Purpose

This workshop will be a high-level presentation that explains what the **Automated Packet Reporting System** is, what you can use it for, and how to get started.

Topics

1. Packet Radio
2. Gateways & Digipeaters
3. Setup & How-to
4. Radio Hardware
5. Emergency Comms.

Packet Radio

What is packet radio?

- Messages sent digitally in *packets* – small bursts of 1's and 0's.

- Structure: Header | Payload Data | Tail/checksum

- Packet is normally done in *connected mode*. This is one-to-one communication.

- Examples: spots, winlink, chat, nodes.

- The ENTIRE packet has to be received for ANY data to be decoded.

How is APRS Different?

- APRS is used for "tactical" data: highly relevant in the immediate term.

- APRS uses *unconnected* mode. Data packets are sent *one-to-many*.

  ○ There is no guarantee of reception, but many can receive at once.

- Standard channel: North American activity is 1,200 baud on 144.390 MHz.

- APRS packets have a standard format, called a *frame.*

The AX.25 Frame   All APRS transmissions use AX.25 UI-frames, with 9 fields of data:

AX.25 UI-FRAME FORMAT

	Flag	Destination Address	Source Address	Digipeater Addresses (0-8)	Control Field (UI)	Protocol ID	INFORMATION FIELD	FCS	Flag
Bytes:	1	7	7	0–56	1	1	1–256	2	1

How well does it work?

- It works great, but does require good reception to decode.

- Roughly speaking, expect half to two-thirds the range of analog FM voice.

Gateways & Digipeaters

The two most important types of APRS infrastructure are igates and digipeaters.

Digipeaters

- Multiple stations sending data back and forth works great. But what happens when you're out of range?

- Add a *digital repeater,* also known as a *digipeater*!

  - Works like an FM voice repeater, but always on 144.390. Receives data, waits, then re-transmits when the frequency is clear.

- Allows moving data between stations that can't hear each other.

  - Repeats are requested using *paths*. Don't clog the channel!

- *We have only a handful of low-level digis south-central. We need more!*

Igates

- APRS uses computers, so what else can we do with that?

  - Send APRS packets computer-to-computer over networks.

  - Often combined with a digi, but many are receive-only.

- Received packets are sent to other computers over the APRS internet system.

- Allows sending messages between stations that are out of digipeater range.

  - Example: RF transmission in Fairbanks picked up by local igate. Sent over the internet to an Anchorage igate. Re-transmitted on RF locally to addressee.

  - Example of one-to-one usage of APRS.

Setup and How-to

You probably already have what you need.

Just Listening

- Use an FM scanner, run audio from the headphone jack into the computer's mic-in jack, use *Dire Wolf* software to decode.

Add Mapping Features

- Install APRSIS32 on the computer and tell it to read data from Dire Wolf.

Send Beacons & Messages

- Use a transceiver and add an audio OUT cable from the computer to the radio. Use VOX to engage transmit, APRSIS32 for maps and messages.

Go Mobile

- Install APRSDroid app on an android tablet or phone. Connect a Mobilinkd TNC to your radio, and connect your phone/tablet to the Mobilinkd using Bluetooth.

Go Portable

- Connect your Mobilinkd and APRSDroid-enabled phone to a handheld radio.

Don't be scared to experiment!

144.39 MHz is the everyone-everyone channel for North America, but APRS works wherever you want. Try 9600 baud on 70 cm for short-range, high-throughput emergency operations. Use 6 M for long-distance APRS in search and rescue work. Or use a different 2 M channel for a dedicated public event APRS net.

Radio Hardware

Follow these general steps to get up and running.

Start with a computer and a radio.

- Computer: install Dire Wolf and APRSIS32.

- Radio: set up to operate on 144.39.

Receive: Get the audio from the **radio** into the **computer**.

- Remember . . . *if you can't hear 'em, you can't work 'em!*

- Best option is an interface like a SignaLink or Rig Blaster.

- Low tech: audio cable from radio's speaker jack to the computer's microphone-in.

Send Data: Get audio from the **computer** to the **radio**.

- Best option (again) is a SignaLink, Rig Blaster, or similar.

- Low tech: cable from the computer's speaker-out jack to the radio's data port

   ○ Or microphone-in jack if the radio doesn't have a data port.

Key the radio.

- Best option (yet again) is a SignaLink, Rig Blaster, or similar.

   ○ Keys the PTT automagically when sending audio.

- Low tech: use the VOX function in the transceiver.

   ○ VOX can be iffy. Some radios don't engage quickly enough, so the start of the transmission is lost.

Emergency Comms

Use APRS for up-to-the-second tactical updates. Let the computer manage and track routine (but useful) data without tying up an operator.

- Track Assets: use real-time maps to keep an eye on mobiles, CERT teams, etc.

- Send Bulletins: useful text messages addressed to everyone in range.

- Text messaging: send messages to a designated operator.

Emergency How-To

- Have your gear ready *before* you need it.

- Designate an emergency APRS frequency that is not 144.39.

- Practice sending and receiving without using digipeaters.

Useful Emergency Hardware

- <u>Portable digipeater</u>: Use a mobile radio, laptop (or raspberry pi), push-up mast, and battery pack to replace downed infrastructure.

- <u>Double-Duty Go-Kits</u>: the same 2 M go-kit that runs Winlink can run APRS as well. simultaneously. Get use out of the digital go-kit between checking emails.

- <u>APRSDroid Mobile Units</u>: With your phone, a Mobilinkd, and pre-downloaded maps you have APRS functionality in your mobile at all times.

Practice, practice, and then practice some more. APRS is extremely useful, but only if you are skilled at utilizing it.

Now What?

For everyone:

1. Tune in to 144.390, FM wide band (same as for regular voice).

2. Listen to the traffic. Try to pick out the original beacons and digipeats.

3. Watch the activity on APRS.fi or APRSDirect.com to see what's in our area.

If you're brand new to digital:

1. Install Dire Wolf on your computer.

2. Connect your radio to the computer with an audio cable (TRS cable).

3. Open the radio's squelch and adjust the volume.

4. Try to decode packets using Dire Wolf.

If you love working with computers:

1. Buy an RTL SDR Dongle (a receive-only radio that plugs into a USB port).

2. Use SDR# to view activity on 144.390 MHz.

3. Connect Dire Wolf to SDR#

If you practice emergency communications:

1. Talk with your team members about adding APRS functionality.

2. Come up with some activities or drills to practice the techniques.

If you like suffering . . .

1. Do ALL of the above, and then build a Rx-only igate using a raspberry pi!