

# PACKET STATUS REGISTER

PSR #88 SUMMER 2003

president's corner

## Something Special

By John Ackermann, N8UR, [n8ur@tapr.org](mailto:n8ur@tapr.org)



If you missed Dayton this year, you missed something special. Forget about whether the attendance was up or down, and about the slightly damp weather. I'm talking about what happened in and around the TAPR booth, where the energy and creativity levels were inspiring.

We had two guests at the booth this year. Gerald Youngblood, AC5OG, was demonstrating his SDR-1000 software defined radio, and Lyle Johnson, KK7P (you may remember him as WA7GXD), was showing off his new DSP engine. Gerald and Lyle are both people whose enthusiasm is contagious, and they and their products drew a crowd.

What was really cool was watching the light bulbs go on when people saw these products and realized what could be done with them. Eavesdropping on the conversations around the booth showed that people were really intrigued by the SDR concept, and — this is important — were beginning to see it as something real and practical rather than as just an idea.

### 802.11b Transverter

A couple of issues ago, I wrote about the inevitable clash between increasing ham use of “WiFi” hardware on 2.4 GHz and the commercial interests who have staked out that unlicensed territory. I suggested that the answer might be found in a transverter that would move the WiFi signal to another ham band that we wouldn't be sharing with Part 15 users.

That column drew a lot of positive response, and we've been looking into the transverter idea. Discussions at the Dayton Hamvention with a

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TAPR is always interested in receiving information and articles for publication. If you have an idea for an article you would like to see, or you, or someone you know, is doing something that would interest digital communications, please contact the editor ([psr@tapr.org](mailto:psr@tapr.org)) so that your work can be shared with the Amateur Radio community. If you feel

uncomfortable or otherwise unable to write an article yourself, please contact the editor for assistance. Preferred format for articles is plain ASCII text (Microsoft Word is acceptable, please save the document as Rich Text Format - .RTF). Preferred graphic formats are PS/EPS/TIFF (diagrams, black and white photographs), or TIFF/JPEG/GIF (color photographs). Please submit graphics at a minimum of 300 DPI.

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number of microwave RF manufacturers indicate that the idea is certainly feasible, but there's a big question whether we can come up with a product that will offer both performance and price that are tempting to hams.

We're continuing conversations that might lead to a commercially-produced transverter, but we'd also like to look into a simple transverter kit. Microwave RF projects can be quite simple to build because most of the tuned circuits can be etched right onto the PC board.

There are a number of low cost "no tune" transverters available today. While they are designed for a different task than our transverter would be, they may show the way for us. If you know of — or happen to be — an RF-savvy ham looking for a challenge, we'd like to find some volunteers to take on a project like this. If you'd like to help out, please drop us a line.

### **It's DCC Time**

It's not too late to make your plans for the DCC, but time is running short. The ARRL/TAPR Digital Communications Conference will be held September 19-21 in Hartford, Connecticut, and it's shaping up to be a great show, with excellent presentations and a first-rate keynote speaker at the banquet. See elsewhere in this issue for more details.

That's it for now. See you at the DCC!

73, John



## **Call for TAPR Board of Directors Nominations**

Nominations are now open for TAPR Board of Director seats expiring this year, i.e., the seats held by John Koster, W9DDD, Brad Noblet, WA8WDQ, and Steve Stroh, N8GNJ.

Board members serve three-year terms and their responsibilities include:

- 1) Attendance at both board meetings each year. (One is held at the Dayton Hamvention in May, the other at the Digital Communications Conference in September.)
- 2) Regular participation in the continuous board session, which is conducted over the Internet.
- 3) Active engagement in TAPR's management.

To place a person in nomination, please remember that he or she must be a member of TAPR. Also, confirm that the individual is willing to have his or her name placed in nomination. Send that person's name (or your own if you wish to nominate yourself), call sign, mailing address, e-mail address, phone number(s), and a biographical sketch (100 words maximum) via e-mail to [tapr@tapr.org](mailto:tapr@tapr.org) or to the TAPR office (P. O. Box 852754, Richardson, TX 75085-2754) no later than August 24, 2003. If you submit a nomination via e-mail, we strongly encourage you to follow up by regular mail.



# Digital Communications Conference Taking Shape

By Steven Bible, N7HPR, [n7hpr@tapr.org](mailto:n7hpr@tapr.org)

HARTFORD, Connecticut - July 24, 2003 - The 22nd Annual ARRL/TAPR Digital Communications Conference slated for September 21-23, 2003 in Hartford, Connecticut is taking shape.

At the heart of the conference are technical presentations by amateurs and experimenters alike on the many technical projects they are working on. Technical papers are solicited for presentation and publication in the proceedings. Annual conference proceedings are published by the ARRL. Presentation at the conference is not required for publication. Submissions of papers are due by August 5th, 2003. Submission guidelines are available on the DCC web page [www.tapr.org/dcc](http://www.tapr.org/dcc).

The DCC guest speaker is Alex Mendelsohn, AI2Q, Senior Technology Editor at ChipCenter ([www.chipcenter.com](http://www.chipcenter.com)). Alex wrote an interesting article titled "NASA, NORAD, Amateur Radio, and Me" ([www.chipcenter.com/TestandMeasurement/ed024.html](http://www.chipcenter.com/TestandMeasurement/ed024.html)) in which he notes first hand that amateurs are movers and shakers in many levels of industry. Some are presidents of leading-edge technology companies. Others are engineers and technicians sweating in R&D labs, large and small.

Several introductory seminars are scheduled throughout the DCC to introduce new technical topics for beginners and experts alike. Here are some of the introductory seminars scheduled:

Intro to WSJT by Del Schier, K1UHF

Intro to EchoLink and VoIP by Jon Taylor, K1RFD

Intro to PSK31 by Steve Ford, WB8IMY

Intro to APRS by Stan Horzepa, WA1LOU

There will also be an APRS Networking mini-seminar moderated by WA1LOU. The seminar will address the many networking options available to the APRS user and how networking decisions effect the operation of the APRS network. Finally, it will make recommendations on optimal network settings for various APRS environments.

Software Defined Radio will be the topic of the four-hour Sunday Seminar. Matt Ettus, N2MJI, will give live demonstrations of software-defined radio, explain what it is, and how you can design and develop your own projects. Matt is involved with the GNU Radio project ([www.gnu.org/software/gnuradio/gnuradio.html](http://www.gnu.org/software/gnuradio/gnuradio.html)), Hamlib (<http://hamlib.sourceforge.net>), and others.

Amateurs and experimenters alike are highly encouraged to write about their projects and submit them for publication in the DCC Proceedings.

More information about the DCC can be found at [www.tapr.org/dcc](http://www.tapr.org/dcc).



Alex Mendelsohn, AI2Q, noted technology editor and author



# Try This On For Size

By Wes Johnston, KD4RDB, wes@johnston.net

Hidden transmitter problems have plagued packet radio since its start. APRS is growing in popularity and the local 2-meter networks are becoming saturated. Throw mobile stations with poor receiving range into the mix and you'll soon have a network crippled by collisions. Any collision leads to a packet with an improper checksum and causes that packet and the interfering packet to both be discarded.

Packet was designed to be CSMA (Carrier Sense Multiple Access) just like Ethernet. The problem is that often some stations assume a channel is clear because they do not hear any activity. When those stations transmit, they could prevent a nearby digipeater from hearing a packet from a station still further away. With the popularity of APRS and its use of mobile transmitters, the problem has gotten worse. To put it clearly, mobile stations do not hear very well and end up causing QRM. Particularly with APRS's use of UI frames, data cannot be resent in the event of a collision.

To check your local APRS network's coverage, make use of the RAW.CGI script available at [www.findu.com/cgi.html](http://www.findu.com/cgi.html) and the BREADCRUMB.CGI. RAW.CGI has an option to show timestamps of received packets and can be used to check for missing packets. BREADCRUMB.CGI can be used to check if coverage is available in a given area. For example, on my commute to work, I thought we had no digipeater coverage over a large portion of my trip. A quick check on findu.com with the breadcrumb script revealed that there was indeed coverage at every point along my trip. The reason for intermittent position reports was caused by transmitters that I could not hear from the area in question. My rig transmitting at the wrong times was causing collisions.

The Europeans have adopted DAMA (Demand Assigned Multiple Access) to address hidden transmitter problems. DAMA is suitable for connected mode links only, and not effective for APRS's "come as you are" methods. Some DAMA documentation strongly discourages UI frames on a DAMA channel.

To date, only one solution has been attempted to alleviate collisions on an unconnected and uncoordinated channel. GPS time slotting is a workable solution, but only if you have a GPS hooked to your station, and then only if you choose a time slot that no one else occupies. Practically speaking, there must be a coordinating body that is responsible for issuing time slots. This method is used to coordinate a large number of APRS trackers at an event such as a foot race.

Recently, a discussion came up on the TAPR APRSSIG about hidden transmitters. Three schools of thought have emerged from this discussion. The first school of thought is to simply use smaller and smaller cells. The second uses multiple receivers at each digipeater site. And finally the third uses many remote receivers on a connected link to the main digipeater.

## Solution 1: Frequency Reuse Through Shorter Sites

In the first proposed solution, more WIDE and RELAY digipeaters would be placed lower and closer together. Ultimately, this would serve to limit the maximum distance a packet could travel. AX.25 allows 7 hops in the path, but only 3 or 4 are practical due to collisions. Reducing the range of a WIDE digipeater does have

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its advantages. Since the WIDE node can't hear as far, it is less likely that two stations will try to access the WIDE at the same time. Even if the WIDE is hearing a distant station, the FM capture effect will allow the local mobile station to get into the WIDE digipeater if its signal strength is higher than the distant station.

This concept will work if implemented with a backbone or if it can get packets to an IGATE (Internet gateway). Using a backbone would permit digipeaters to hear one another on a link frequency and to hear users on 144.39 MHz. As more of these types of linked digipeaters come on the air, it will become necessary to pass information from one segment of the network to another. Since the backbone would contain all data, it is simply a matter of requesting certain data from your local wide node and having that data selectively "gated" from the backbone to the user channel. This could be as simple as sending a message to the local digipeater periodically that requests that certain stations be "gated" out to the local network, or that certain data products, such as tides and weather from distant places be "gated" out to the local network. Of course these requests would timeout after a fixed interval. This would permit mobile users to request data from local networks as they pass through and the local networks would not stay busy if the requesting station was not around any longer.

In other words, I could setup my mobile rig's status message to periodically request the tides in Tampa Bay. As I travel, linked WIDE nodes hear this request and "gated" that data onto 144.39 for me to hear. As I continue to travel, other wide nodes begin to hear this periodic request and begin to pass this information from the backbone frequency to the local access frequency. The linked WIDE nodes from the areas I passed through in the past no longer hear my requests and within 30 minutes, cease passing the traffic I requested. All that is needed to implement this is the addition to the APRS specification to facilitate the requesting of specific data products. Ninety percent of the programming is already implemented in the form of IGATES.

## **Solution 2: Frequency Agile Mobile Stations**

The second solution to be discussed is to simply place multiple receivers at each digipeater. Several TNCs could be wired together in parallel so that each could access the transmitter at the digipeater site. Any TNC hearing a carrier would prevent the others from transmitting and any TNC transmitting would also prevent the others from transmitting. This is not as restrictive as it sounds. The additional receivers would not hear nearly as many packets as the primary TNC at a WIDE digipeater hears now.

The point of holding off a TNC from transmitting if another is receiving a packet is to prevent the transmitter from desensing a receiver on the same band and causing a packet to be lost. Call sign substitution could be used to identify the entry point into the digipeater. Suggested call signs would include the six-digit frequency of the receiver or the word SATGATE, for example. Remember, only one radio is used here, so only one of the TNCs must ID its proper call sign.

From a user's perspective, the system would require frequency agile equipment. This is easier than one might think. Simply tie the PTT line on your radio to the MIC-UP button. Program several memories in your radio with "odd-splits" that transmit on the digipeater's input frequencies and listen on 144.39 MHz. Each time your TNC keys the radio, the radio advances to the next memory channel.

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The obvious difficulty with this concept is that each area may have different input frequencies. This has been addressed in the new OPENTRAC protocol. A digipeater would publish its alternative frequencies periodically over the air and user equipment such as Kenwood D700s or D7As could be automatically programmed.

The next question is which frequencies to use? As connected mode BBS systems have been shutdown, they have left largely unused ranges of frequencies in the 144.9 to 145.1 MHz range and the other packet sub-bands. Any unused frequency is a prime candidate. The downlink frequency of PCsat, 145.825 MHz, is another candidate. Also, it could be beneficial to “scavenge” packets from the output frequency of your local 2-meter and 70-cm repeaters in case there are any mic-encoder users on them.

The end result of this proposal would be to reduce the likelihood of collisions by increasing the number of choices available to the mobile user’s equipment.

### **Solution 3: Linked Remote Receiver**

The third solution most closely resembles a voice repeater’s use of remote receivers. In this system, a TNC at a short, limited range receive site would hear a packet. That packet would be presented on its serial port and in turn, passed along to a second TNC at the same site. This second TNC would operate in connected mode on 70 cm.

The connected link between this TNC and the WIDE node would guarantee delivery of each and every packet heard at the remote site. It would be up to the WIDE digipeater to sort out duplicates and only publish one copy of a given packet even if it came in from multiple receiver sites.

What happens when the WIDE node fails in this system? Recall that the second TNC at each remote site is operating in the connected mode. Should the link to the WIDE node fail, the “connected” LED will extinguish. This can be hardwired to a relay that enables and disables the PTT line on the first (144.39 MHz) TNC at the site. The 144.39 MHz TNC would be setup to act as a WIDE node, but if connected to the community WIDE node, its PTT would be disabled in hardware.

If that link failed, the 144.39 MHz TNC would have access to its 144.39 MHz radio and behave as a WIDE. In either case, copies of all packets received are sent out on the serial port and queued for delivery to the community WIDE node. Care must be taken to insure that no old packets are allowed to stay buffered in the second TNC should the link fail, and care must be taken that a packet originating from the community WIDE node is not forwarded back to itself in an endless loop. A simple PIC processor or BASIC stamp could be used to coordinate and filter packets to be forwarded.

From the user’s perspective, no equipment changes are needed.

In conclusion, there are many ways to decrease collisions in the APRS network through geographic and frequency diversity. The methods detailed above are by no means the only solutions to this problem. Additionally, the CGI scripts at [www.findu.com](http://www.findu.com) are also valuable tools to use for network analysis to help determine the best solution for your area.



# NZART Conference

By Darryl Smith, VK2TDS, vk2tds@tapr.org

In the last four years since I was in New Zealand, some things have changed in the ham radio world. The national society is in a better financial state and the hobby is once again starting to experiment with new modes. Back in 1999, there was almost no usage of APRS. Now this mode has close to 95% population coverage.

Back then, my job was to publicize APRS. This time around it was to represent TAPR in an attempt to spur interest in newer aspects of the hobby. Like everywhere, the NZART is growing older. However, because of the smaller ham population in general, the lack of younger members is somewhat magnified.

## Wellington

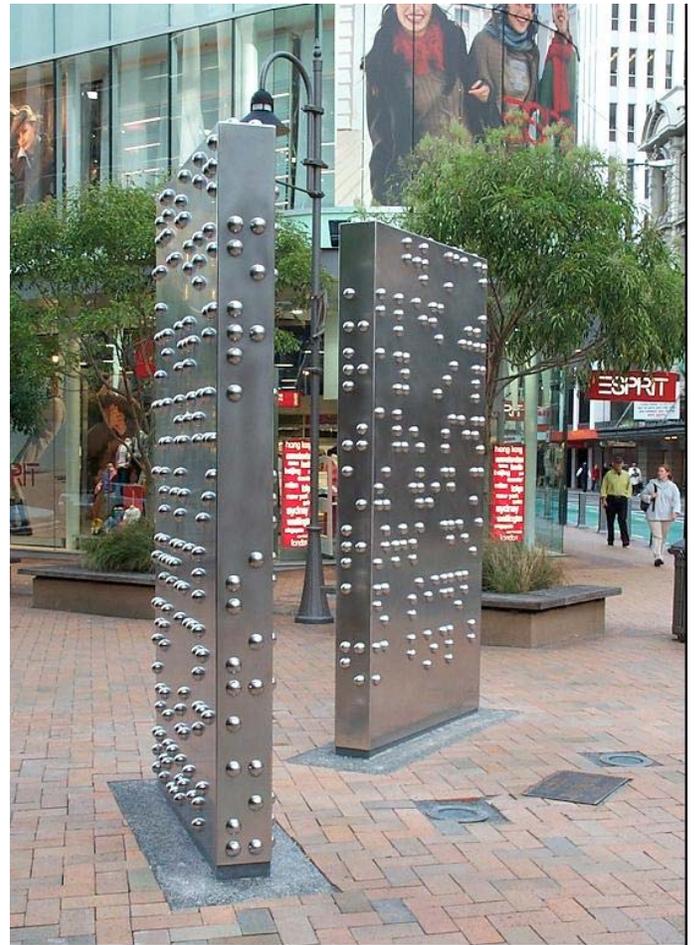
What I need to explain here is that the national capital of Wellington, where the conference basically was held, is one of the most wired capital cities in the world thanks to an unauthorized project by the IT department of the local city council. Back in the early 1990's, the IT manager started installing Ethernet cabling around the city at night on the poles used by the cities electric busses. Eventually, the project became an official project and became a fiber-optic backbone.

The network is continuing to expand with about 20 wireless access points scattered around the city ([www.cafenet.co.nz](http://www.cafenet.co.nz)) allowing wireless access from a huge number of coffee shops in the city.

For Internet access in Wellington and at the conference, I purchased a prepaid Internet card from a local ISP. They provided a nationwide free call number for only about \$1 per hour. This was a bargain.

I did not realize that the CafeNet was so extensive when I bought that card. Whilst in Wellington, I was able to access this network for \$20 for 120 Mbytes of traffic. They state that they hope to bring in 4 hours or 120 Mbytes, but there is a lot more value from the per-Mbyte charge in my view.

In Wellington, my hotel room faced the wrong direction to maintain wireless signals without some help. The 8-dBi omni provided the required gain when positioned in a window, but only when I worked out which side



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of the hotel the wireless signal was coming from. The other thing that took some time to work out was that I needed to use DHCP.. When I run the wireless card at home, I normally use static addressing to make automated use of my home access point a bit harder.

What was also great was that my cell-phone worked as soon as I turned it on in the country - thanks to the joys of GSM Global Roaming. I was always amazed when people rang me, thinking I was at home and in fact, I was in another country. I am just glad that I have not seen the phone bill yet.

In Wellington, they had just in the last week unveiled a sculpture as part of an arts program, a sculpture that may be of interest to people who are interested in digital codes. I am sure there is a message there and I suspect that it is actually in brail for the blind, but it is an example of binary codes in the real world.

### VHF Group Meeting

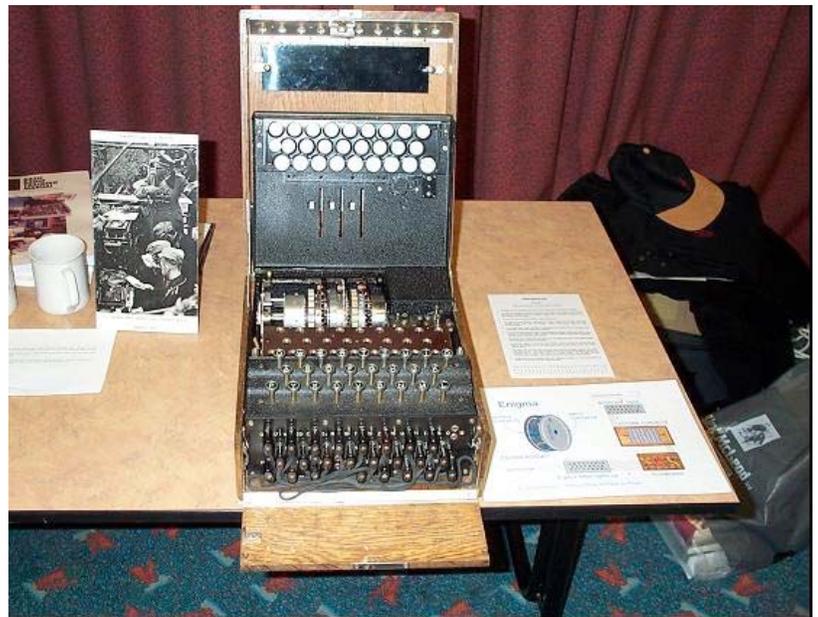
On flying into the New Zealand capital of Wellington, I needed to present a talk to the local VHF group on the technology of 802.11b running at 2.4 GHz. As a catch phrase, I called the talk “High Speed Packet Radio at 2.4 GHz for under \$50 (US\$30)” ensuring some interest. Interest there was, with about 25 local members venturing out into the cold Wellington night.

One of the highlights of this presentation was showing the club that 2.4 GHz experimentation was not hard. In the talk, I even built a 2.4-GHz antenna lab with an Access Point and NetStumbler.

At this meeting, I made some very interesting people, who have some fantastic ideas for the use of GPS and APRS without the use of expensive equipment in their cars. It was fantastic to see people actually doing experimenting in groups.

### The Conference

The conference itself was over the Queen’s Birthday weekend, about an hour north of Wellington. The conference was opened on the Saturday morning by the head of the New Zealand signals interception organization with a talk about the history of signals intelligence, the unclassified version. After that lecture, I was able to actually use an original ENIGMA machine as used by the Germans during WWII. In general though, this talk was a bit of a disappointment. Later, I found out that we got a “recruitment” talk.



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Following this talk was the NZART annual meeting, which I did not attend... I had some talks to complete at this time. In the early afternoon once the AGM was over, it was time for me to give my first talk.

This talk was of general interest with a 10-minute segment on TAPR followed by a session about the radio in the Sydney Olympics. The choice of this talk was deliberate. It showed how ham radio was being used in the real world and is making a difference. This, along with lots of colorful pictures inside the presentation meant that the many spouses would also be interested in the talk. All in all, about 100 people turned up for this talk.

The TAPR presentation I gave will soon be available on the TAPR www site. I just need to find time to finish it.

Sunday morning, I gave what was probably the most important one of all, one that I started writing at the 2002 DCC in Denver. The title of this talk was "Bazaar Ham Publicity" or how to publicize the hobby using the bazaar approach. It was rather disappointing that only about 10 to 15 people turned up to this talk. I can say that without a doubt that those that did turn up were challenged to change the hobby and have started to think about what the perceptions about ham radio are, and how to counter them.

Personally, I was rather concerned about this talk because it is not one that I would call "polished." I was asked about a week before the conference for a talk that could fit a timeslot, and that was what I came up with and my biggest concern was that it would only last 10 minutes. In the end, the talk lasted 50 minutes and the discussion went on much longer. People were still talking about the issues at breakfast the next day, something that is not really common for a lot of presentations.

The universal view was that this talk should have been given to every ham at the conference. Some people were talking about flying me to a conference over the Easter long weekend solely to give this talk.

Sunday afternoon, it was time for a talk on "High Speed Packet Radio" just like the earlier talk in Wellington. This went down really well and as always, the discussion came back to the regulatory environment. I found it really hard to tell these people that they have effectively lost the primary allocation in 2.4 GHz and need to fight to keep secondary status.

One thing I was able to suggest was that they start looking at moving their "National System" from 70 cm to 2.4 GHz. The National System covers most of the country and really is an amazing engineering effort giving most of the country access to a linked repeater system. By moving to a digital 2.4-GHz backbone, they could leverage the sort of applications only available with a countrywide data network.

## **Conclusion**

Visiting New Zealand for the conference was no holiday for me, but it was really enjoyable. Many of the contacts that I have made over there now know that there is an international community out there doing things, and that they can assist. Just because it is isolated does not mean that the country is not producing some real innovations.



# WAPaprs: APRS on a Cell Phone

By Richard Parry, W9IF, [w9if@arrl.net](mailto:w9if@arrl.net), [http://w9if.net/cgi-bin/wapaprs/web\\_main.pl](http://w9if.net/cgi-bin/wapaprs/web_main.pl)

## Abstract

WAPaprs is an application to display APRS information on a cell phone that supports the Wireless Application Protocol (WAP). It was written to provide useful APRS data within the size, memory, color, and bandwidth limitations of a wireless handheld device. The paper includes a description of all menu options and example displays.

## Keywords

APRS?, WAP, WML, Linux, Perl, Cellular Technology

## Introduction

Few could have imagined in the early 80s that cellular communication would enjoy the popularity that it does today. A cellular phone, once thought of as a luxury, is now considered by many to be a necessity. As of early 2001, one out of 10 people in the world (680 million) used a cellular phone. Many Amateur Radio operators have joined the ranks of cellular phone users and find they are legitimate devices to supplement amateur communication.



Cellular technology has come a long way in a brief time. First generation (1G) systems used analog technology. Although primitive and unreliable by today's standards due to poor voice quality and frequent call drops, 1G showed that mobile communication for the masses was technically feasible and economically viable.

The late 90s introduced second generation (2G) systems using digital technology. This new generation brought substantial improvements to voice quality, call reliability, miniaturization, battery life, and heralded the beginning of data services.

At the dawn of the new millennium, third generation (3G) advanced digital systems are being deployed worldwide. This latest generation is characterized by improvements to system capacity, reliability, extended services, and significantly higher data rates. For example, 1xEV-DO, which is a 3G standard, supports rates in excess of 2 Mbit/s. These higher speeds mean that bandwidth hungry multimedia applications that were once limited to the desktop can be provided to the mobile user.

Cell phones today, even low-end phones, can be used for more than just talking. A user can send and receive e-mail, surf the Internet, play MP3 music, and even send and receive color pictures using the latest generation of camera-ready phones.

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As an Amateur Radio operator and APRS aficionado, I was anxious to retrieve APRS data using a cell phone. WAPaprs is the result of my work. It provides the cell phone user the ability to retrieve information from the findu.com and aprsworld.net databases.

## WAPaprs Access

Due to the relative difficulty to input text using a small cell phone keypad, the suggested method for using WAPaprs is to permanently bookmark call signs of interest. For example, if you often check the location of KC5PVL-9, permanently bookmark: <http://w9if.net/cgi-bin/wapaprs/main?kc5-pvl-9>. Using this method, very few keystrokes are required to obtain the desired information.

Alternatively, users can bookmark: <http://w9if.net/cgi-bin/wapaprs/main> ; in which case the user will be prompted to supply just a call sign. This significantly reduces the number of keystrokes. In the examples below, URLs are included to allow the user to access specific displays without first going to the main URL. I provide these URLs for completeness, but do not expect users to access WAPaprs in this manner. Generally, the user will start at the main WAPaprs display and navigate to other displays with single keystroke responses.

### Main

<http://w9if.net/cgi-bin/wapaprs/main>

<http://w9if.net/cgi-bin/wapaprs/main?w9if>

The “main” display can be accessed with or without a call sign. If a call sign is not provided, the user will be directed to another display and prompted to supply one. If a call sign is provided, a menu is provided to allow the user to select from one of seven options: Position, Cities, Landmarks, Weather, Maps (Black and White), Maps (Color), and New Call. The seventh option, New Call, is off the cell phone display in the figure to the left.



### Position

<http://w9if.net/cgi-bin/wapaprs/posit?w9if>

The “position” display shows the latitude, longitude, speed, and course of an APRS object. All information displayed comes from the findu.com database. The age of the packet is displayed in hours and minutes. In this example, the packet is 2 hours and 34 minutes old. Showing seconds was deemed to be unnecessary and of little value given the time for the transaction. The limited display on a cell phone was also a consideration in dropping the seconds information.



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## Cities

<http://w9if.net/cgi-bin/wapaprs/cities?w9if>



The “cities” display allows the user to locate an APRS object in reference to nearby cities. The term “cities” is used loosely. Many of the locations are not cities, but populated areas. The information displayed comes from two sources. First, the findu.com database is accessed to obtain the latitude and longitude. From there, the aprsworld.net database is accessed to determine a nearby city. WAPaprs does this by calculating a “box” around the APRS object. If ten or more cities are located within the box, WAPaprs displays the closest ten cities. If there are less than ten cities nearby, the box is expanded until ten or more objects are located. The objects, along with the distance and direction are computed and displayed.

## Landmarks

<http://w9if.net/cgi-bin/wapaprs/lmarks?w9if>



The “landmarks” display is similar to the cities display. Both access the findu.com database to determine the latitude and longitude of the APRS object. They both access aprsworld.net, but use different databases. The landmarks database differs from the cities database in that the locations are not populated areas, but geographical locations of interest. For example, in the display to the left, Blacks Beach is a clothing optional beach in San Diego. The Salk Institute is the world famous institution founded by Jonas Salk, who was responsible for curing polio in the 50s. Like the cities display, the ten closest landmarks are shown along with the distance and direction to each landmark.

## Weather

<http://w9if.net/cgi-bin/wapaprs/wx?w9if -4>



The “weather” display shows weather conditions for APRS weather stations. The findu.com database is accessed for this information. The data displayed includes: age of packet, wind direction, wind speed, wind gust, temperature, rain, humidity, and pressure.

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### Maps (B&W)

<http://w9if.net/cgi-bin/wapaprs/mapbw?w9if>



The “maps” (B&W) display shows three map resolutions: 500', 2,500', and 2 miles to the scale shown. One may question the usefulness of the small maps. However, the usefulness of the map really depends on the users requirements. In the example shown, the names of the street are not available, but the APRS object (shown as a circle) can be seen a few streets south of I1. There are many situations where that level of detail is useful and sufficient. The size of the map is approximately 70 x 90 pixels. Most Internet users are familiar with GIF and JPEG images. However, WAPaprs maps are WBMP (Wireless Bit Map) graphic files. WBMP images are used since they are the standard format supported by most WAP cell phones.

### Maps (Color)

<http://w9if.net/cgi-bin/wapaprs/mapcolor?w9if>



The “maps” color display shows three map resolutions identical to the B&W maps: 500', 2,500', and 2 miles. However, there are two major differences. First, the maps are in color. Second, the images are in GIF format rather than WBMP. While most WAP compliant cell phones support WBMP graphics, there is no guarantee the phone will support GIF images. For this reason, some users may find color maps are not displayed. However, today’s high-end cell phones that support GIF images will be tomorrow’s low-end phones. So I suspect it is just a matter of time before most users will be able to see these color maps.

### New Call

<http://w9if.net/cgi-bin/wapaprs/newcall>



The “new call” display allows the user to input a new call sign. I wish to emphasize again that few users will access this display or any of the other displays mentioned directly, with the exception of the main display. When a user accesses the main display, he/she can easily navigate to all other pages including the “new call” display. Note that WAPaprs does not support wild cards such as W9IF\* or W9IF-\*. The limited viewing area of a cell phone makes displaying more than one APRS object impractical.

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## **Terminology**

This section includes WAPaprs background information and nomenclature. It describes some of the unique terminology of WML and the WAPaprs architecture.

WML (Wireless Markup Language) was used to create WAPaprs. WML is a formatting language similar to HTML. It is defined as an XML (Extensible Markup Language) document that is optimized for small screens and memory size. Although WML is similar to HTML, WML cannot be displayed directly on a desktop web browser such as Internet Explorer or Netscape because these desktop browsers support HTML not WML. A WAP enabled cell phone or WML emulator is the best way to correctly render WML.

A WML document is called a “deck”. A deck is similar to an HTML web page and is identified by a single URL (Universal Resource Locator). This means a deck shows a single screen on a cell phone. A deck consists of one or more “cards”. Of the seven WAPaprs displays, all are a single deck with the exception of the B&W and color map decks. The B&W map deck is made up of three cards. Each card displays a different map resolution. The same is true for the color map deck; it also consists of three cards. Each card displays a different color map.

## **Software Development**

I include this section for those that may be interested in the WAPaprs software development process and tools used. This will aid those wishing to develop their own cell phone application.

All WAPaprs displays use the Wireless Markup Language (WML). The language is very similar to HTML; in fact, many of the tags are identical. However, the language has been specifically created for wireless applications where bandwidth and transfer rates are critical requirements and need to be understood. As an example, while normal HTML source code is sent from a web server to a client as plain text that the user can read, WML source code is compiled by a WAP gateway into a compressed binary file. The binary is more transmission efficient than sending plain text and therefore, reduces airtime and substantially increases throughput.

It is possible to develop a WAP application using only a cell phone, but it is uneconomical due to the airtime required. It is also an inefficient use of development time. Fortunately, there are several options. The most popular WAP development tool is the Openwave Software Development Kit (SDK) available free of charge at [www.openware.com](http://www.openware.com). This web site also serves as a great resource for cell phone development software and information.

## **Acknowledgments**

Thanks to Jim Morrison, KB0THN, for the USGS cities and location database. Special thanks also to Steve Dimse, K4HG, for the findu database. APRS is a trademark of Bob Bruninga, WB4APR.

## **Caveat**

Please do not use WAPaprs while driving!



# Packet in the Real World

By Darryl Smith, VK2TDS, vk2tds@tapr.org

For those that don't know me, as well as a TAPR board member from Sydney, Australia, I am also a consultant engineer working in wireless technologies. What I have been finding recently is that there are an increasing number of Amateur Radio technologies making it into the real world

The work has involved looking at some GPS tracking devices using a satellite uplink to get the data back to the rest of the world. Since I have been dealing with these on the commercial side, I thought it might be useful to examine some of them from the commercial standpoint.

## Satellite Systems

The system that I have been using is operated by a US-based company called OrbComm ([www.orbcomm.com](http://www.orbcomm.com)). They operate a constellation of about 35 satellites operating in low earth orbit (about 500 miles). The satellites themselves weigh about 45 kg, and operate on VHF with 2400 bit/s up and 4800 bit/s, as well as a VHF 56k downlink for command and control. The satellites operate with an uplink frequency of 148-150.05 MHz and a downlink frequency of 137-138 MHz.

These satellites have a lot in common with the early AMSAT satellites, apart from the fact that these were mass-produced. They operate in two modes: Instantaneous Downlink, and Store-and-Forward.

The Instantaneous Downlink mode allows long messages such as e-mail to be sent and received directly from the earth station with the satellite acting as a digipeater. Since there are no downlinks in my part of the world, I have been unable to determine if the link layer is done on a per-hop basis, or for the entire up and downlink. It would make sense for them to be separate, but I have not been able to find out.

The Store-and-Forward mode allows binary messages of up to 250 characters to be transmitted from anywhere in the world for downlinking the next time the satellite passes over a ground station. The message is then sent to a service provider for processing.

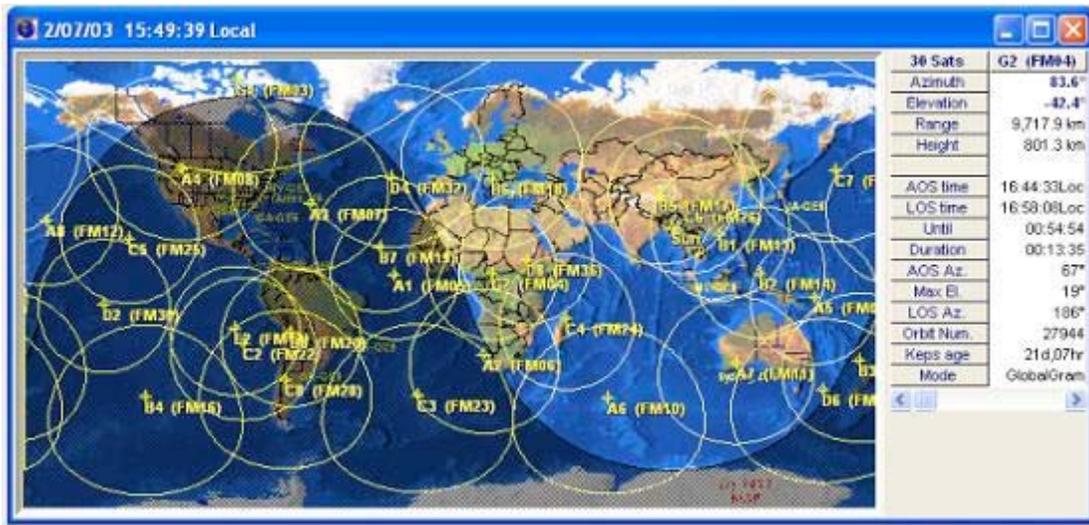
What is unique with this mode is that the "from" call sign is just the serial number of the unit and the routing is dependant on a database maintained by OrbComm. The ability to add data to the packet to do additional routing makes possible routing to multiple recipients, but that is not the purpose of this mode.

It is to allow telemetry to be delivered with a minimum of overhead. Where data is costing US\$1.40/kbyte, adding a long e-mail address to the start of a packet is wasteful. Therefore, this data format assumes that the service provider that OrbComm sends the data to will know what to do with it. In my case, they know to format the packet and place the data into a POP-3 mailbox for me to collect.

Having so many satellites means that most of the time there is about 80% coverage of the earth. If there is no coverage at a particular spot, it is likely that there will be within just a few minutes.

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OrbComm View  
software from  
[www.nlsa.com](http://www.nlsa.com)

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OrbComm currently has four Gateway Earth Stations (GES) located in the continental USA, with three more in South America. Other earth stations are located in Japan, Indonesia, and Italy. Additional base stations are planned for Africa and Australia to improve the performance of the system.

Each of the ground stations is linked back to the manned control center in the eastern USA.

### Ground Stations

The ground stations are effectively self-contained TNC and radio units combined into a single small package. The units that I have been using operate with a Motorola 68332 processor for controlling the radio and an AVR to wake up the CPU at appropriate times and to log data.

The radio is advanced enough to periodically download a copy of the orbital elements for the satellites. It can then use this data along with the GPS receiver to know when to listen for a satellite and what Doppler offset to use.

In my case, the units are programmed to sample the GPS positions a few times every hour and upload the data when the packet is full. As soon as a satellite is overhead, the radio powers up, locks to the satellite, and uplinks the GPS data. If there is no satellite passes for a while, the messages will just get stored until a satellite is available.

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The units are able to work under very low power thanks to the strict power management. However, the radios do transmit 5W, which is ample for the distances involved.

### **Performance**

What I have found with the entire system is exactly what I expected: the system generally worked well, at least in store-and-forward mode. Generally it took about 45 minutes for uplinked data to be downlinked in North or Central America and arrive at our office through the Internet, although there are occasions where the downlink must have come through one of the other base stations since the delay was about four hours.

I also found that the uplink of data was never successful at highway speeds and would only uplink when I slowed down. This is probably the result of Rayleigh fading causing interference to the uplink signal.

I really was amazed to be able to send telemetry packets to the satellite from my car when it was parked under a steel roofed carport. I guess that the packets must have been sent when the satellite was on the horizon; that is the only thing I can think of that allowed this to work.

### **Conclusion**

I hope that I have shown is that Amateur Radio is making a difference in the wider world. Just think about the technologies that this system uses that Amateur Radio either developed or refined, such as microsatellites, packet radio, GPS tracking, store-and-forward satellites, and high speed data links on satellites.

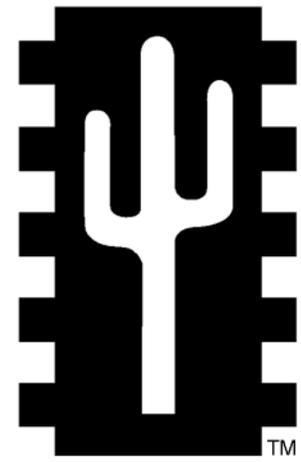


ARRL and TAPR 22nd Annual

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Renewal, Enter Membership Number here:		\$20.00			0
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TNC1 WA8DED EPROM	\$12.00	\$10.80			2
TNC2 KISS EPROM	\$12.00	\$10.80			2
TNC1 KISS EPROM	\$12.00	\$10.80			2
PK-87 WA8DED EPROM	\$12.00	\$10.80			2
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Garmin GPS-20/25 Data Cable	\$15.00	\$15.00			2
Garmin GA-27 GPS Antenna (w/MCX conn., mag. & suction mounts)	\$75.00	\$67.50			8
Oncore UT+ GPS	\$169.00	\$149.00			28
Oncore VP Interface/Power Kit	\$40.00	\$36.00			8
Oncore GT+ GPS	\$149.00	\$129.00			28
Motorola Antenna 97 (w/BNC connector and magnetic mount)	\$65.00	\$58.50			8
MCX Right-Angle Connector with Coaxial Pigtail	\$15.00	\$15.00			2



# TAPR Order Form

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Subtotal

Sales Tax (Texas residents only, 8.25%)

Shipping

Total Order Amount

1-7 Kit Code Points: \$6.00  
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16-27 Kit Code Points: \$8.00  
28-55 Kit Code Points: \$9.00  
55 or more Points, contact TAPR

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E-mail Address

Check Enclosed  or Charge My Credit Card: VISA  MasterCard   
Account Number   
Expiration Date   
Signature