APRS®: An Introduction

By Robert, VA3ROM (va3rom@rac.ca)

APRS® is the Automatic Position Reporting System, also called the Automatic Packet Reporting System. It is a tactical communication and GIS (graphical information system) that operates in real-time. Using digital 1200-baud (for VHF) or 300-baud (for HF) AX.25 packet data protocol, information between many stations, covering either a local or large area can be exchanged. It is very different from conventional Packet radio, and is often confused with conventional Packet radio by old time Packratts. Bob Bruninga, WB4APR, an instructor at the U.S. Naval Academy created APRS in the early 1990's. Bob wanted to combine the then new GPS (Global Positioning Satellite System) with a radio and beacon to track a moving object. The U.S. navy goat mascot is rumoured to have been the first thing ever tracked during an annual Army/Navy football game! Bob allows APRS to be freely used by amateur radio operators for non-commercial use.

Major differences from conventional Packet radio:

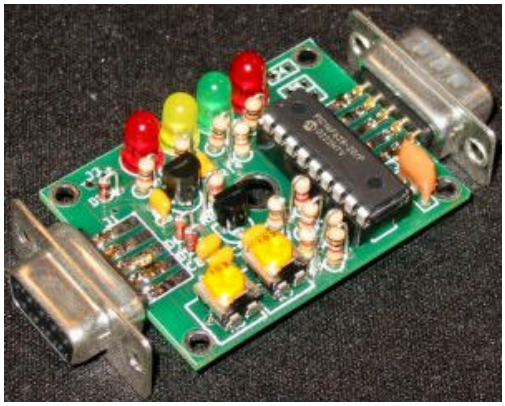
1. Maps and other data displays are used to display tactical information (a GIS or Graphical Information System).
2. APRS uses a many-to-many paradigm to update everyone on the system at the same time and in real-time.
3. No prior knowledge of the APRS network is required since APRS uses generic digipeating.
4. APRS information can be fed into the Internet (World Wide Web), linking the world.
5. GPS technology is easily integrated into APRS information to track moving/flying/floating objects.

Conventional Packet radio's usefulness was in passing bulk email messages from point to point. It could not be applied to real-time events where the information must be acted upon immediately, and must get to everyone at once.

What Can APRS Do?

APRS has obvious uses in public service events and emergency communications. It was used by the Atlantic 1996 Olympics® to handle the tracking, recording of athletic events (it kept helicopter cameras and ground cameras in sync) which was broadcast to the networks. While APRS can span the world via the Internet, it is optimized for short distance, real-time emergency operations. All stations can easily connect because it avoids the complexity and limitations of networks and nodes and paths. If one station or a group disconnects from APRS, it will not impact the rest of the system except for those stations that disconnected. Any number of stations can exchange data just like users on a regular voice net. But, unlike a voice net, any APRS station that has important information can send it out immediately, and all other station will receive it in real-time. You don't have to wait around for an opening in the traffic flow to get your message out.

Besides passing routine and emergency traffic, messages, bulletins, etc., APRS can also track people, things, or objects (things that don't normally exist) and display their whereabouts and status on maps. Where is the command HQ? Where are the emergency vehicles, or first aid stations located? What is the weather at this or that location? What is the forecast? Where is the fire hazard area? Where are the fire crews? What areas are flooded? Are there any weather alerts, warnings, or watches? Where is the eye of the hurricane, and it's speed and course now? APRS can answer all those questions quickly by a person glancing at a computer display. No need for excessive radio chatter and confusion in terms, phraseology or language barriers A picture is worth 1,000 words, and so is APRS.



TinyTrak radio/GPS interface, (kit or built). www.byonics.com

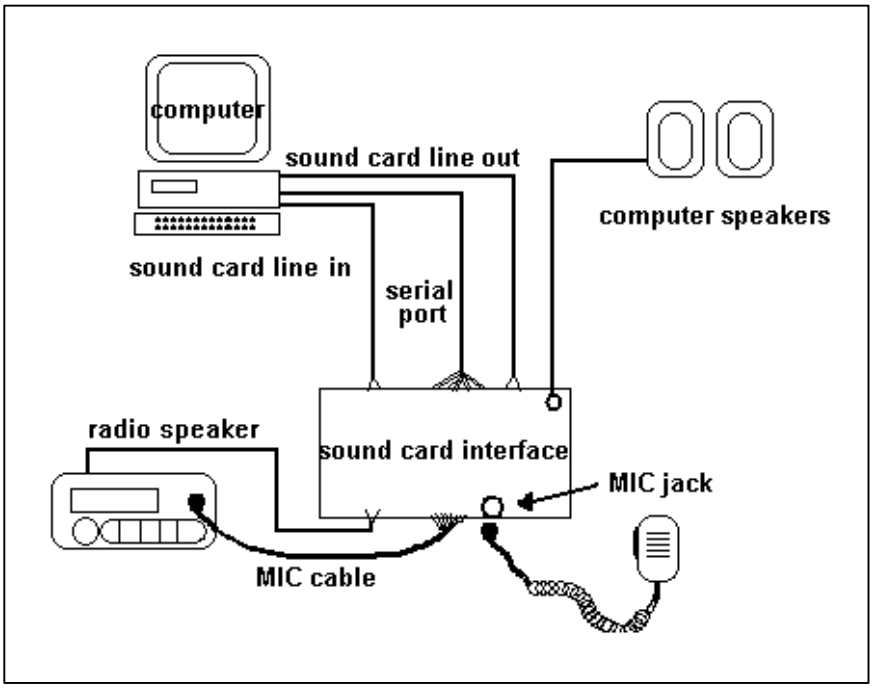
Frequencies and Methods of Transmission

APRS normally uses 144.390MHz for passing information in North America, and other countries use different frequencies or various reasons But, any 2-way radio system and frequencies can be used including ham, CB, marine, GMRS/FRS, or even cellular phones. The standard frequency of 144.390MHz was first used in Canada, while the U.S. used a different frequency. For various reasons, the Canadian frequency was adopted as the standard for both countries. In heavy traffic areas, stations are now using APRS duplex repeaters sending information on one frequency and receiving it on another, perhaps not in the same band. This effectively doubles the handling capacity of the overloaded digital system.

Using various web sites such as www.aprs.va3tk.com live APRS information can be viewed and tracked without using a radio or ARPS software. In 2006, there are many APRS servers in operation around the world. You can find past transmissions of any APRS station and view a history of the tracks of an APRS mobile station, etc. Other uses of APRS include sending out emails, DX information, connecting home weather stations to the APRS weather net, and forwarded to the NWS (U.S. National Weather Service via the CWOP (Citizen Weather Observer's Program)), direction finding on radio interference or good old foxhunting. Maps of any scale can be created for specific needs and situations very easily and integrated in to APRS software. The ISS (International Space Station) uses a Kenwood D700 transceiver for the astronauts to use for voice contacts or as APRS digipeating (see separate article). There are several other flying satellite digipeaters (PACSATS), as well as terrestrial ones. Helium and hot-air balloons have lifted transceivers and TNCs (terminal node controllers) aloft as extended range digipeaters. The sky is literally not the limit with APRS applications. If you can think it, APRS can do it!

Getting Started

There's not much to setting up an APRS station. Most of us will use the AGW sound card packet engine as a substitute for hardware TNC. See http://www.patmedia.net/ralphmilnes/soundcardpacket/ for more information. There are many great APRS programs out there, but the most popular is UI-View32. See http://www.ui-view.org/ for more information. Registration is free, but a donation to your local or national Cancer Society is suggested. This is a phenomenal program, and I've used a lot of good and bad software over the years. The author, Roger Barker G4IDE passed away from cancer in 2004. He was a brilliant programmer and his passing is a true loss for all of us. UI-View took Europe by storm and came over to North America a couple of years before Roger passed away in 2004. There are many program add-ins (plug-ins) that are written for UI-View such as a FCC/RAC callsign database lookup, NWS weather integration, weather station interface, etc.



The diagram gives you the general idea of how things are hooked together. If you check out the Soundcard Packet and UI-View websites you'll see that it's not that hard to get started in the digital world of APRS and other digital modes. This basic setup is also used on HF for SSTV, PSK31, RTTY, and almost every kind of digital mode except PACTOR, and a few others that require specific hardware modems. Just remember that when you are using your soundcard and radio in this setting; don't put on some MPEG audio files for background music! Guess what else will get transmitted on 144.390MHz or other frequency!

If you just want to listen and display APRS signals, just install the AGW packet engine and UI-View. You can take the audio from your 2-metre radio with an audio cable, and feed it into your line or microphone (most laptops,) input and skip the interface, as it's only required for transmitting digital signals. You can also listen on HF with your transceiver or shortwave receiver and load up some programs like DIGIPAN, SEATTY, MMTY, MMSSTV, CWGET, etc., and have some fun decoding those digital signals. Don't forget to set your Windows audio levels properly. Most of the digital programs explain that in their documentation or help files.

I'm using an old Pentium II, 333MHz computer with 384MB of RAM that has 2 real serial ports that most amateur radio programs use. This old machine amazingly runs Windows XP with no problems and all my 6 concurrent digital and other programs. Yes, those old computers don't need to be thrown away and clogging up our landfill sites. You can get some great machines for cheap prices and put them to use in the amateur radio service.

The New WIDEn-N Paradigm

In 2004, Bob Bruninga developed a new paradigm for APRS called WIDEn-N to help reduce radio gridlock in high radio traffic area. The old RELAY, WIDE and TRACE methods of digipeating are not to be used anymore. These methods just kept repeating redundant data packets thus jamming the frequency. WIDEn-N adds a counter to the number of digipeats or hops that an APRS signal would be allowed (the second N). The value of N is decrement each time until it reaches zero. Digipeater stations should now use WIDE2-2 (or WIDE3-3 in large coverage areas) and mobiles should now use WIDE1-1, WIDE2-1 (or WIDE2-2, if necessary) in their APRS UNPROTO path. APRS stations should no longer respond to RELAY, WIDE or TRACE transmissions. Well, that's the theory anyway. New APRS networks such as the one that is starting in Thunder Bay can just go with the new paradigm with no big deal. Just modified our APRS program configuration file (UI-View32) and we were good to go (Fred, VE3FAL, and myself). The older APRS networks have a serious problem of getting tens if not hundreds of users to change.

-30-

August 2007