
- **Verbal Delivery** – no permanent record for accountability

# Portable Printer Considerations



- Size
  - Smaller is better
    - Very limited space in many agencies/situations
- Light weight (for carrying)
- Quiet operation
- Emergency power capability
  - 12vdc capable printers desirable
  - 12vdc converter or battery operation
  - Small 100-200watt inverter possible for some 120vac printers
- Sheet feed bin



# Portable Printer Suggestions

- Recommended Printers
  - Canon BJC-85
    - Color or monochrome capability
    - 12vdc or internal battery power
    - USB or serial/printer port connectivity
  - HP DeskJet 340
    - Monochrome or color capability
    - 10vdc or internal battery power (will run on 12vdc)
  - HP 3300-3700 Series (newer)
    - Recommended by Rob Roller (N7LV)
      - No immediate specifics available

# Terminal Node Controllers (TNC)



- We're going to spend some time discussing various TNC types in detail
- The TNC you choose will depend upon:
  - Your interest level (how much you use it)
  - How you intend to use it (application)
  - Financial considerations (cost)
- TNCs range widely in function & price
  - Entry level (\$50 - \$200)
  - Top end units (\$500 - \$1600)
  - AND, everything in between!!!



# Sound Card Technology

- Uses computer sound card to emulate a TNC
  - Emerging technology
  - May ALL be using Sound Card TNCs in future
- Limited capability vs. hardware TNCs
  - Generally lack Mailbox
  - Don't have node capability
- Soundcard quality varies
  - Some work – many don't
- Configuration issues
- The DDG is keeping an eye on the progress of sound card technology
  - Not presently recommended for ARES use

# Terminal Node Controllers (TNC)



- Types of Hardware TNCs
  - Basic 1200 Baud packet
    - Usually for VHF operation
  - 1200/9600 baud packet TNC
    - For VHF & UHF operation
  - Multi-mode TNCs
    - Generally have Packet, RTTY, AMTOR, Pactor and other modes.
    - For HF/VHF operation
  - Multi-mode TNCs with 9600 baud packet
    - Same as above, but have 9600 baud packet capability for UHF



# Basic 1200 Baud Packet

- Numerous makes/models available
  - Way too many to discuss individually
- ARES Recommendation
  - Kantronics KPC-3 or KPC-3 Plus Packet Communicator
    - (Used \$50 up, MSRP \$190)
    - Small compact size (0.8" x 5.2" x 5.2")
    - Lightweight (11 oz) and rugged
    - 6 ~ 25VDC, less than 30mA
      - Has internal 9vdc battery option



# 1200/9600 Baud Packet TNCs



- 1200 baud used primarily on VHF
- 9600 baud used primarily on UHF
  - Moves data 8 times faster than 1200 baud
- Most ARES packet currently on 1200 baud VHF
  - May start using 9600 baud for limited applications
- More expensive than 1200 baud-only
  - Timewave PK-96 Packet TNC (MSRP \$210)
  - Kantronics **KPC-9612+** (MSRP \$369)
- Units small enough for portable operation

# 1200 baud vs. 9600 baud



- 1200 baud VHF
  - Most any VHF FM radio will work
  - Most any 1200 baud TNC will work
  - Plug & Play
    - Attach cables, configure and your ready to go
- 9600 baud UHF
  - Most UHF or Dual-Band FM radios don't work
  - Requires multi-mode radio
  - NOT Plug & Play
    - A lot of "tweaking" involved

# Single Port Multi-Mode TNCs



- Single Port
  - Only connect to one radio (VHF, HF, etc.) at a time
- Multi-Mode
  - 1200 baud packet for VHF
    - Some have 9600 baud capability or option
  - Most common HF modes (RTTY, Amtor, Pactor, etc.)
  - Must reconfigure when changing between V/UHF packet and HF modes
- Good entry level TNC for VHF and HF
- Example:
  - Kantronics KAM-98 (Discontinued MSRP \$369)

# Dual Port Multi-Mode TNCs



- Most often used in home-base stations
  - Units a bit big for portable operations, but can be used if necessary (SE Region Mass Clinic Exercise)
- Two Radio Ports (VHF/VHF or HF/VHF)
  - Connect to two radios (VHF, HF, etc.) at a time
- Multi-Mode
  - All have 1200 baud packet capability
    - Some have 9600 baud or optional 9600 capability
  - Most common HF modes (RTTY, Amtor, Pactor, etc.)
  - Don't have to reconfigure when changing between VHF packet and HF modes
  - A couple have VHF to HF gateway capability

# Dual Port Multi-Mode TNCs



- Kantronics KAM-XL (MSRP \$399)
  - 300, 1200 & 9600 baud packet
  - Expanded HF digital modes including PSK-31
- AEA/Timewave PK-232/DSL (MSRP \$532)
  - 300 & 1200 baud packet
  - Most HF digital modes including PSK-31
- AEA/Timewave PK-900 (discontinued)
  - Until recently considered the “Rolls-Royce” of TNCs
  - 300 & 1200 baud packet (9600 baud optional)
  - Most traditional HF modes (RTTY, Amtor, Pactor)
  - Full cross-mode gateway standard on later versions
  - DSP & 9600 Baud upgrades available

# Pactor II & III Capable TNCs



- SCS (Germany) developed Pactor language
  - Pactor I language offered to other TNC manufacturers
- Pactor II & III are SCS proprietary
  - Not offered to other TNC manufacturers
    - Provides much higher data transfer for HF digital
    - Used extensively worldwide for Winlink 2000 communications
- SCS PTC-IIex (single port – MSRP \$888)
- SCS PTC-II Pro (3-port – MSRP \$1478)
  - Several in D-14 and DRT
  - Just beginning to explore extensive capabilities
  - Local Packet operators will soon be interfacing with these units

# What is a “Gateway?”



- A “Gate” separates two areas, but allows easy access to get from one to the other
- A digital “Gateway” allows a station on one frequency to communicate with stations on another frequency
  - These can be two VHF frequencies (VHF to VHF)
  - These can be VHF to UHF
  - These can be VHF to HF
- Gateway use will be further explained in Digital Communications 201



# Packet Radios

# VHF & UHF Packet Radios



Just about any VHF  
or UHF radio can  
be used for Packet

# Home-Base Packet Radio



- Part-time Packet Station
  - Use your home base radio for both phone and packet operations (switch back and forth)
    - Involves building TNC/radio cables
- Full-time Packet Station
  - Suggestion – buy an older, inexpensive VHF radio at a swapfest
    - Many available because they didn't have CTCSS tone capability. These radios have been abandoned because most repeaters now require CTCSS tones for access.
    - Will have to wire TNC into the microphone & speaker connectors

# Portable Packet Radio



- If you have a portable emergency radio, adapt it for both phone and Packet operations
- While HTs can be used for packet, they generally don't have enough power to support many locations – **NOT RECOMMENDED!**
- Many locations are very space-restrictive so compact station size is a very important consideration
- Radio cabling – simpler is better, safer and more reliable

# Desirable V/UHF Radio Features



- Data Jack (newer radios – usually 6-pin mini-DIN)
  - Alleviates having to connect through mic connector and speaker jack
  - Simpler and safer connection
- For 1200 & 9600 baud operation
  - Dual-band/single VFO
  - Menu-selectable 1200 or 9600 baud modes
- Dual-band/dual-VFO radio
  - Allows monitoring phone net or other frequencies while operating packet
  - Can be used (with a little practice) to operate both packet and phone using one operator on a single antenna



Questions???