



Maps – Mobiles - Users

## APRS Summary Jan 2011



Human to human info exchange!

APRStt !!!

Appalachian  
Trail **Golden**  
Packet Event

Jan 2011

APRS is a registered trademark Bob Bruninga, WB4APR



# APRS

Human to human info exchange!

Single channel info-resource!

- **Universal Ham Radio Text Messaging Initiative**

- [aprs.org/aprs-messaging.html](http://aprs.org/aprs-messaging.html)

- **National Trail Golden Packet Event (24 July 2011)**

- [aprs.org/at-golden-packet.html](http://aprs.org/at-golden-packet.html)

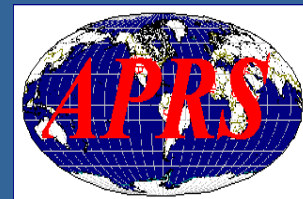
- **APRStt (Touchtone for any HT) !!!** [aprs.org/aprstt.html](http://aprs.org/aprstt.html)

- **APRS-RFID!** [aprs.org/aprs-rfid.html](http://aprs.org/aprs-rfid.html)

- **A-Star Nodes!** (universal voice network) [aprs.org/avrs.html](http://aprs.org/avrs.html)



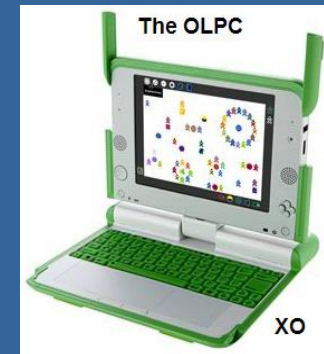
# Universal Ham Radio Text Messaging Initiative 2010



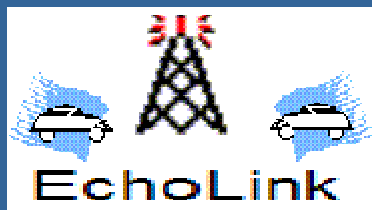
cell



wireless



APRS



DTMF



Send/RX anytime, anywhere, any device by callsign

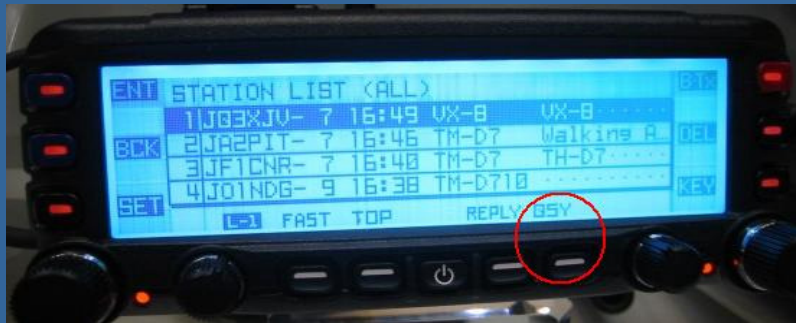
26 separate systems!

APRS is a registered trademark Bob Bruninga, WB4APR





# Universal Texting – New Radios! 2011



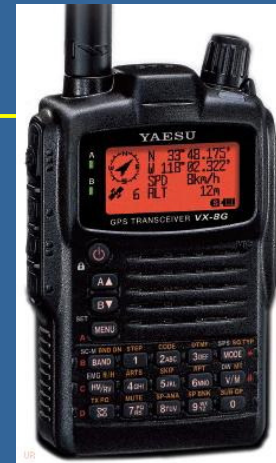
FTM-350R

All now come with GPS BUILT-IN!

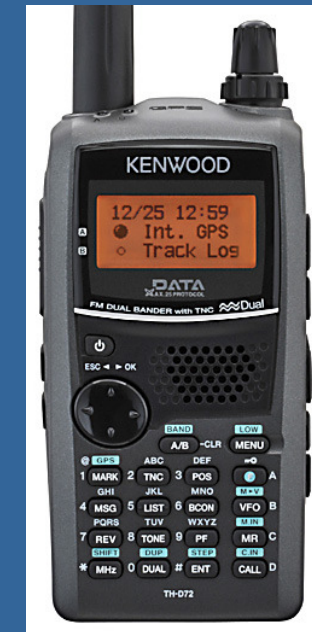


VX-8R &  
VX-8DR

VX-8GR



TH-D72A



# APRS for ALL Portable Terminals!

## OLPC -One Laptop Per Child

- \$100 laptop per 3rd world kid
- Low power, no moving parts
- High power WI-FI and MESH net
- Runs Linux
- Sound Card to DC, volts, O'scope
- Jack, KG4GJY's APRS app:

APRS Activity

APRS-XO: This amateur radio program will update your position & status on all of the global APRS web pages once every 10 minutes.

Select an APRS site: [FINDU.COM](#) [APRSworld](#) [About](#)

With a ham license you can communicate worldwide with wireless and radio. Without a ham license you can only communicate with other XO's on the Internet.

**Identifiers**

First Name: Jack

Call sign: KG4GJY Zip Code: 18107

If a ham radio operator otherwise your call will be XZZZZZ

**Station Text**

Enter up to 36 characters, the most important first since some displays can only see the first 20 or 28.

**Position Data**

Location Type: ☒ home ☐ club ☐ work ☐ visiting ☐ school ☐ other

Latitude: 35 07 42 N Longitude: 085 06 93 W

If you do not know your LAT/LONG then your zip code will be used to place you on the map.

[Disconnect](#) [Send](#)



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# National Trail Golden Packet Event

26 July 2009

25 July 2010



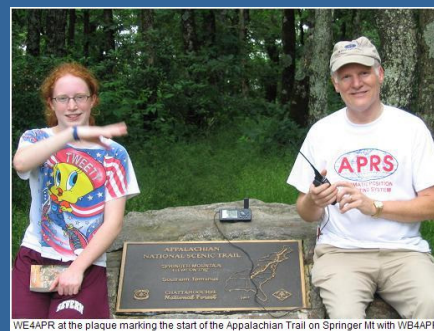
2000 Miles

15 Stations

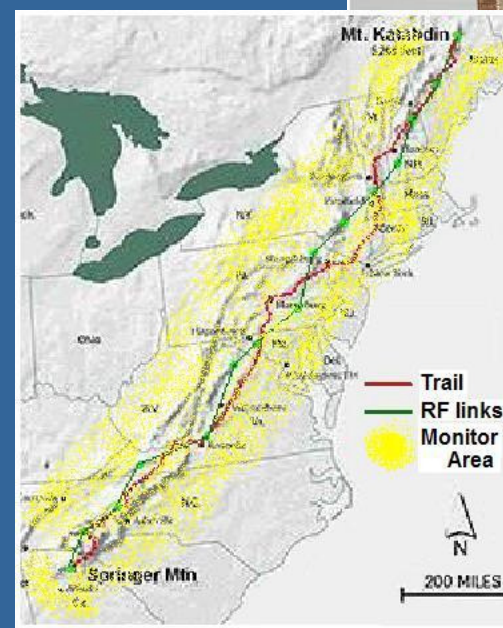
Two HOP7-7 paths

Golden Packets end-to-end

Omni Antennas



WE4APR at the plaque marking the start of the Appalachian Trail on Springer Mt with WB4APR



Others can Monitor!

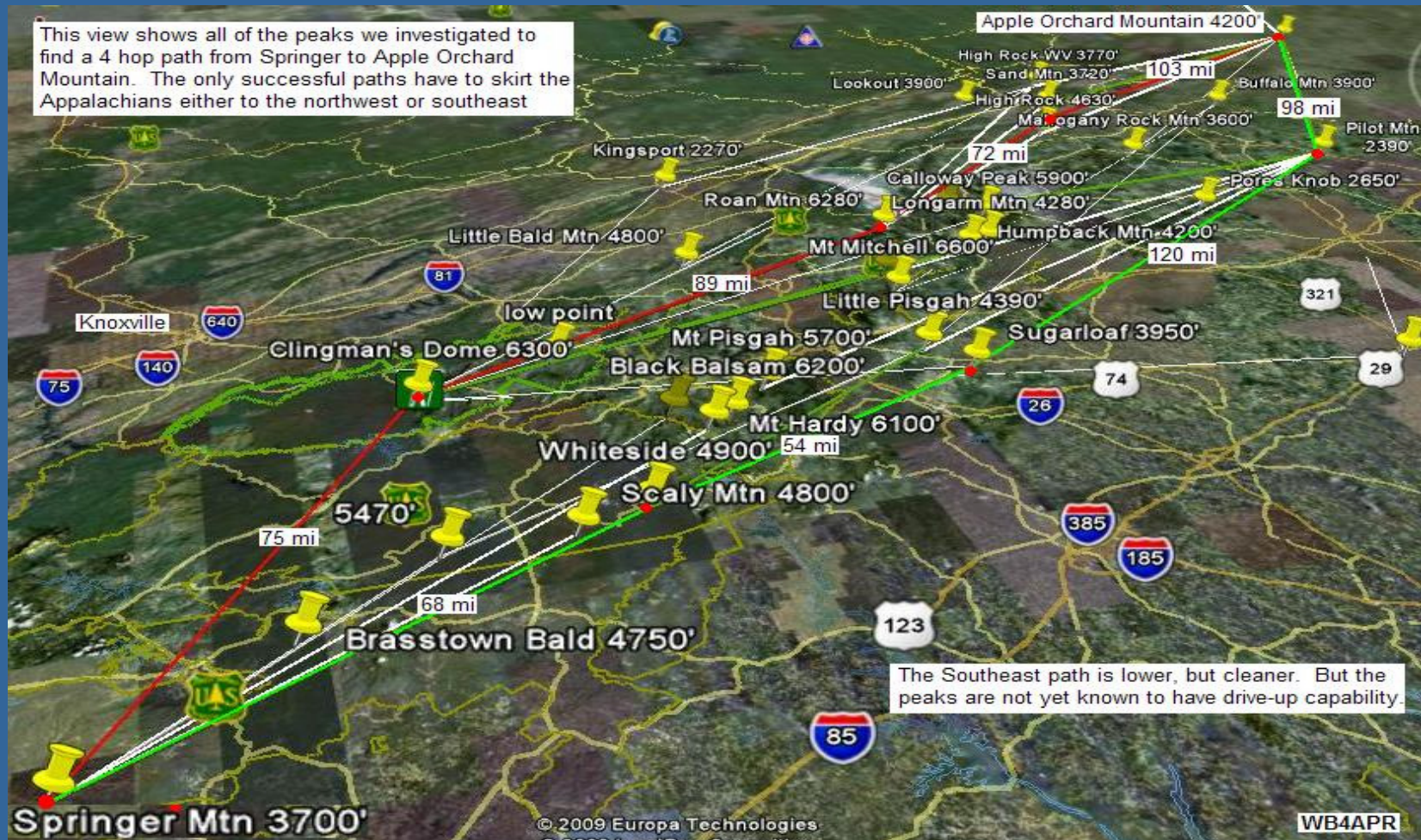
[aprs.org/at-golden-packet.html](http://aprs.org/at-golden-packet.html)

APRS is a registered trademark Bob Bruninga, WB4APR



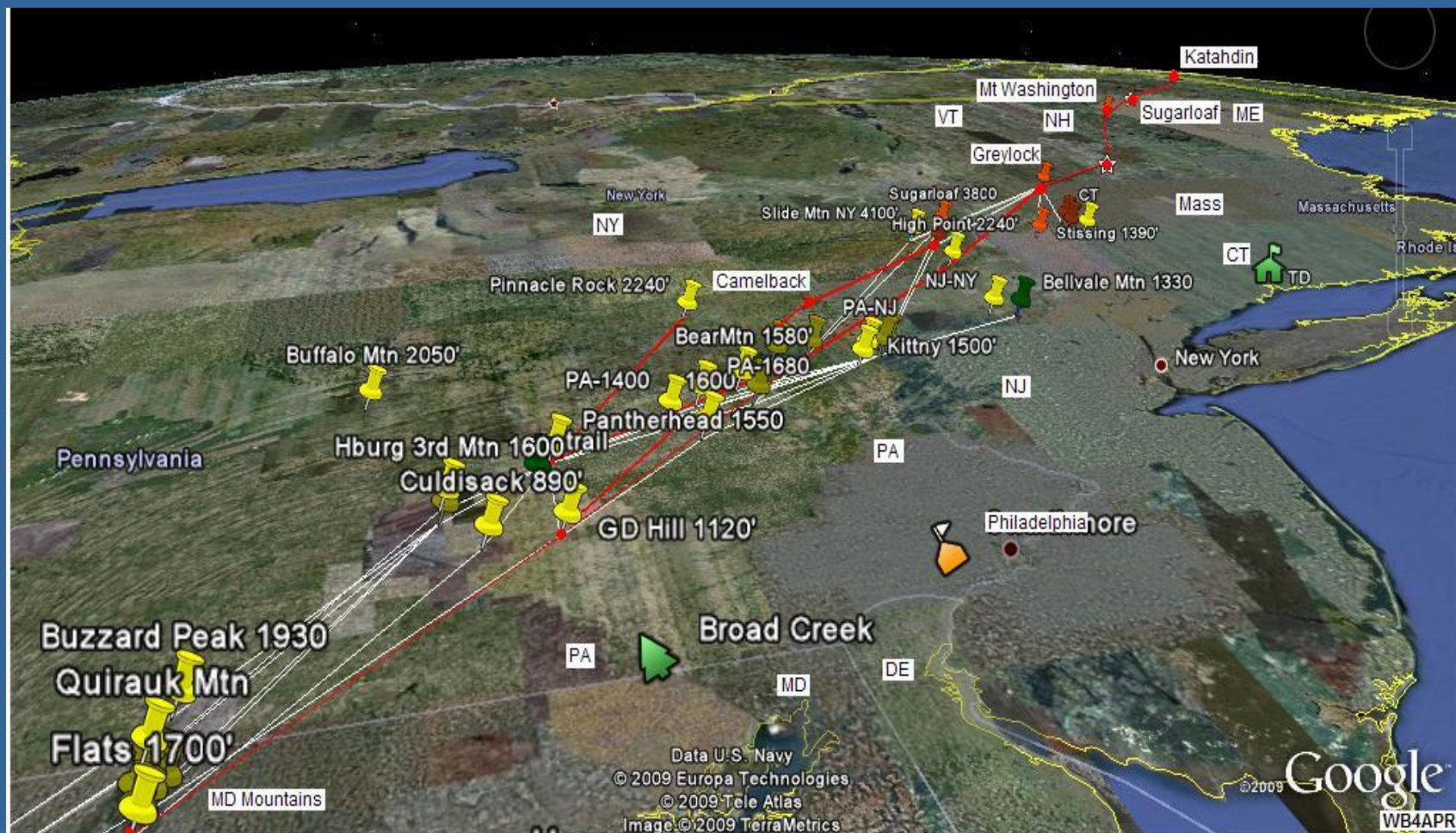


# Appalachian Trail Golden Packet





# Appalachian Trail Golden Packet



The hardest part of the path is going across Pennsylvania with its many low ridges. From NY onward, the path is simply peak-to-peak on popular high mountains.



# Using Google Earth for Links

## 50,000 miles of national linear trails!



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# Appalachian Trail Golden Packet

## KX4O John Huggins Complete RF Link Analysis!



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# What is APRS?

- ❑ Some think it is for GPS
- ❑ Some want the best Maps!



- But others want COMMUNICATIONS!
- Not just GPS Vehicle Tracking!

Can you see APRS Stations? No!

Can you see APRS network? No!



# What is APRS?

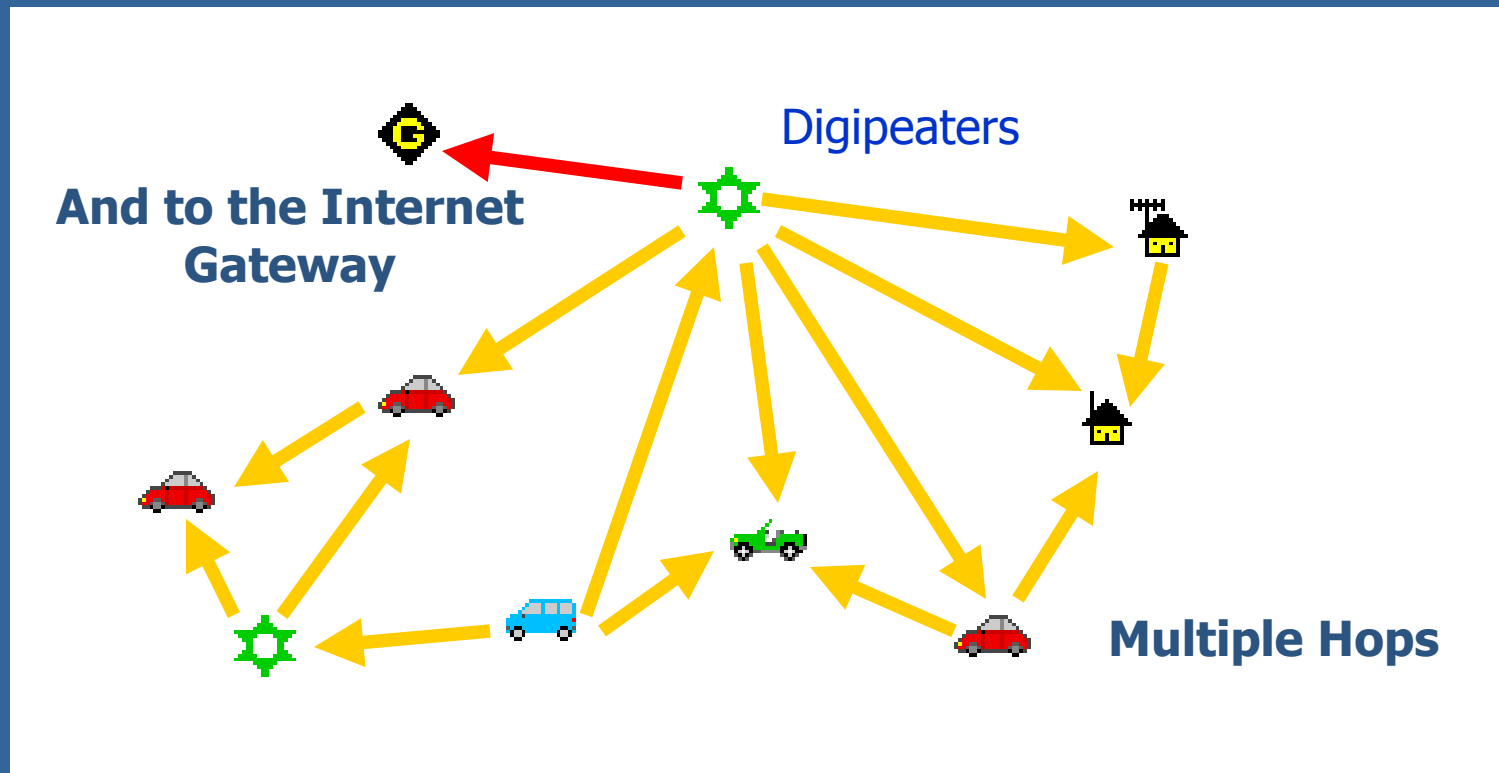
- **APRS** = Automatic **Packet Reporting** System (not position tracking!)
- **APRS** was developed in the late 1980's for local **tactical digital communications**, situational awareness and **TWO-WAY** information exchange
- Messages + maps for OBJECTS – everyone sees the same situation and Network Connectivity
- Not just GPS Vehicle Tracking!





# The APRS Network

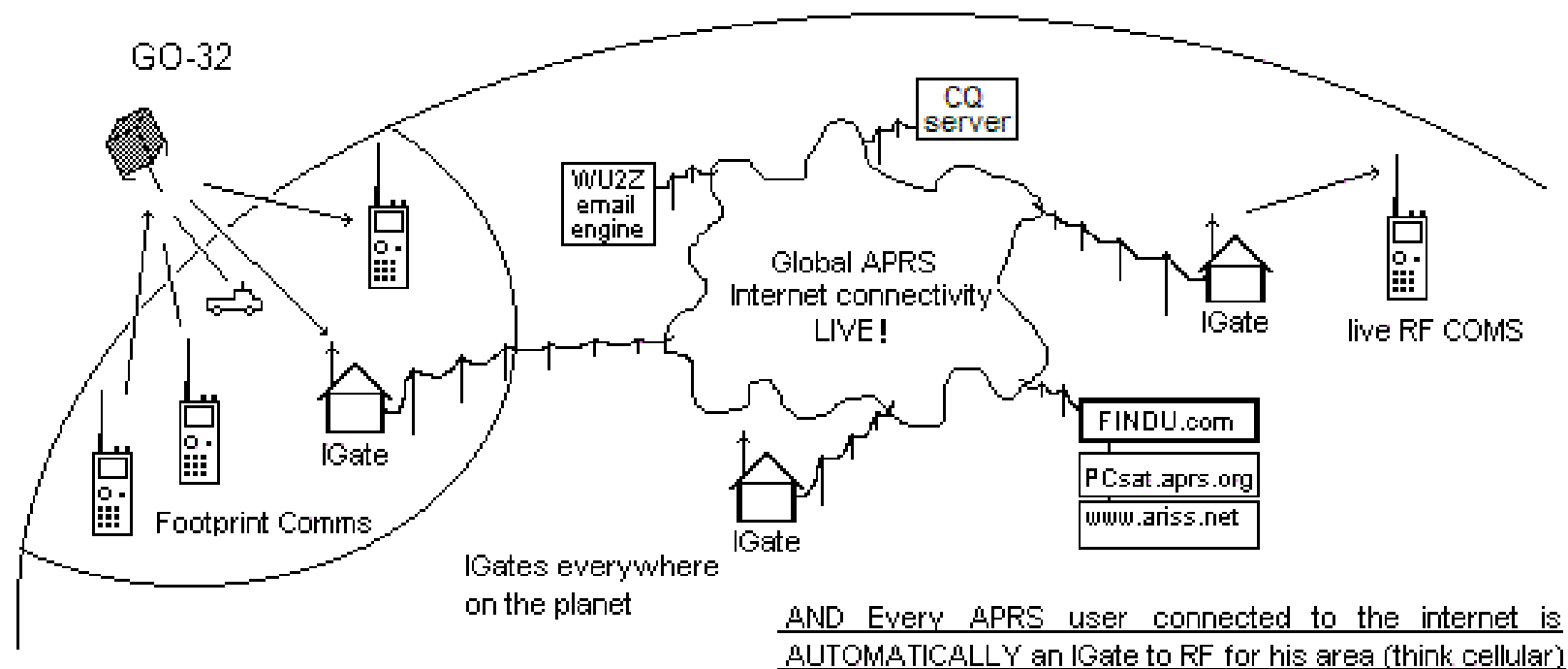
Information exchange between everyone



# Global Mobile/HT Position and Texting Connectivity

## APRS Global Network

( End-to-End Everywhere )



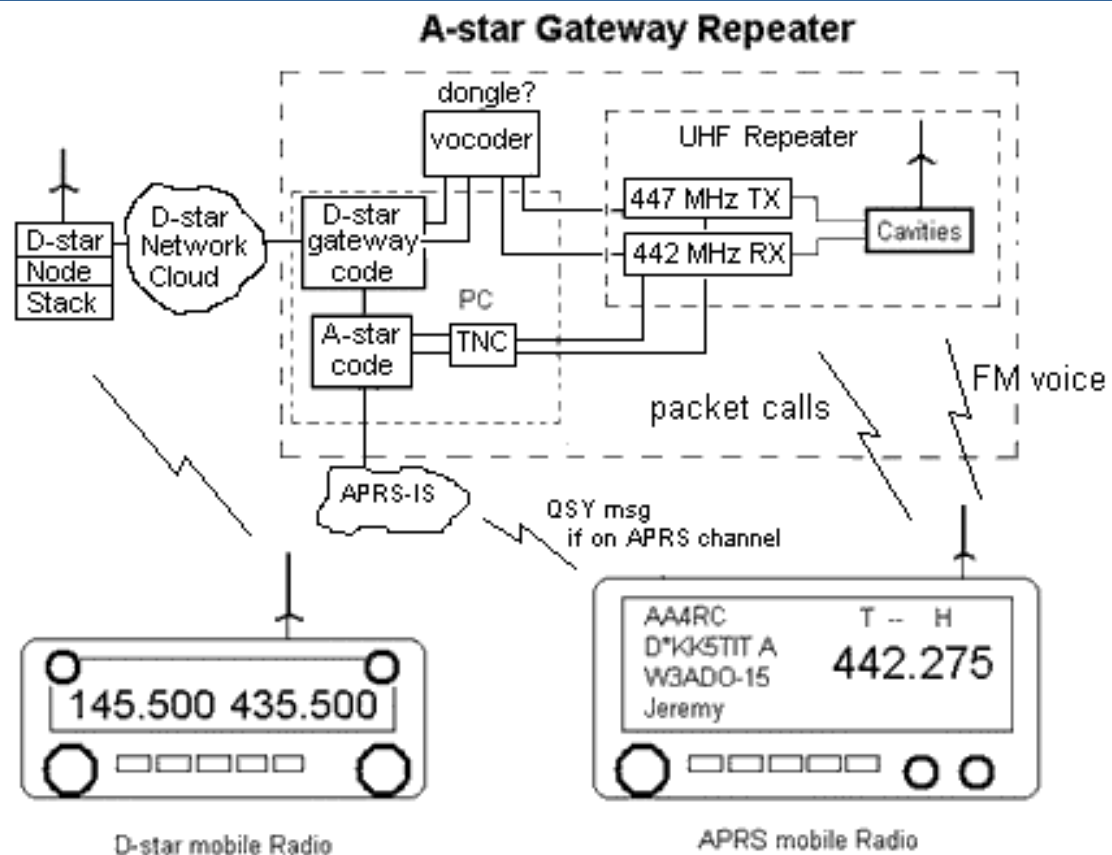


# Global Mobile/HT VOICE Connectivity

## AVRS

([www.aprs.org/avrs.html](http://www.aprs.org/avrs.html))

We can do this now with a little software and some incentive by a good author!



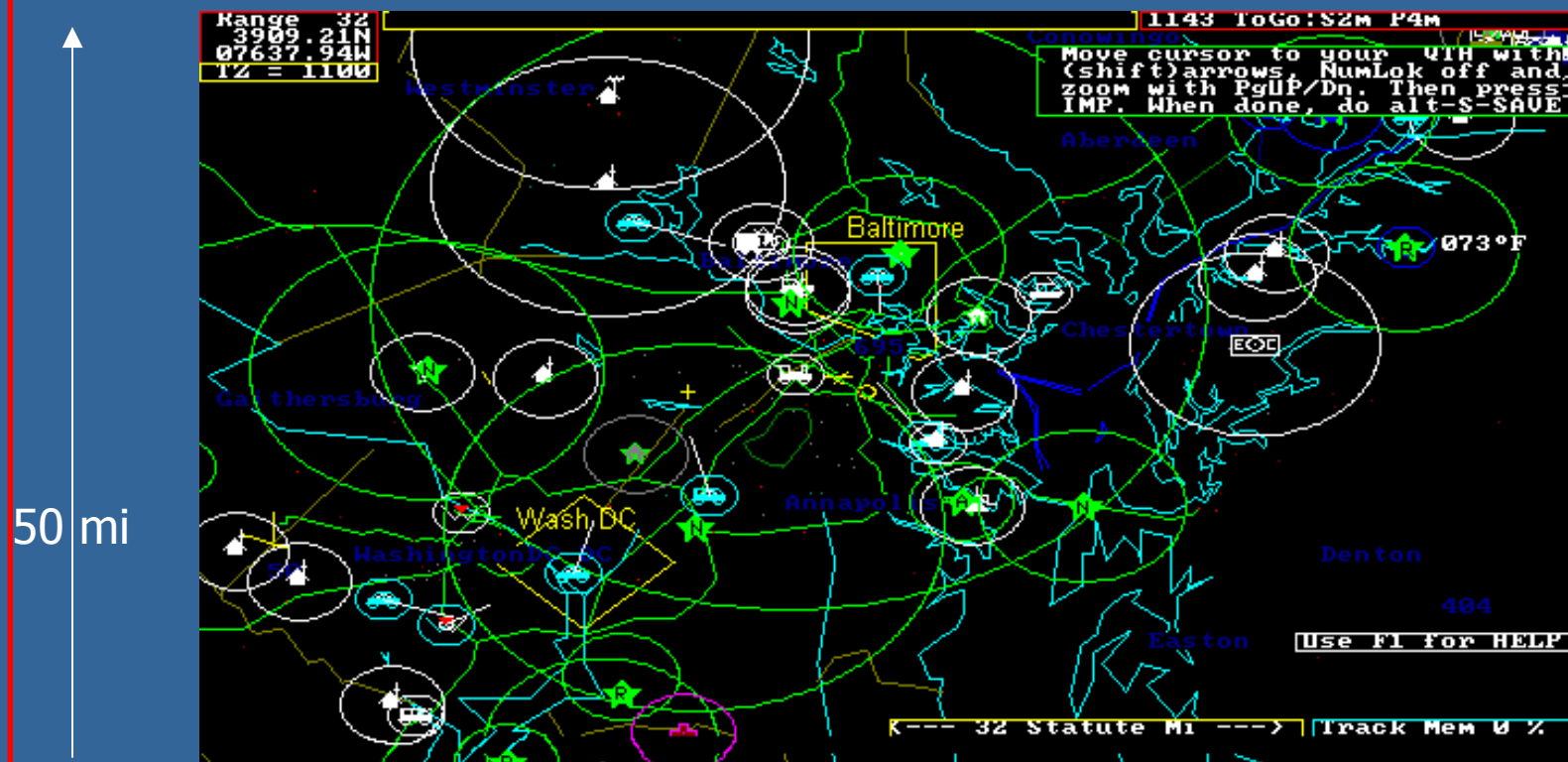
The D-star radio displays the calls of the A-star gateway during the QSO, but when the APRS user releases his PTT, then his actual call is streamed over the D-star channel for display. How long is the call retained on the front panel after the signal stops?

WB4APR

Notice how the APRS side of the A-star gateway is also listening for the APRS callsign data on the repeater input. The mobile ID's every time he releases his PTT. Callsigns from the D-star network are sent to the APRS radio as packets for front panel display.

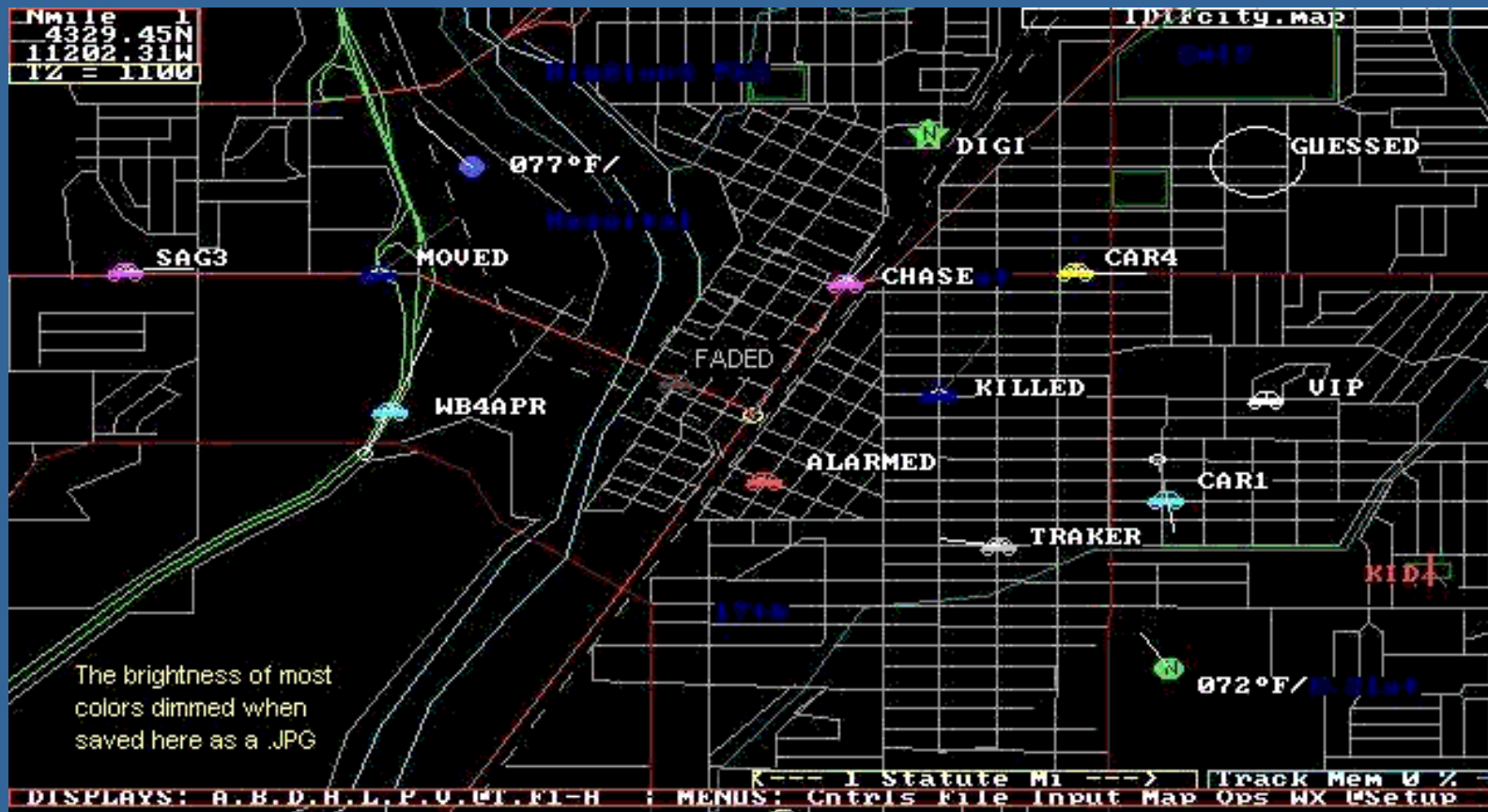
# Seeing the Network

(PHG data shows relative station performance)



APRSdos map with PHG circles displayed and calls, roads, and rivers turned off to reduce clutter. The green interstates remain and you can see WashDC in the lower left and Baltimore in the upper center. Notice the three WIDEn-N digis cover the area though there are more than 15 digis around. Two stations in the upper center live on hills... 2 hops covers everywhere.

# Seeing the Situation (Symbol Attributes)



APRS Symbols on a map should convey their TYPE. In APRSdos, this is conveyed by the COLOR of the ICON. There are 12 CAR symbols on this map, using identical "icons", but each represents a different "TYPE" of symbol as follows:

|   |                                 |                                      |
|---|---------------------------------|--------------------------------------|
| WHITE - A full APRS mobile station      | YELLOW - Your active Objects    | BLACK - Faded, more than 80 mins old |
| GRAY - A Tracker with no msg capability | VIOLET - Someone else's objects | RED - Alarmed, Emergency or Unkwn    |
| BLUE - The previous posit when moved    | CYAN - Moving or Dead Reckoned  | CIRCLE - Ambiguous (GUESSED)         |

























# Symbol Attributes

The original  
Overlayable  
Symbols

## APRS Overlayable Symbols and Color Attributes

-     - Commonly Overlayed APRS symbols
-     - Overlayed symbols that rotate in direction of movement
-      - Generic Overlayable shapes    ie: ARES     RACES 
-   - Other Overlayable Mobiles
-   - MODIS reports and Types of Shelters
-  - New RADIO symbol with multiple overlays

In APRS1.2, all  
symbols may now  
have overlays

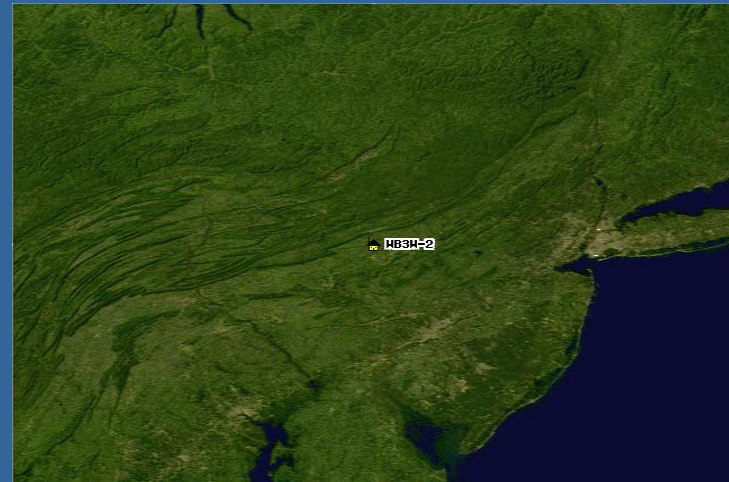
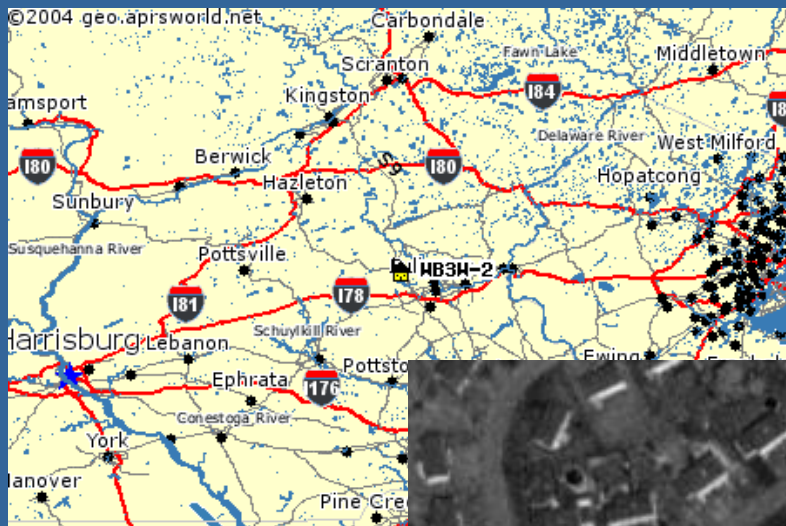
Only a simple "3" overlay is shown here, but 0-9 or A-Z may be used.  
Also any APRS symbol can have other attributes (usually shown by color) such as  
of age, ● ● ● movement, ● ● ● capabilities, ● ● ● object ownership, ● ● ● msg-capability, ● ● ● etc

Since April 2007, all  
alternate symbols  
may now have overlays

Note, some popular "aprs" programs do not  
display ANY of these 11 attributes on any  
map! They show meaningless ICONS instead

# Findu.com Internet Interface

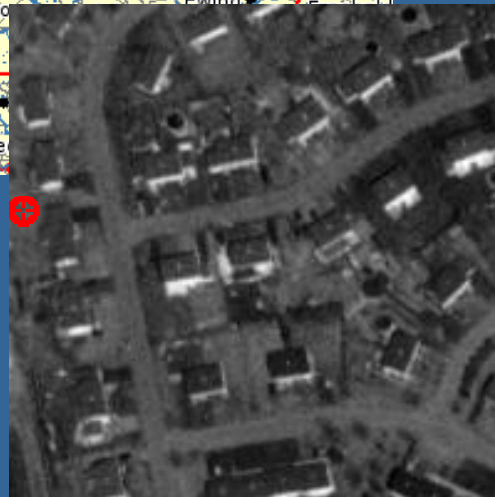
Internet tracking developed by Steve Demise – K4HG and Sproul Brothers



Also:

[APRS-fi.com](http://APRS-fi.com)

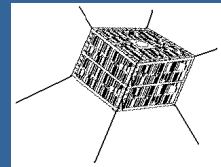
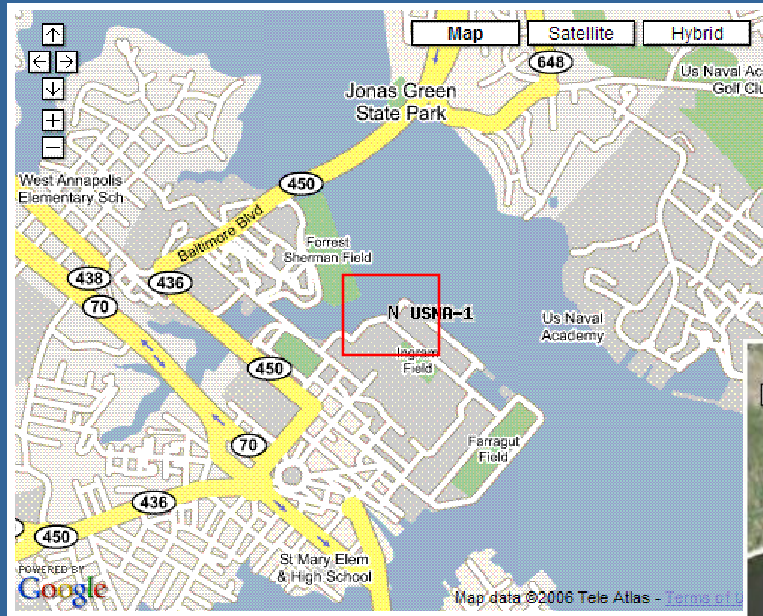
[OpenAPRS.net](http://OpenAPRS.net)



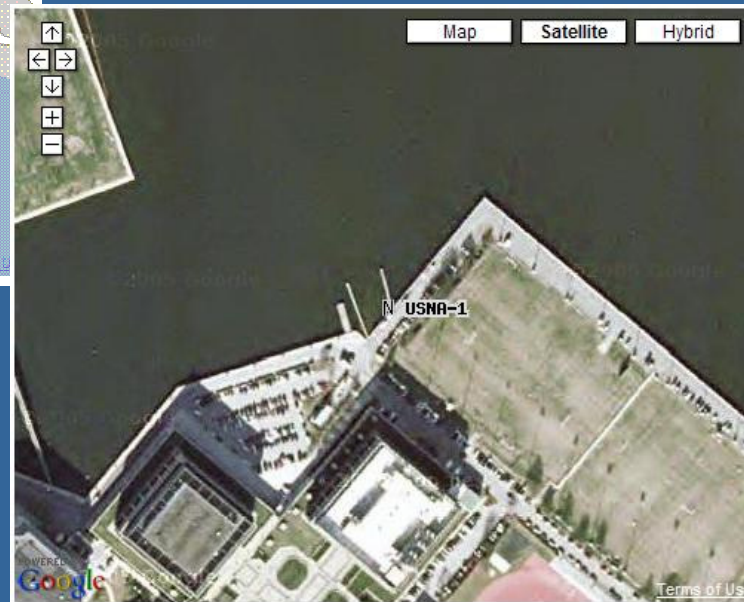
APRS is a registered trademark Bob Bruninga, WB4APR



# APRS-Internet (APRS-IS)



& situational awareness



This data is LIVE  
[http:// Pcsat.aprs.org](http://Pcsat.aprs.org)

APRS is a registered trademark Bob Bruninga, WB4APR





# APRS-IS (FINDU – Near)

















**APRS Stations Near WB4APR-9 (last 240 hours)**

**Google™**  
**findU links for WB4APR-9**

- [Nearby APRS activity](#)
- [Raw APRS data](#)
- [Messages](#)
- [Nearest tide stations](#)
- [Metric units](#)
- [Nautical units](#)
- [Display track](#)
- [APRS Map Manager coverage](#)
- [NexRAD Radar](#)
- [Topographic map](#)
- [Aerial Photo](#)
- [APRSWorld map](#)
- [hide Google Maps](#)

**External links for WB4APR-9**

- [QRZ Lookup](#)
- [MSN map \(North America\)](#)
- [MSN map \(Europe\)](#)
- [MSN map \(world\)](#)
- [TopoZone](#)

| Call  | callbook | msg | wx | lat      | lon       | distance | direction | Last Position |
|---|----------|-----|----|----------|-----------|----------|-----------|---------------|
|  <a href="#">WB4APR-9</a>  | **       | **  | .  | 39.00000 | -76.50000 | 0.0      |           | 00:06:02:46   |
|  <a href="#">VA3ADG</a>    | **       | .   | .  | 38.99717 | -76.50450 | 0.3      | SW        | 05:22:10:17   |
|  <a href="#">WB4APR-1</a>  | **       | **  | .  | 38.99033 | -76.49850 | 0.6      | S         | 00:00:11:28   |
|  <a href="#">WE4APR-9</a>  | **       | .   | .  | 38.98667 | -76.49283 | 0.9      | SE        | 00:03:23:42   |
|  <a href="#">WB4APR-3</a>  | **       | **  | .  | 38.98500 | -76.48550 | 1.3      | SE        | 00:10:55:08   |
|  <a href="#">KB3KAK-9</a>  | **       | .   | .  | 39.02567 | -76.50067 | 1.5      | N         | 01:00:57:40   |
|  <a href="#">VA2JPN</a>    | **       | .   | .  | 38.97150 | -76.49717 | 1.7      | S         | 06:07:21:19   |
|  <a href="#">K3FOR-8</a>   | **       | **  | .  | 39.03200 | -76.50267 | 1.9      | N         | 00:08:58:06   |
|  <a href="#">WB1HAI-9</a>  | **       | .   | .  | 38.97067 | -76.48400 | 2.0      | SE        | 00:02:25:47   |
|  <a href="#">N3MNT-9</a>   | **       | .   | .  | 39.02117 | -76.46400 | 2.5      | NE        | 06:21:14:31   |
|  <a href="#">N3HU-9</a>    | **       | .   | .  | 39.01833 | -76.44867 | 3.3      | NE        | 00:02:18:02   |
|  <a href="#">N3KNP</a>   | **       | **  | .  | 38.97233 | -76.55017 | 3.4      | SW        | 04:01:37:14   |
|  <a href="#">W3AFE</a>   | **       | **  | .  | 39.03517 | -76.45100 | 3.6      | NE        | 00:02:14:24   |
|  <a href="#">K3TH-14</a> | **       | .   | .  | 38.97383 | -76.56283 | 4.1      | SW        | 08:23:06:24   |
|  <a href="#">K3TH-3</a>  | **       | .   | .  | 38.97400 | -76.56317 | 4.1      | SW        | 00:00:14:52   |
|  <a href="#">N3HU</a>    | **       | .   | .  | 39.04017 | -76.44183 | 4.2      | NE        | 00:00:01:28   |

\* Click to see all stations on map



# FINDU.COM (click to see all stations on map)

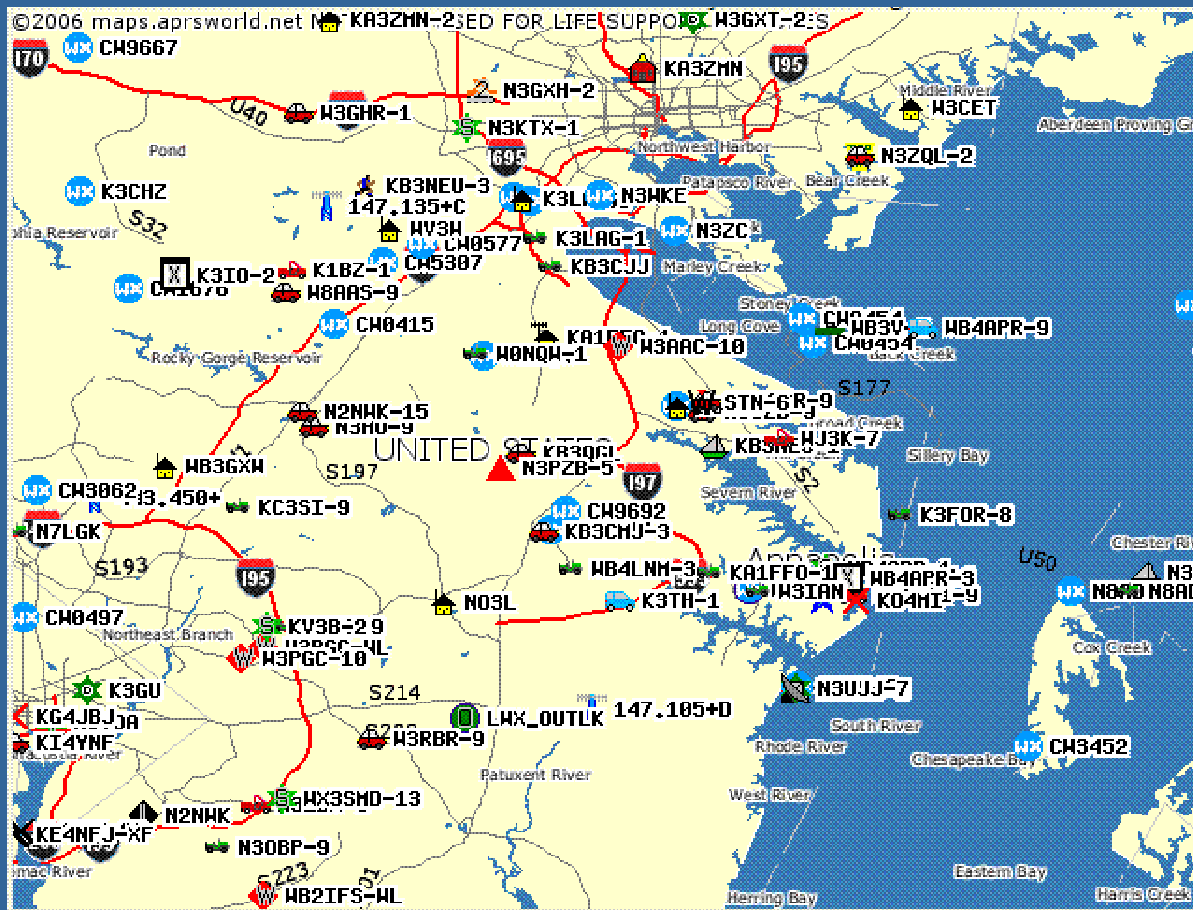
Also:

[APRS.fi](http://APRS.fi)

[OAPRS.net](http://OAPRS.net)

Etc...

40 miles

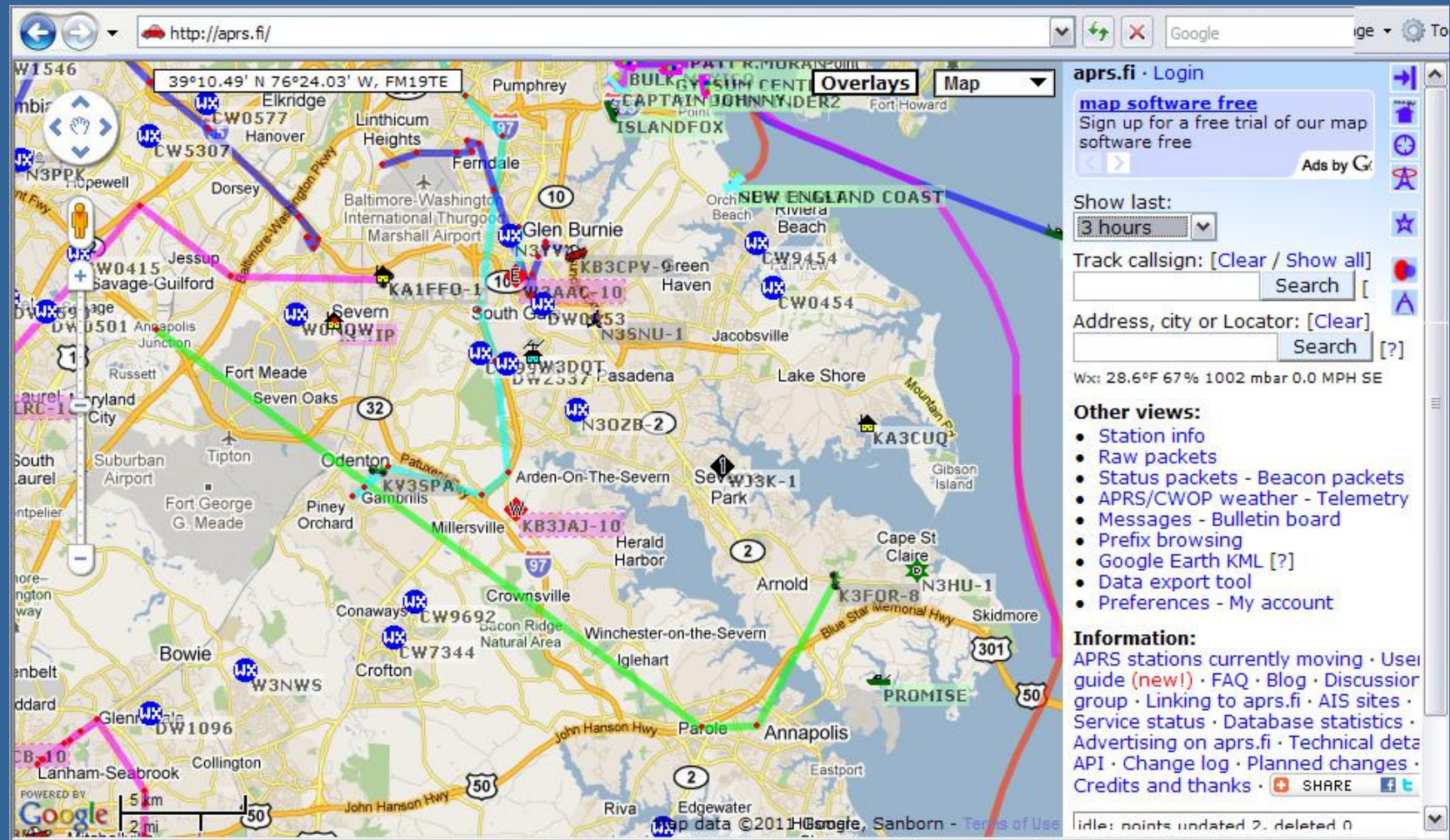


APRS is a registered trademark Bob Bruninga, WB4APR





# APRS-FI (anyone can see APRS)



The screenshot displays the aprs.fi website interface. The main map shows the Annapolis, Maryland area, with various APRS stations and tracks visible. The interface includes a search bar, a list of other views, and a sidebar with navigation links.

**aprs.fi · Login**

**map software free**  
Sign up for a free trial of our map software free

Ads by Google

Show last:

Track callsign: [Clear / Show all]

Address, city or Locator: [Clear]

Wx: 28.6°F 67% 1002 mbar 0.0 MPH SE

**Other views:**

- Station info
- Raw packets
- Status packets - Beacon packets
- APRS/CWOP weather - Telemetry
- Messages - Bulletin board
- Prefix browsing
- Google Earth KML [?]
- Data export tool
- Preferences - My account

**Information:**  
APRS stations currently moving · User guide (new!) · FAQ · Blog · Discussion group · Linking to aprs.fi · AIS sites · Service status · Database statistics · Advertising on aprs.fi · Technical details API · Change log · Planned changes · Credits and thanks · [SHARE](#) [f](#) [t](#)

Idle: points updated 2, deleted 0

APRS is a registered trademark Bob Bruninga, WB4APR





# APRS-IS (FINDU - Messages)

| from      | to        | time            | message  |
|-----------|-----------|-----------------|--|
| WB4APR-9  | JA1RBY-4  | 10/25 00:07:04z | no msg list?{44                                    |
| WB4APR-9  |           | 10/25 00:02:47z | qsl!{43  |
| JA1RBY-9  | WB4APR-9  | 10/24 23:59:59z | hello{15   |
| N3HEV-1   | WB4APR-9  | 10/14 14:09:06z | GM hve a grt day! 73! {0                           |
| WB4APR-9  | ALL       | 10/14 13:53:03z | in d700... ignore that msg. It was 4 satellite.{42 |
| WB4APR-9  | ALL       | 10/14 13:50:24z | in d700 {41  |
| WB4APR-9  | ALL       | 10/14 13:49:07z | in d700 use ptt mode to TX while RXing{40          |
| KE4NYV-15 | WB4APR-9  | 09/30 21:55:30z | S1, if that{7                                      |
| KE4NYV-15 | WB4APR-9  | 09/30 21:51:01z | noisy{6  |
| WB4APR-9  | KE4NYV-15 | 09/30 21:50:32z | 6.85?{38   |
| KE4NYV-15 | WB4APR-9  | 09/30 21:49:45z | noisy{5  |
| N8PK      | WB4APR-9  | 09/30 21:12:16z | Try again on 6.835 {003                            |
| WB4APR-9  | KE4NYV-15 | 09/30 20:48:11z | 52?{37   |
| N1TI      | WB4APR-9  | 09/29 02:47:14z | Good luck @ DCC{82                                 |
| N3IDX-1   | WB4APR-9  | 09/28 02:06:44z | Greetings from Huntingtown, Md{2b}                 |
| KD8ATF-2  | WB4APR-9  | 09/28 01:55:17z | r u going to be on the next pass of go-32 bob?{26  |
| WB4APR-9  | ALL       | 09/28 01:51:40z | ck in!{35  |
| N1TVZ     | WB4APR-9  | 09/28 01:45:12z | %private line{M                                    |
| WB4APR-9  | ALL       | 09/28 01:43:14z | what is pl?{34                                     |
| N8PK      | WB4APR-9  | 09/28 01:40:41z | Gud 2 C U on the CARA last night! -Pat {000        |

Also:

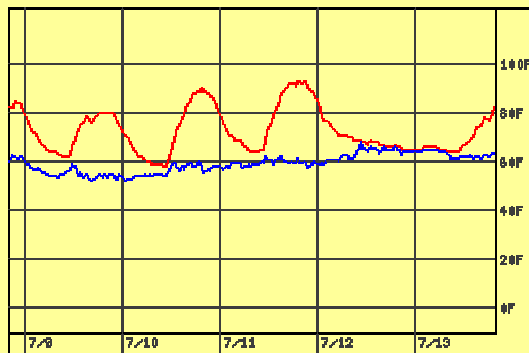
[APRS.fi](http://APRS.fi)

[OAPRS.net](http://OAPRS.net)

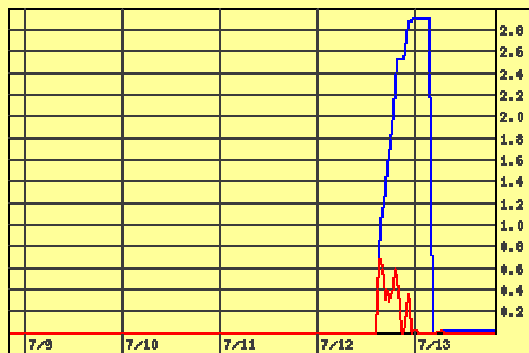
Etc...



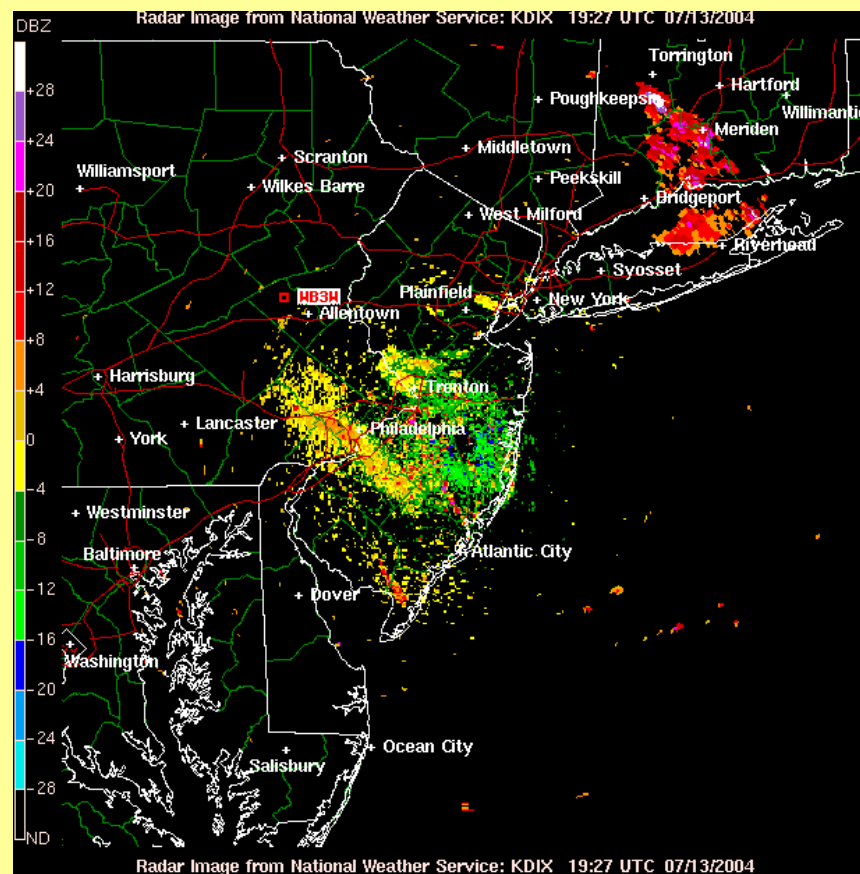
# Findu.com Weather Data



Temperature & Dew Point



Rainfall Rates



# What is APRS all about?

## (Humans communicating INFO with Humans)

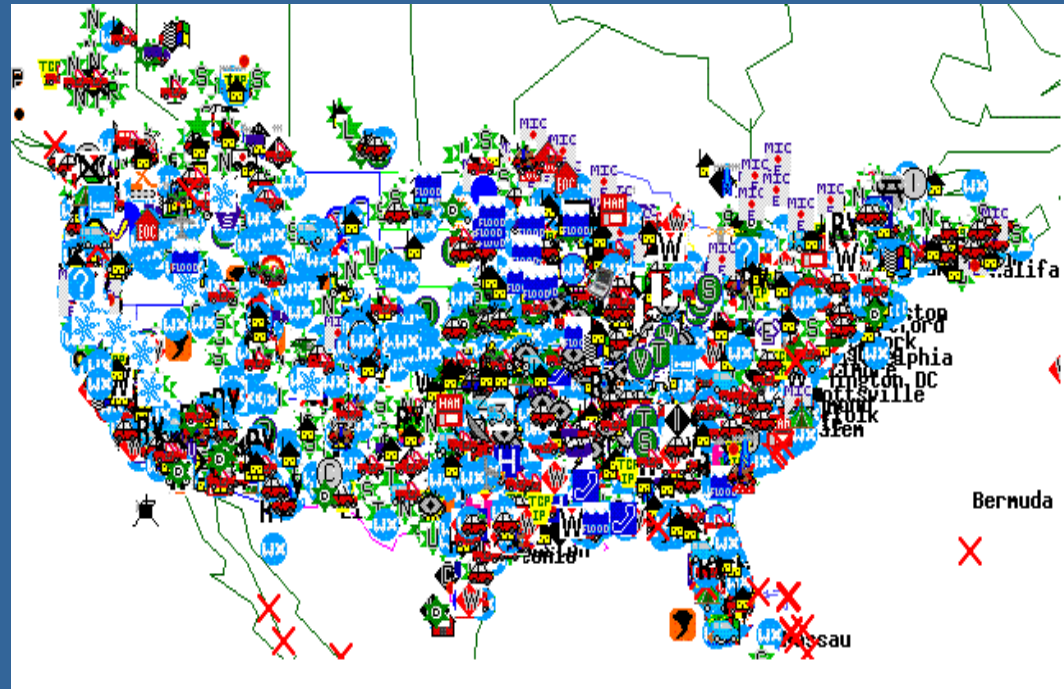
- Immediate local digital and graphical information exchange between all participants in a local area or event. This includes:
  - **Positions** of all stations and objects
  - **Status** of all stations
  - **Messages**, Bulletins and Announcements
  - **Weather** data and **telemetry**
  - **DF bearings** and **signal strengths** for quick transmitter hunting
  - **RF Connectivity** plots of all stations
  - Local **OBJECTS** on a common map display for all users
  - Local **Freqs**, **IRLP**, **ECHOLink**, **Winlink**, **Nets**, **Meetings**
- Typical applications are:
  - **Routine local awareness** of all ham radio events and assets around you
  - Marathons, races, events and public service
  - Search and rescue
  - Family communications and tracking and one-line emails
  - **Mobile-to-mobile global text messaging**
  - Weather data exchange and display
  - **Efficient multi-user Satellite communications**





# Scope of APRS

- Over 40,000 users worldwide.
- RELAYS every 20-30 mi called "digipeaters."
- All linked by home station Igates
- Global links by Amateur Satellites
- Thousands of Weather stations
- Telemetry and data everywhere



But, only 2% of local ham radio users...  
(a side show)...

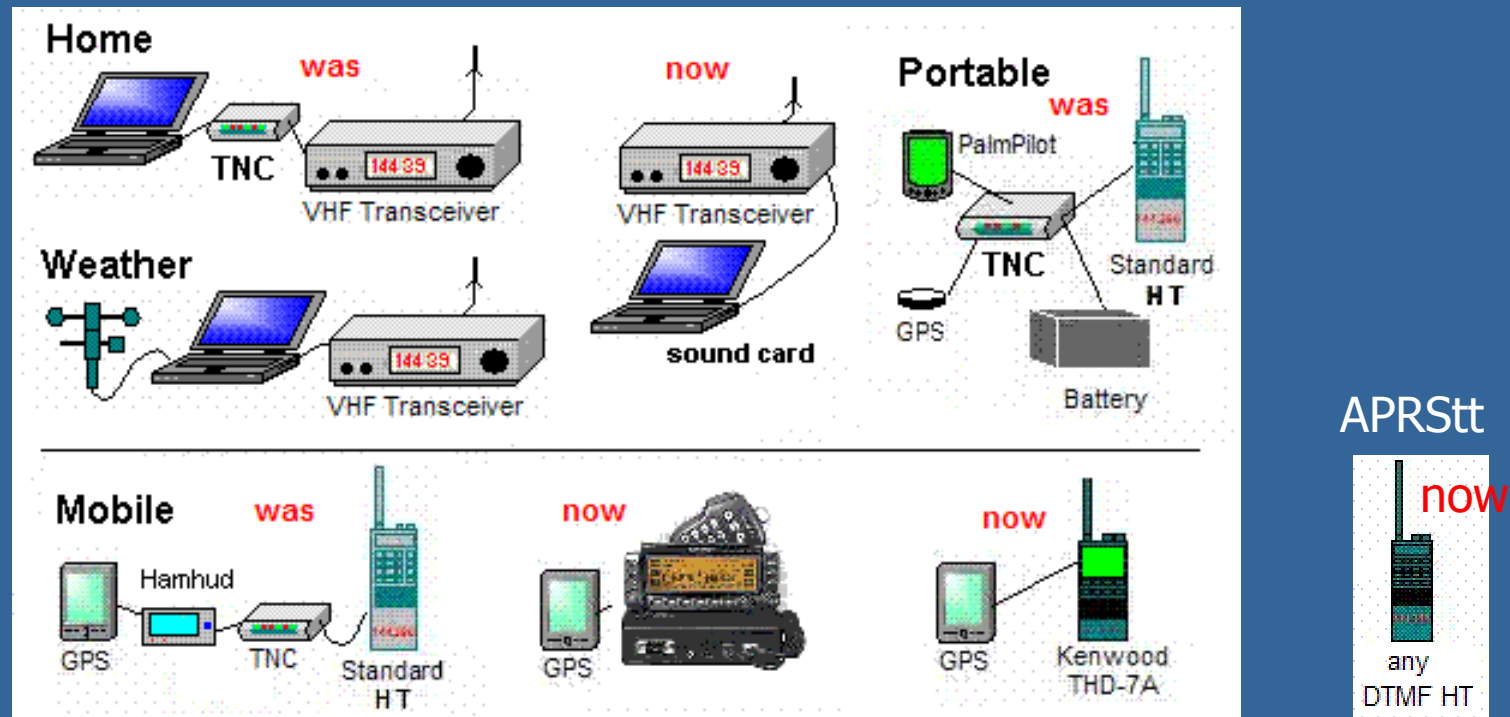
# APRS, Maps, Events and Objects!



APRS is a registered trademark Bob Bruninga, WB4APR



# Various APRS Stations (two-way)



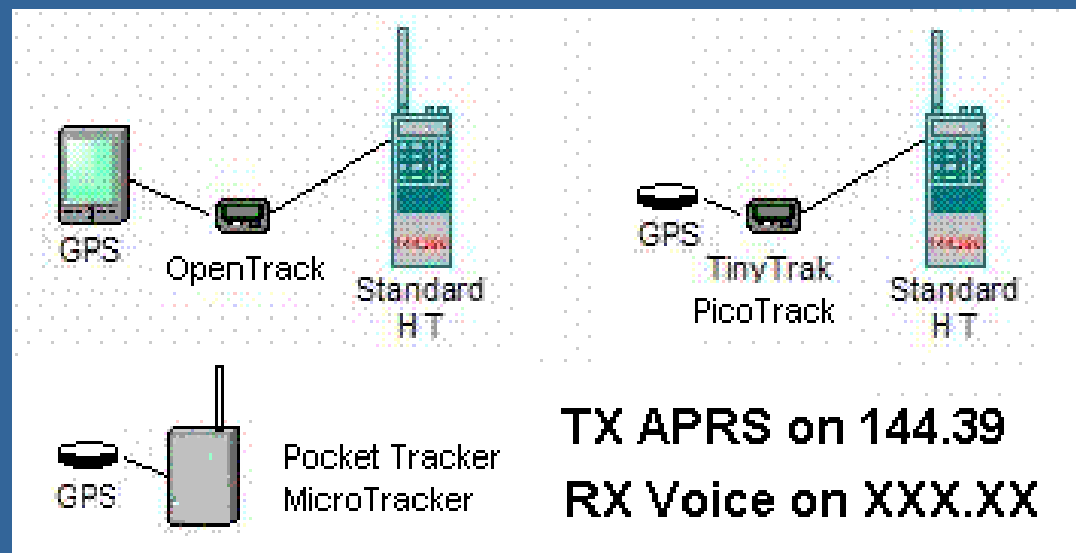
APRS is a Network intended for real-time Tactical INFORMATION exchange. This means TWO-WAY.



# TRACKERS (should be two-way)

One-way APRS is not normally recommended. APRS is a Network. We want good 2-way communications among all participants for maximum utility.

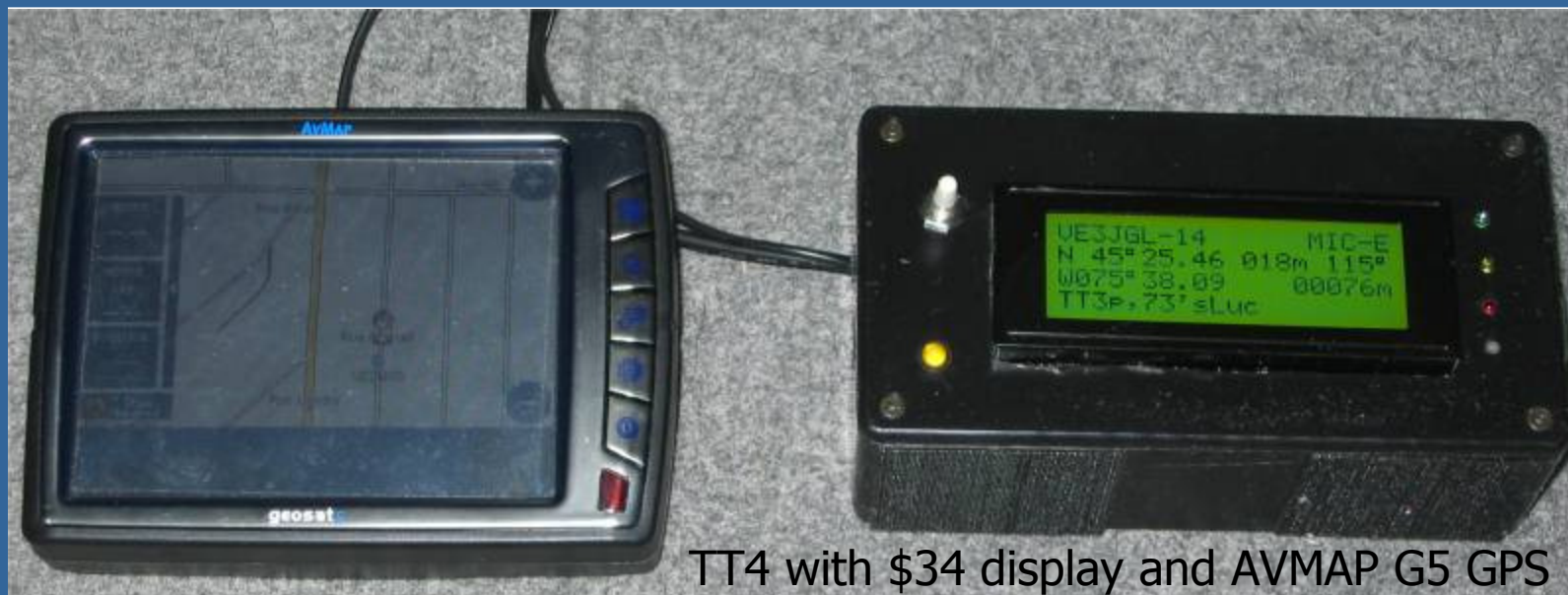
Trackers have no APRS data display. So the receiver should be tuned to a beaoned Voice frequency so the operator can be involved in the Net!



One-way trackers are good for non-manned assets at large movement events.. Not as the only APRS asset for a ham.

Trackers may be his 2<sup>nd</sup>, 3<sup>rd</sup> or 4<sup>th</sup> unit for APRS support... not his 1<sup>st</sup>!

# TRACKERS (Now are two-way!)



TT4 with \$34 display and AVMAP G5 GPS



OT2m case front



OT2m case rear



OT2m circuit board

## Mobile/Portable APRS Terminals

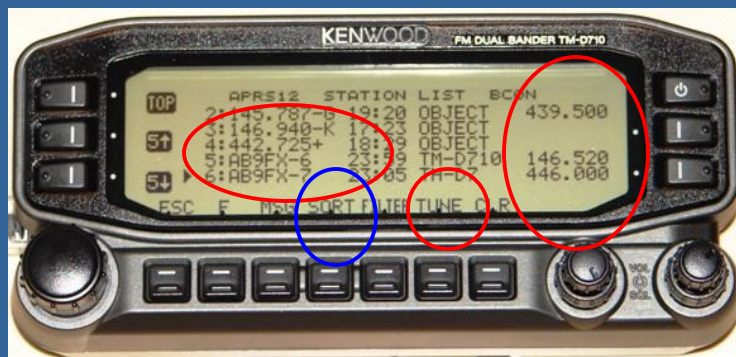
### Kenwood TM-D700A

- Dual band 144/440 MHz 50/35 Watts
- Built-in 1200/9600 bps TNC including digipeater
- Built-in APRS Displays and messaging.
- Other APRS stations show on attached GPS map

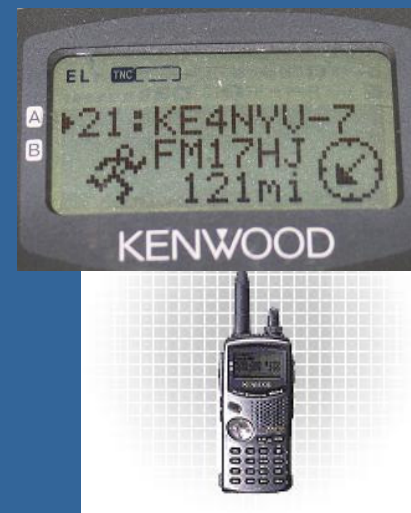


### TM-D710

- Adds operation Freq to every posit !
- Auto tunes to others with Freq!
- Shows local Voice Repeaters !



### Kenwood D7



### Yaesu VX8R





# APRS on ANY radio! (using the RC-D710)

Plug-n-play Audio Connection



RC-D710 DISPLAY

On IC-2820 DSTAR

# APRS on ANY radio! (using the RC-D710)



Attached to an  
ALINCO HT

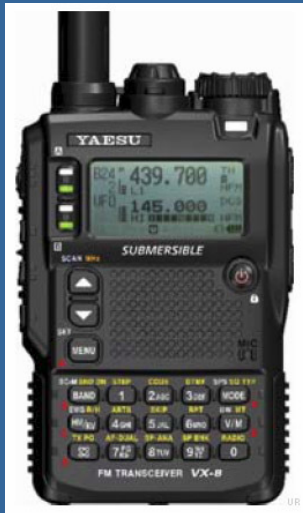
Simple SPKR/Mic connections

NiCd Battery Pack



# Other APRS radios

- Alinco DR-135T/EJ-41U
- 2 M Radio with optional TNC.
- N1VG Scott makes an OT tracker module
- No messaging/data display
- But OT adds GPS map display



- VX8R available since Dec 08.
- Has GPS built-into speaker mic
- Or HAMHUD on any radio!





# APRS MisConceptions!

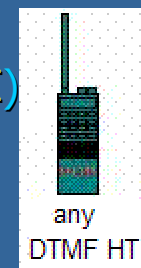
See [APRS-tactical.html](http://APRS-tactical.html)

- That APRS is just Vehicle Tracking instead of a **Real-Time Information Distribution System**.
- That APRS is dependent on GPS for its value (**GPS is not needed. See Objects**).
- Failure to use the APRS built-in **Mile-Marks** for tracking all other non-APRS mobiles.
- Using APRS clients that only do maps and ignored **too many of the APRS fundamentals**.
- Ignored the fundamental **Decay Algorithm** to accelerate new data, and decay old data!
- Failure to understand the importance of OBJECTS: . See **Objects 101** and **Operations**
- Failure to use real-time messaging: . See **Messages 101** and **Message Operations**
- Failure to implement the original APRS Centralized **Common Bulletin Board** concept.
- Not understanding the APRS operator's role as a **Data Input** (Objects, Bulletins and Messages)
- Not using the D7 and D700 as **data entry and clipboard display units** at field events.
- Too much focus on **Large Screen** Displays **—vs- Individual Operator displays for** events.
- Failure to display APRS **symbols with all their attributes** and colors without clicking them
- Failure to manage the network by **adjusting the local digipeater** for the situation at hand.
- Not realizing the importance of **Voice Operating frequencies** in APRS.

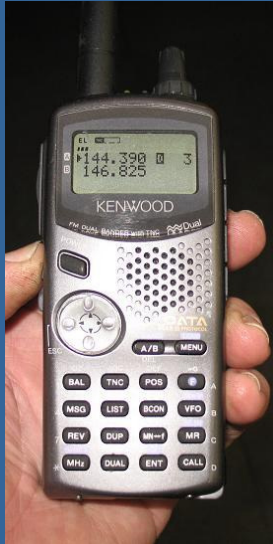


# APRS Growth Opportunities!

- **Global Email** Done! (WU2Z) - **Now Universal Text Messaging** (any device)
- **CQSRVR** (Global APRS CQ's) Done! (AE5PL)
- **APRStt** (APRS touchtone) – **APRS for Every Radio** Done! (W4PC of CSSI)
  - Simple DTMF memory for your Callsign – One Button Send
  - APRStt receiver converts to APRS Position, Time, Frequency and Status!
  - On IRLP nodes, Echolink nodes, some repeaters, anywhere on 146.58
- **AVRS** (Automatic Voice Relay System) **Global Callsign-to-callsign VOIP**
  - Uses APRS message to set up call – APRS knows where you and callee are
  - Automatically links to Echolink or IRLP for nearest node and sends to APRS
  - APRS Radio auto-QSY's to make link (= Ham Radio Cell phone from Mobile) (90% D710)
- **AI-FI** (APRS WIFI) in every laptop
  - OLPC message client (APRS-XO) and XASTIR (50% ...)
  - Other Systems (View on OpenAPRS, APRS-fi, FINDU)
- **APRS RFID** for ARRL name tags (event locating)



# Global APRS Email!



To: EMAIL

MSG: [wb4apr@amsat.org](mailto:wb4apr@amsat.org) ET call home!



- APRS Global **Text Messaging** since 1993; from HT's since 1998!
- Send Email from any APRS radio anywhere to anyone on the planet, anywhere LIVE.
- WU2Z Email Engine on the APRS-IS gates it to Internet
- **Great Demos.** Send an Email to a Blackberry in the audience.

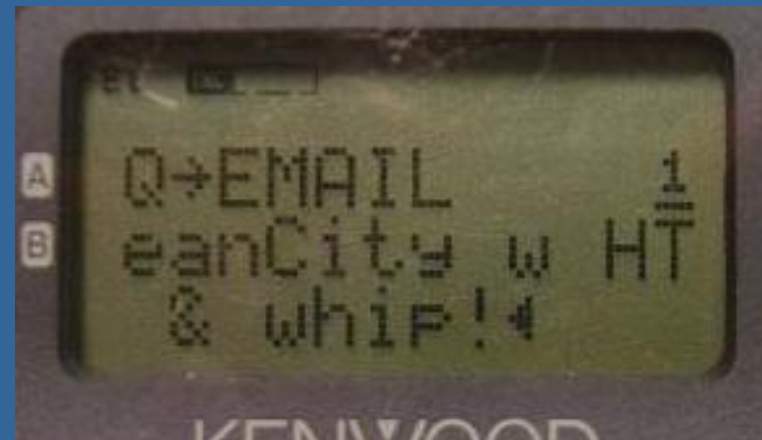
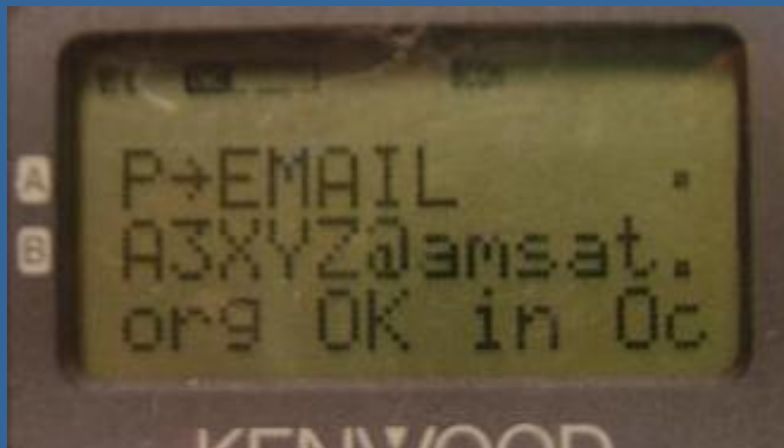
**New Initiative! Universal Amateur Radio Text Messaging**





# APRS Msgs/Email

MSG  
menu



Send/Receive messages or email

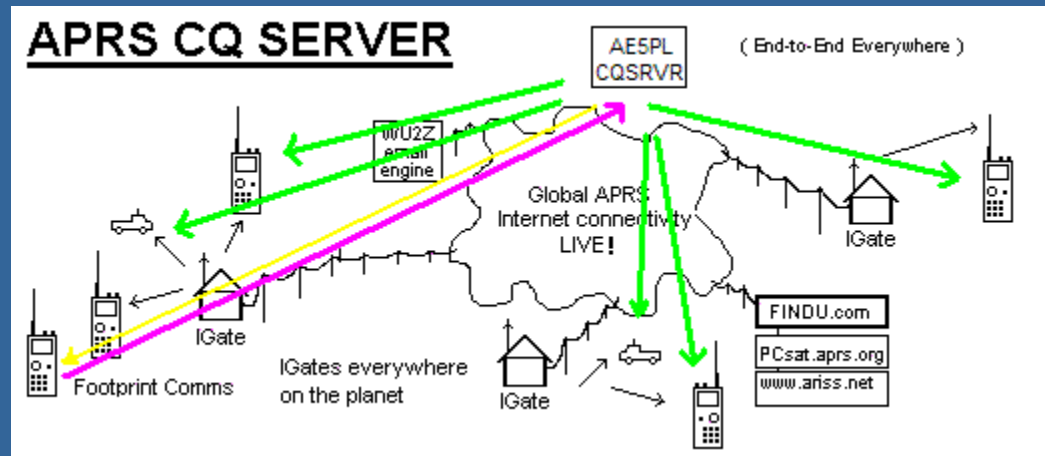
Anywhere on the planet via APRS satellite

Confirmation of Relay =>



# APRS Global CQ's

[www.aprs.org/cqsrvr.html](http://www.aprs.org/cqsrvr.html)



- We needed a CQ System for **SCOUTS, JOTA, SATERN, IOTA, SCR** and **Field Day!**
- **AE5PL** responded with **CQSRVR**
- Allows anyone to send a global message to everyone involved in an **XXXXX** activity
- Just send a message to **CQSRVR** starting with **CQ XXXX CQ XXXX** message
- **Everyone** who has sent a similar **CQ XXXX** message to CQSRVR will get your CQ
- From then on, once you see **callsigns**, you message normally **point-to-point**
- To limit load, only one CQSRVR message per 30 minutes is forwarded.
- Can also be used any day, any time, anywhere! **CQ CQ CQ CQ** anyone around?
- Can also be used for **global GROUP comms** if 30 minute timer is changed.

# APRStt (Touchtone)

(every radio!)

See [aprs.org/aprstt.html](http://aprs.org/aprstt.html)



- For WB4APR, the DTMF Sends: **A9A2B42A7A7C79#**
- This is converted to an APRS packet on the APRS channel as:  
WB4APR-12>APRStt,WIDE1-1:!DDM\_\_.\_\_N/DDDM\_\_.\_\_W\$146.58MHz HAMvention
- **Puts you on global map near Hara Arena, with your immediate calling frequency, your Tone and your Echolink node number and that a Hamfest is going on.**
  - That is everything you need to be known to the Global APRS system!
  - Exists since 2001 (in DOS w DTMF chip). Now we have a Windows Version! By W4PC
  - Also Needed in Echolink, IRLP, and some repeater controllers with a serial port!
- APRStt and therefore 100% situational awareness of any Ham mobile or HT then APRS will always be a side show only used by 10% of any club or organization.
- Other Positions: #B95\*234\*1D => Milemark #234 on Route 95, northbound

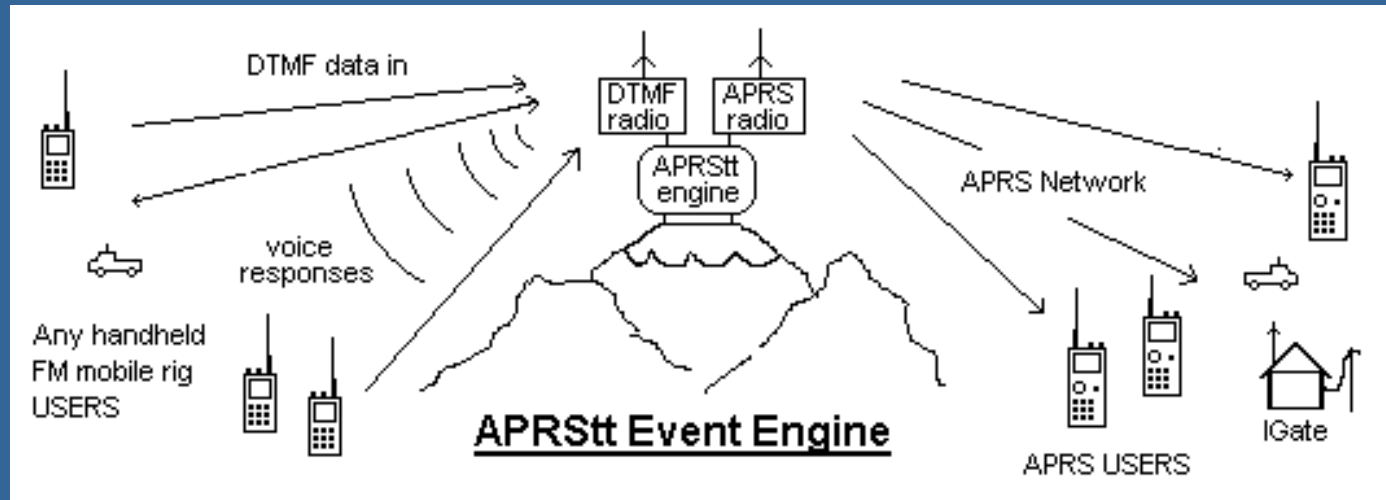




# APRStt (special event)

(every radio!)

See [aprstt.html](http://aprstt.html)

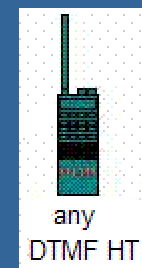


- Simple DTMF memory - One button puts you in APRS (**Position, Frequency and Status**)!
  - DTMF on voice freq translated to packet on APRS channel (or direct to APRS-IS)
  - Position is .1 mile LIST on map display adjacent to repeater or FREQ object
  - Frequency used is inserted in packet (for return contact)
  - If Echolink, IRLP or Autopatch, APRS packet includes node or Phone number!
  - All responses in Voice



# DTMF users show on map

See [aprstt.html](http://aprstt.html)



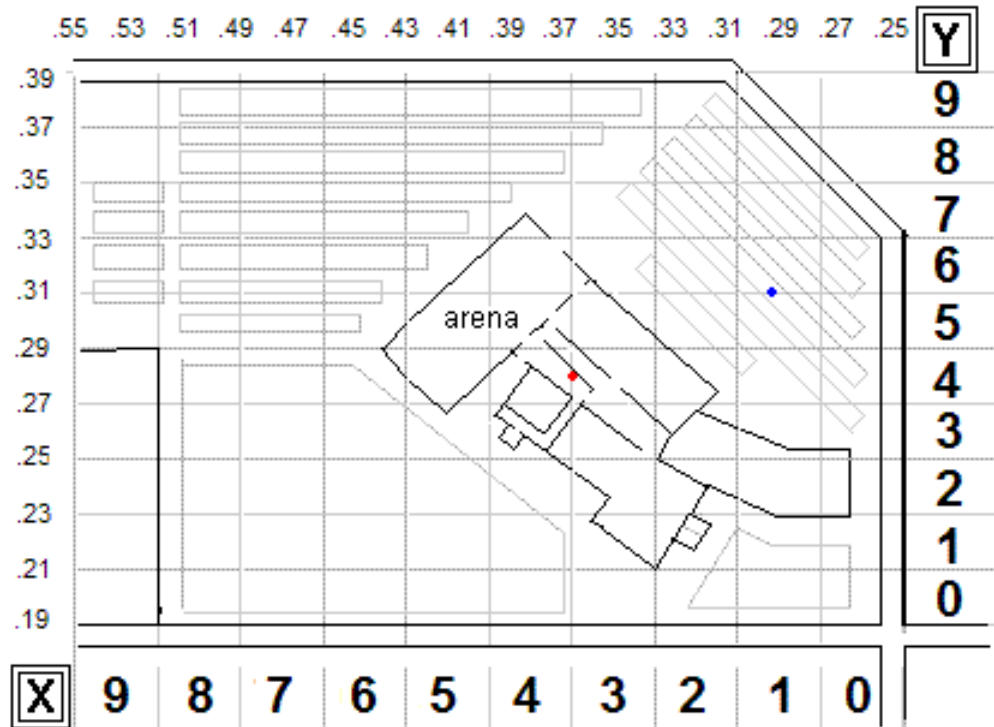
## DTMF Report shows on APRS!

- CALLSIGN with date and time
- Position LIST in vicinity of repeater or APRStt entry point
- Voice Operating Frequency, Tone and local other info
- Node number if Echolink or IRLP, or reverse patch number if Repeater

147.105MHz T107 R30m



# APRStt (Hamvention) (Doug Quagliana)



**TT Position Format: BXY#**

**APRStt on 146.58 MHz**

Lat =  $3949.20 + .02 \times X$

Long =  $8415.26 + .03 \times Y$

**DTMF Users:** Report position by pressing B then an X and Y digit from above map, then \*, then select your DTMF Callsign memory and send.

**THD7 Users:** (without GPS): simply set the above aa/bb in your position.

|      |     |      |   |
|------|-----|------|---|
|      | ABC | DEF  |   |
| 1    | 2   | 3    | A |
| GHI  | JKL | MNO  |   |
| 4    | 5   | 6    | B |
| PQRS | TUV | WXYZ |   |
| 7    | 8   | 9    | C |
| *    | 0   | #    | D |

**Store Callsign in DTMF memory**

**Format: AccccccccccVK#**

Where ccc... is call, spelled out using 2-key method. ie W is 9A, E is 3B, L is 5C and S is 7D.

Where V is an overlay digit 0-9

Where K is the checksum by adding all keys and keeping only the units digit. Treat ABCD as hex.

• **Radio Spotter (APRStt) Booth**

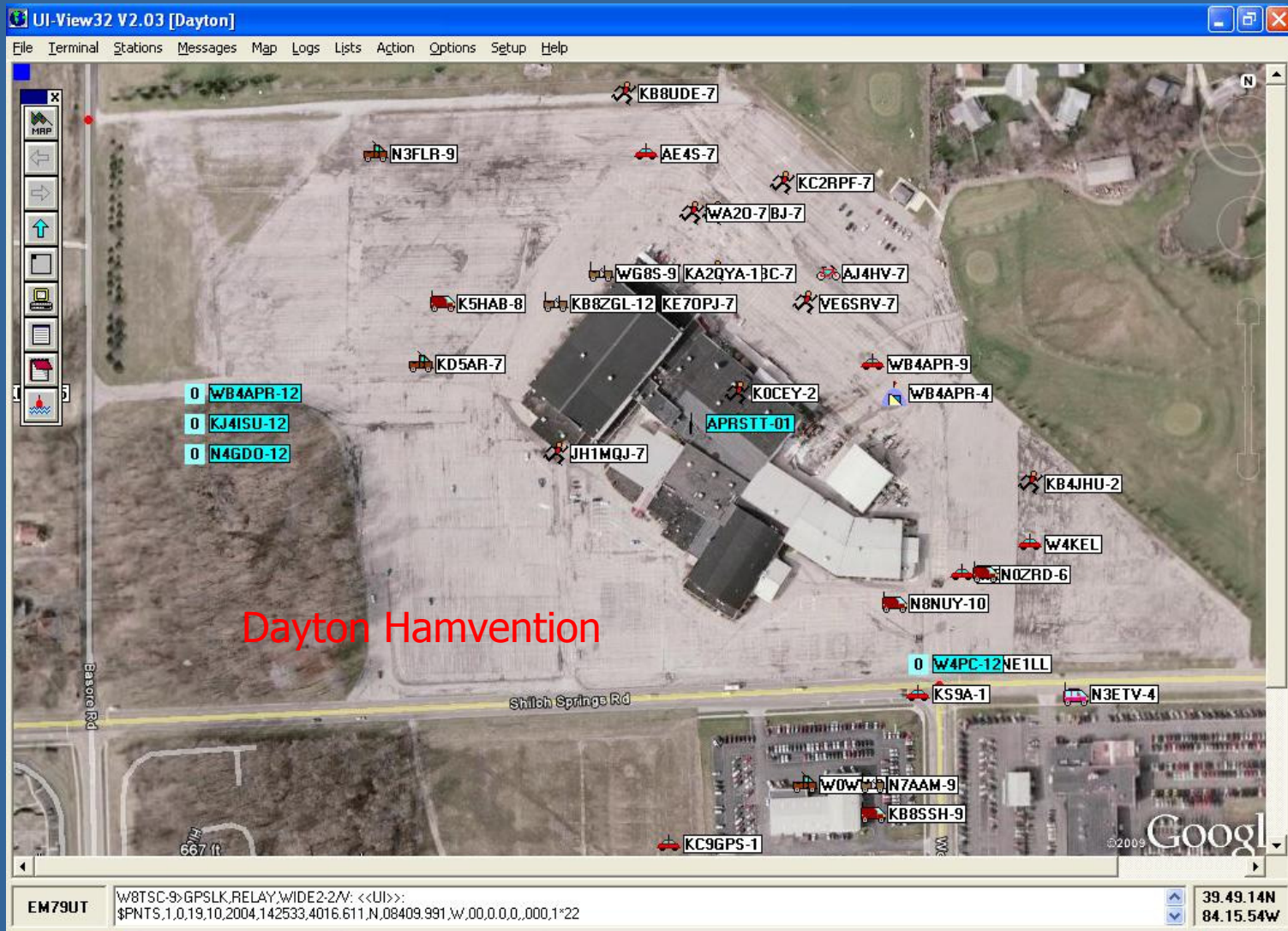
• **WB4APR Solar Prius**

**WB4APR**





# APRStt!

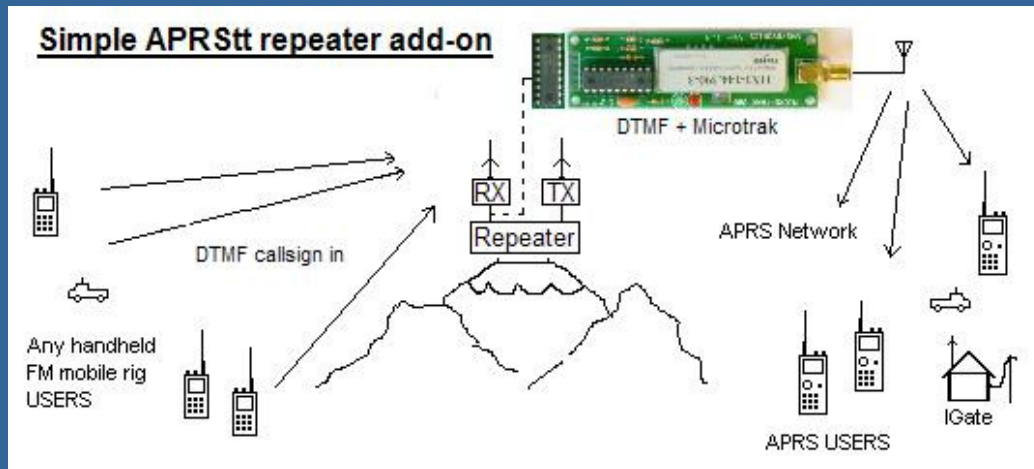
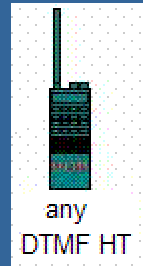


*APRS is a registered trademark Bob Bruninga, WB4APR*



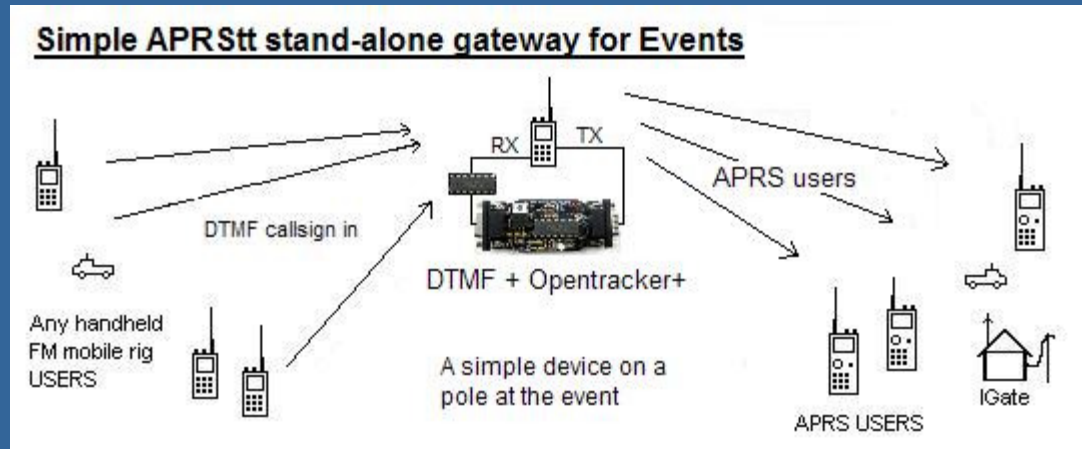
# APRStt (Simple Gateways)

See [aprstt.html](http://aprstt.html)



As simple  
as adding a DTMF  
chip to a **Micro-Trak**

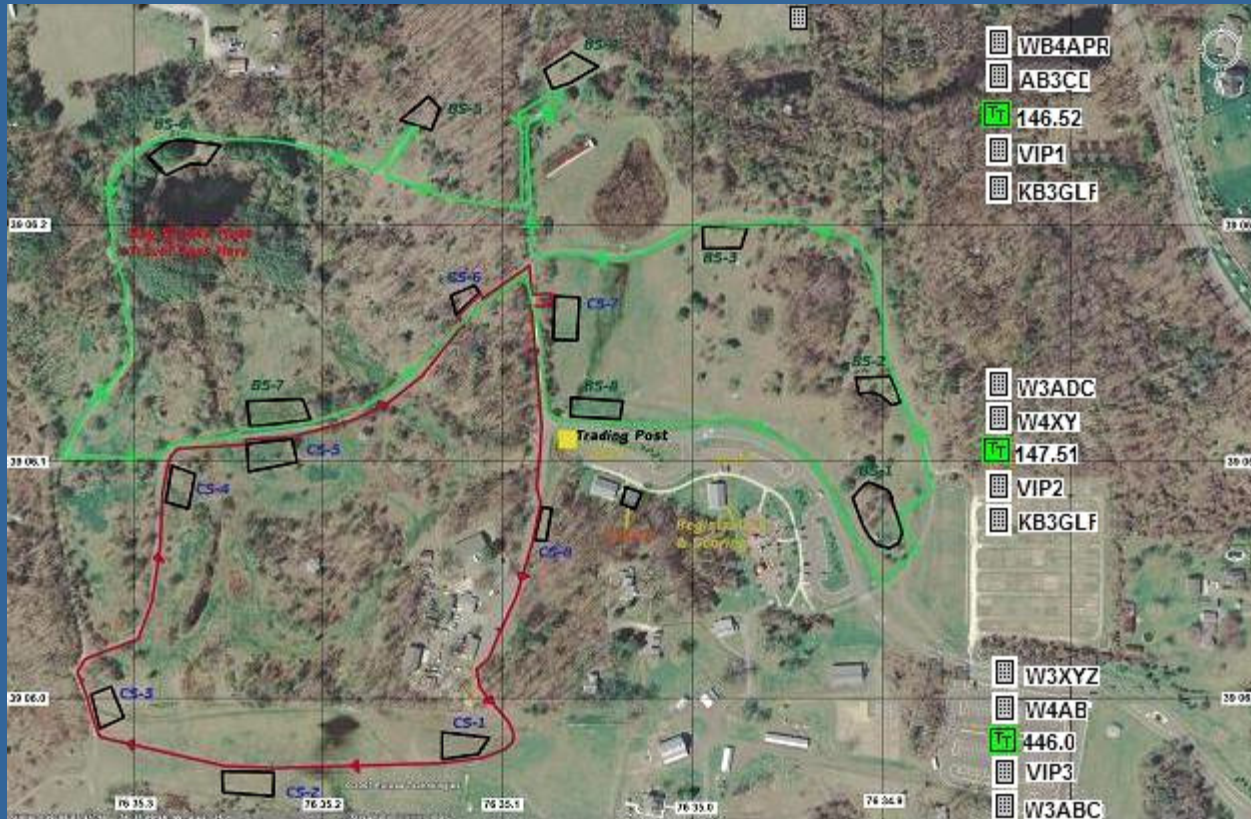
Or adding a DTMF chip  
to an **OT** and **HT** for  
use in the field at a  
special event





# APRStt (Freq Display)

See [aprstt.html](http://aprstt.html)



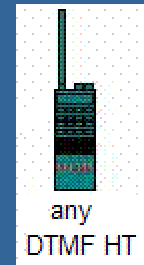
For events, put one on each operating frequency and set posits along unused edge of map.

See **who** is operating **where**, on what **frequency** and **when**



# APRStt (DTMF messaging)

See [aprstt.html](http://aprstt.html)



300,000 TH-78 and FT-51R's have DTMF Messaging

APRStt sends APRS info to TH-78 and FT-51R Displays

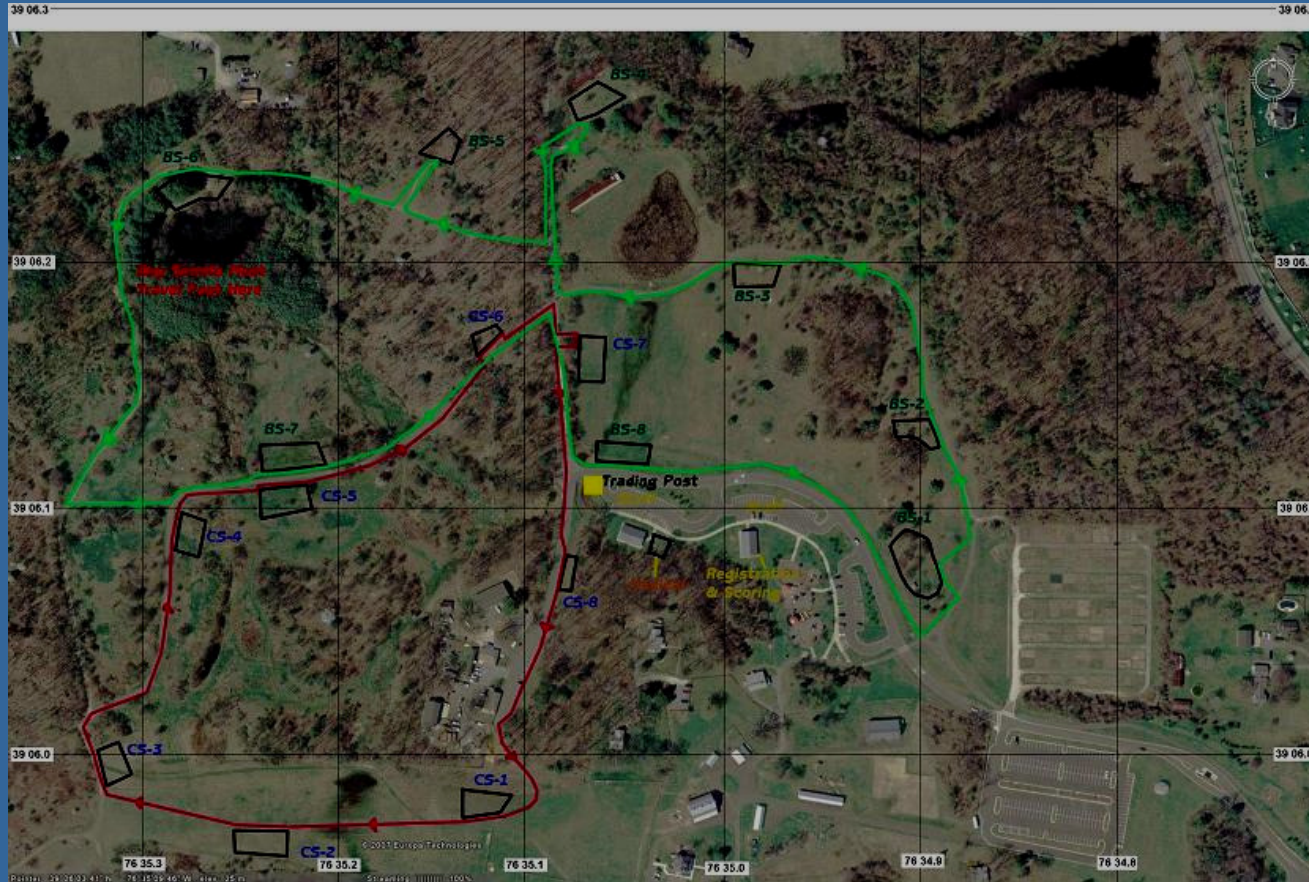
APRStt receives APRS info from TH-78 and FT-51R users

For events, put one on each operating frequency and set posits along unused edge of map.



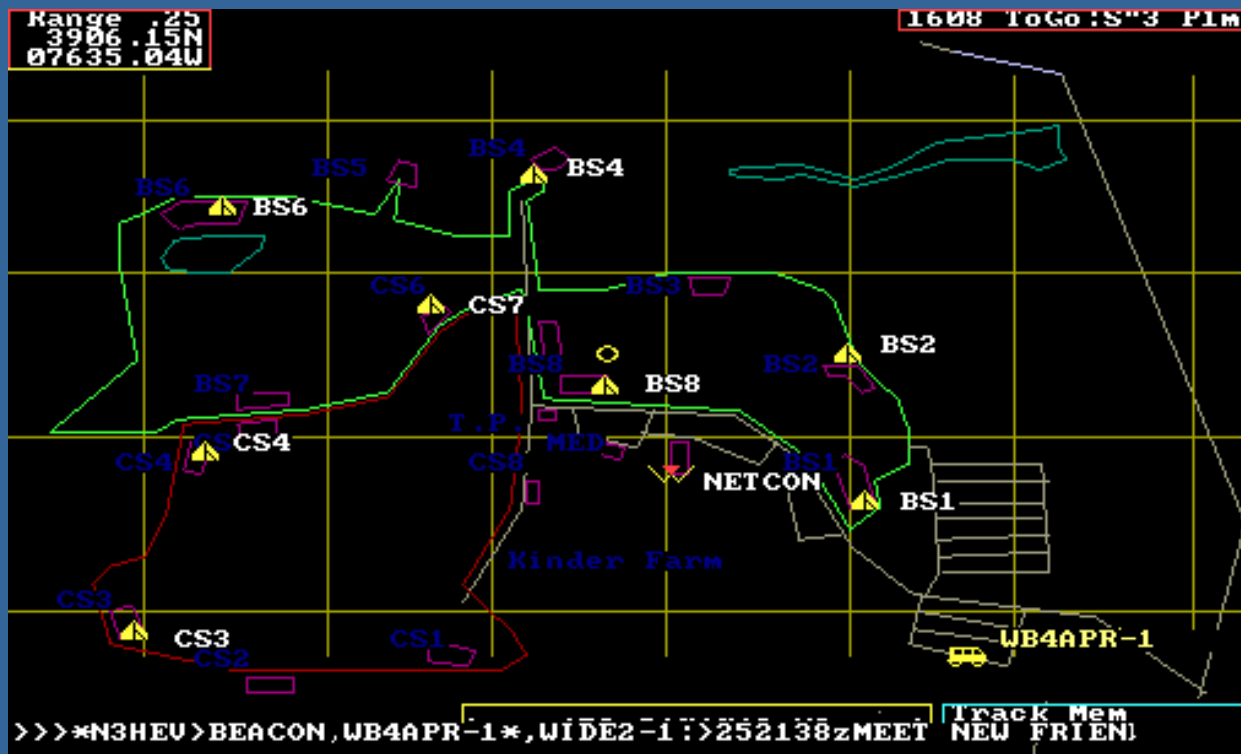
See **who** is operating **where**, on what **frequency** and **when**

# APRS Event Data Entry



How to use APRS HT's for keypad entry of Troop data at camporees.  
20 stations, 40 troops, 800 scores all day long. Use keypads!

# APRS Event Data Entry

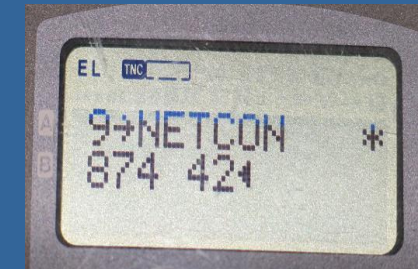
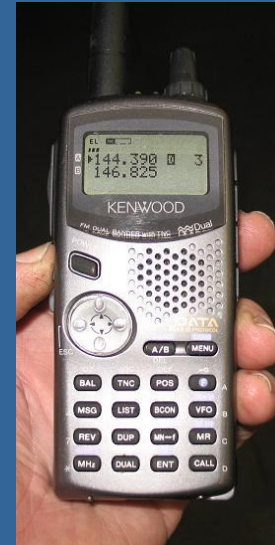
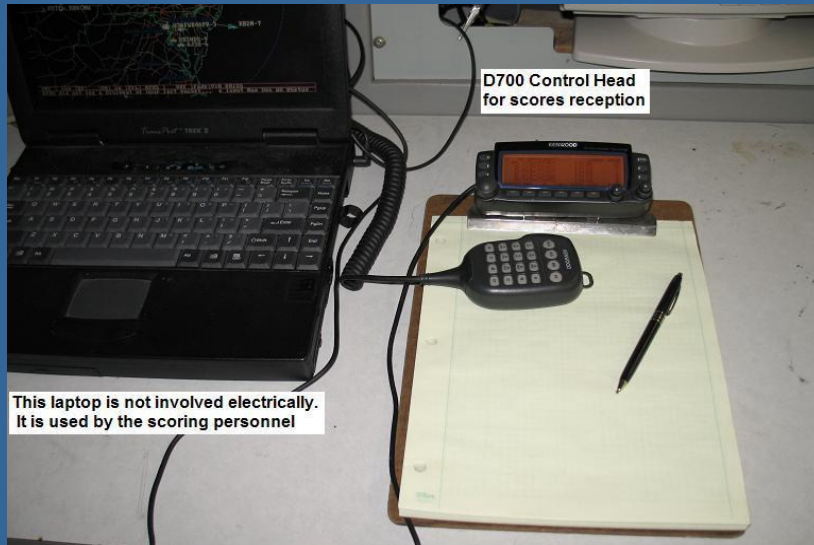


Typical APRS map display of positions

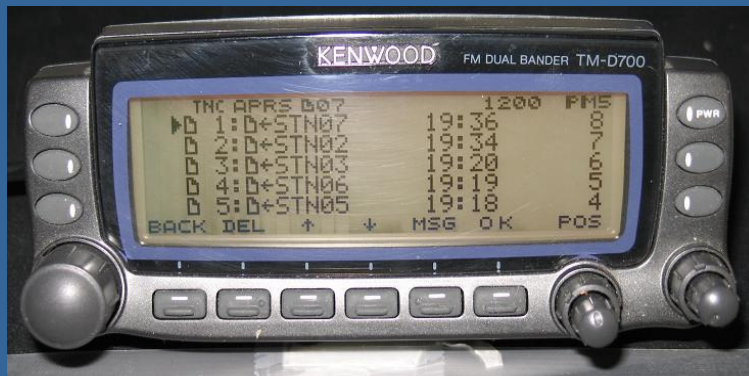
But this is only HALF of the APRS function!



# APRS Event Data Entry



Score Message Sent



Score Data Received

# Event Data Entry (DTMF)

Using ANY Radio  
with a DTMF keypad

**DTMF Decoder** original by Norbert Pieper

File Options Help Groups ☒ Showall

| Date      | Time     | GRP | SNDR | DATA or MESSAGE          |
|-----------|----------|-----|------|--------------------------|
| 09-Feb-12 | 17:54:09 | 999 | 277  | 995 85 (troop and score) |
| 09-Feb-12 | 17:56:53 | 999 | 180  | 278 95 (troop and score) |
| 09-Feb-12 | 17:57:34 | 997 | 884  | GO HQ                    |
| 09-Feb-12 | 17:57:54 | 999 | 567  | CALLME                   |
| 09-Feb-12 | 17:57:34 | 999 | 277  | NEED H2O                 |
| 09-Feb-12 | 17:57:54 | 998 | 567  | CKPT13                   |

**Example of DTMF Text Messaging Decoder** WB4APR

Troop Number and  
Score received at  
Net Control

The format for DTMF text messaging is : GGG\*123#TEXT#  
 Where GGG is a 3 digit group code  
 Where 123 is the senders 3 digit ID  
 Where #TEXT# is up to 6 characters using the common 2-key method.

GGG\*123#TEXT#  
preloaded into a DTMF memory

A number is just the number itself  
 A letter is a two-key sequence with the first key being the number key on which the letter is located. The next key is one of the A,B, C keys to indicate if the letter was the first, second or third letter on that key.  
 The text string begins and ends with the # key.

\* Set your list of GROUP codes under the Options tab

WB4APR

# More INFO Display radios!

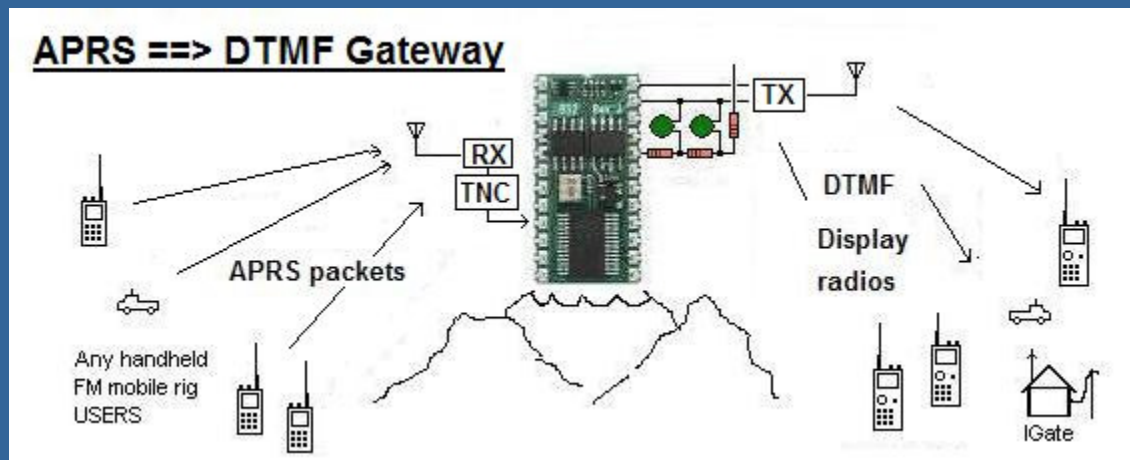
- TH78 and FT51,41,11 Display text messages
- Can also display local APRS!
  - Traveler's Freqs
  - IRLP or Echolink freqs
  - Messages
- FTM-10R uses DCS texting
- ANY RADIO WITH DTMF! (see APRStt)
- See [www.aprs.org/aprs-messaging.html](http://www.aprs.org/aprs-messaging.html)



# APRS → DTMF Gateway!

Gates all Local APRS traffic to the DTMF radio!

APRS  
Packets  
gated to  
DTMF  
channel!



■ See [www.aprs.org/aprs-dtmf-gate.html](http://www.aprs.org/aprs-dtmf-gate.html)



# APRS → DTMF Gateway!

Simple PIC processor added to any Radio/TNC

APRS  
Packets  
gated to  
DTMF  
channel!



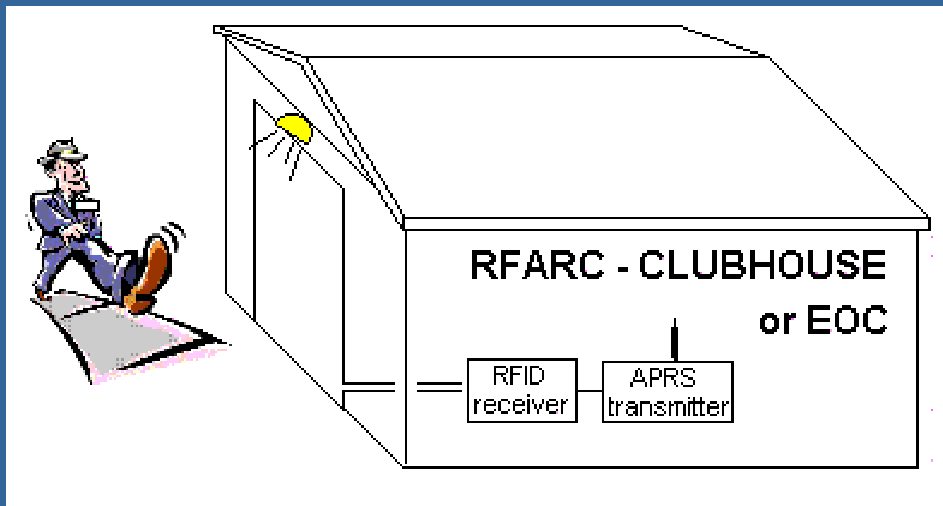
See [www.aprs.org/aprs-dtmf-gate.html](http://www.aprs.org/aprs-dtmf-gate.html)

# APRS (RFID)

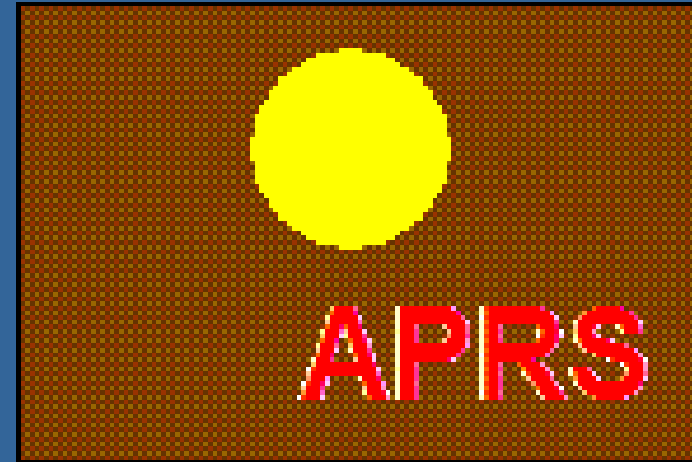
See [aprs-rfid.html](http://aprs-rfid.html)



ARRL RFID tag designed to identify the wearer whenever he passes through a door



See **who** is operating **where**, on what **frequency** and **when**



## Hot Spot

For big events, put one at each checkpoint or venue.

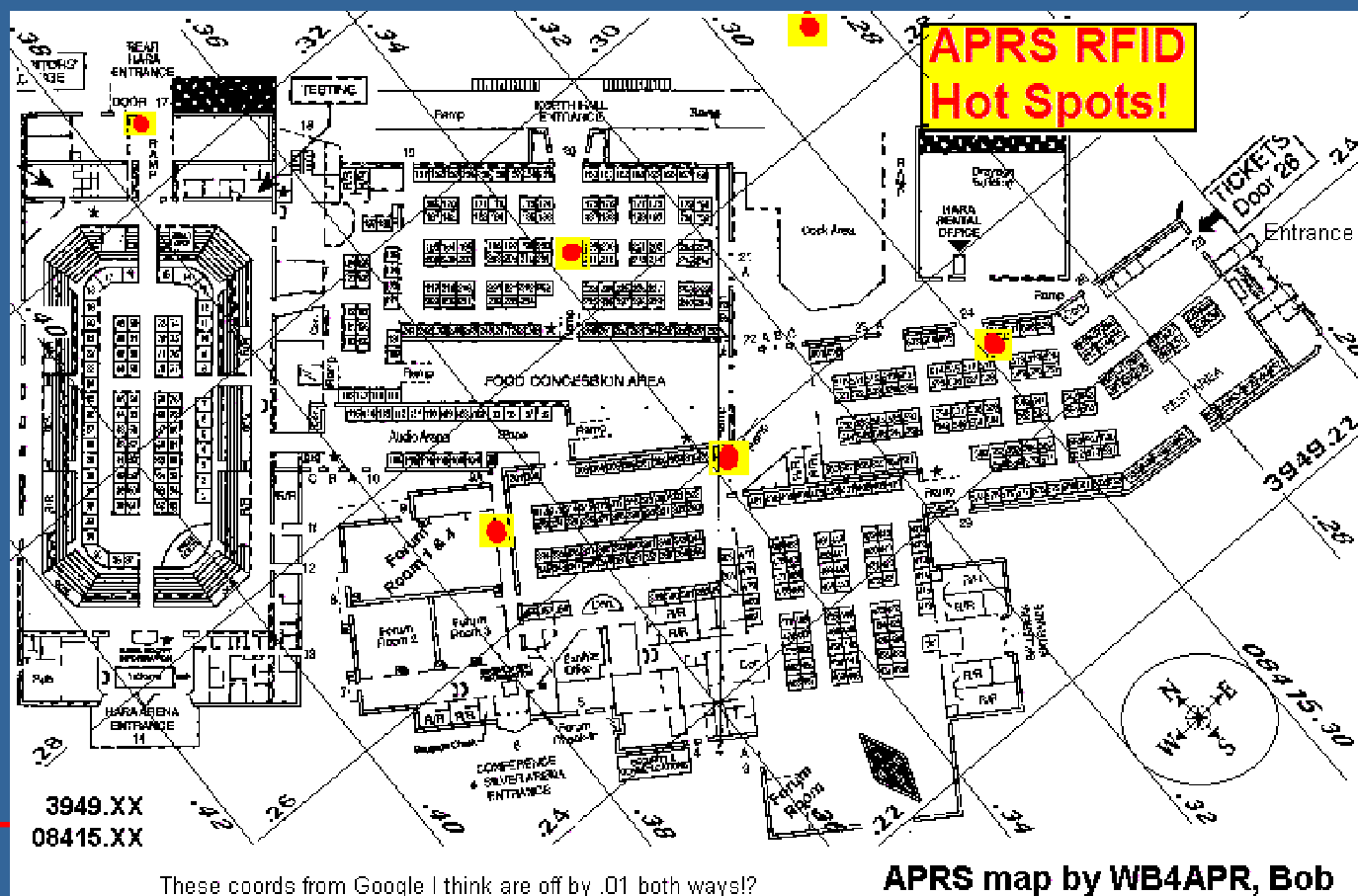
Every clubhouse/EOC door

# APRS (RFID)

See [aprs-rfid.html](http://aprs-rfid.html)

Hot Spot

APRS



These coords from Google I think are off by .01 both ways!

# APRS Voice Alert! \*

(For all mobiles!)



- Voice Alert is effectively 3<sup>rd</sup> Radio channel for the D7 and D700 APRS radios
- By setting the **APRS Band A to CTSS-100**, but **keeping the volume turned up**:
  - You won't hear any packets on 144.39 \*
  - But you will hear a voice call using PL-100 on 144.39
  - And you will hear\* an occasional Ping packet if another D700 comes in line-of-sight to you, like a proximity radar alerting you to local presence.
- Great for long haul traveling and meeting other APRS users.



# APRS – IS - Local Info!

Last 100 stations!



Direction & Distance  
Frequency and Tone



APRS is a registered trademark Bob Bruninga, WB4APR

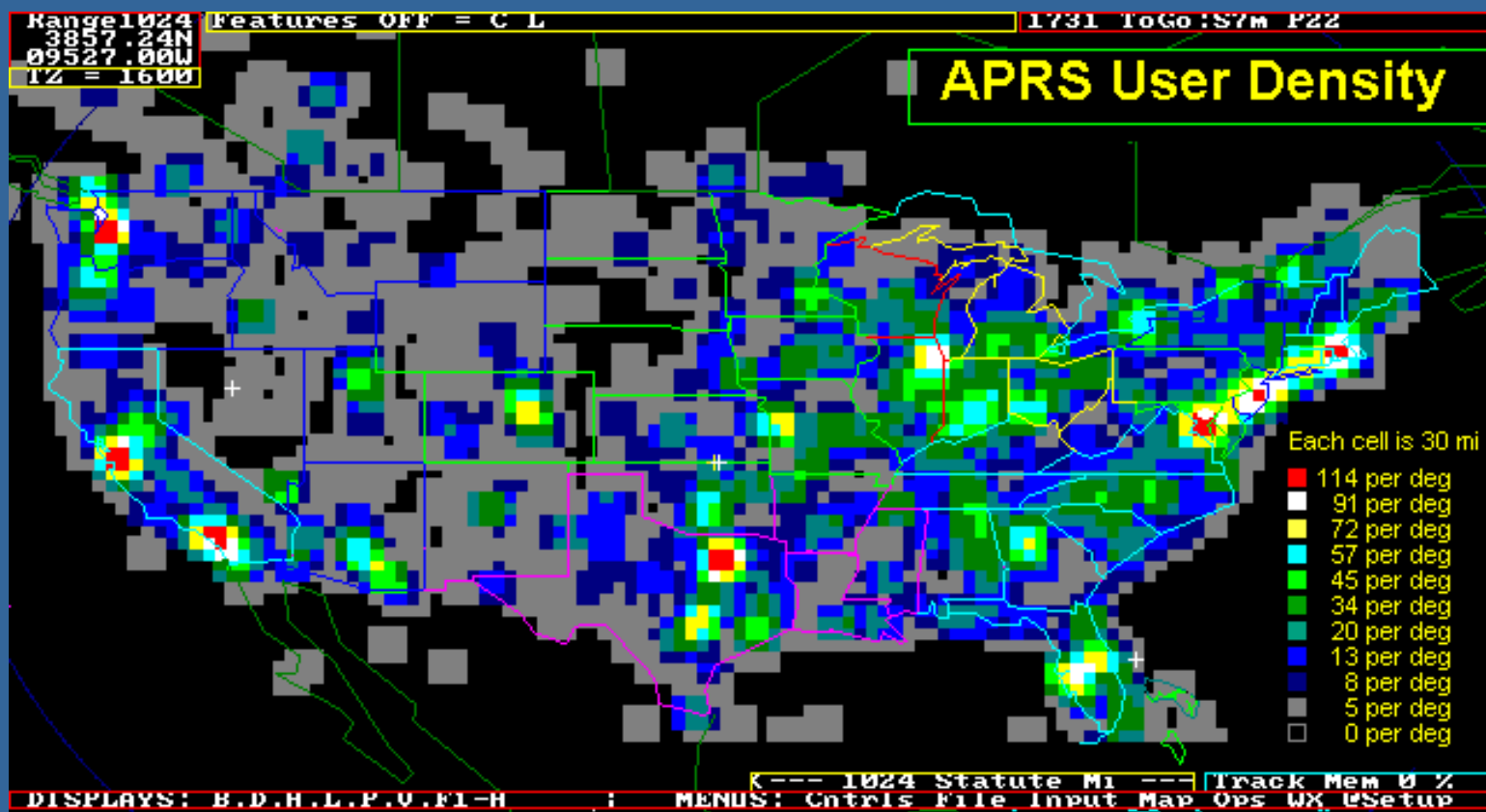


# The New-N Paradigm 2005

**Factor of 3 to 5 improvement!**

- ❑ **APRS Generic Paths** evolved over 13 years and the presence of many old legacy formats and procedures were really bogging down the network making it saturated and unreliable in busy areas.
- ❑ In 2005 all **old paths were declared obsolete** (RELAY & WIDE) and the entire APRS system in the US was then focused only on the WIDEn-N type of generic paths with small values of N.
- ❑ **WIDEn-N** goes **N** hops outward in all directions.
- ❑ **N=2** in most areas colored on next slide





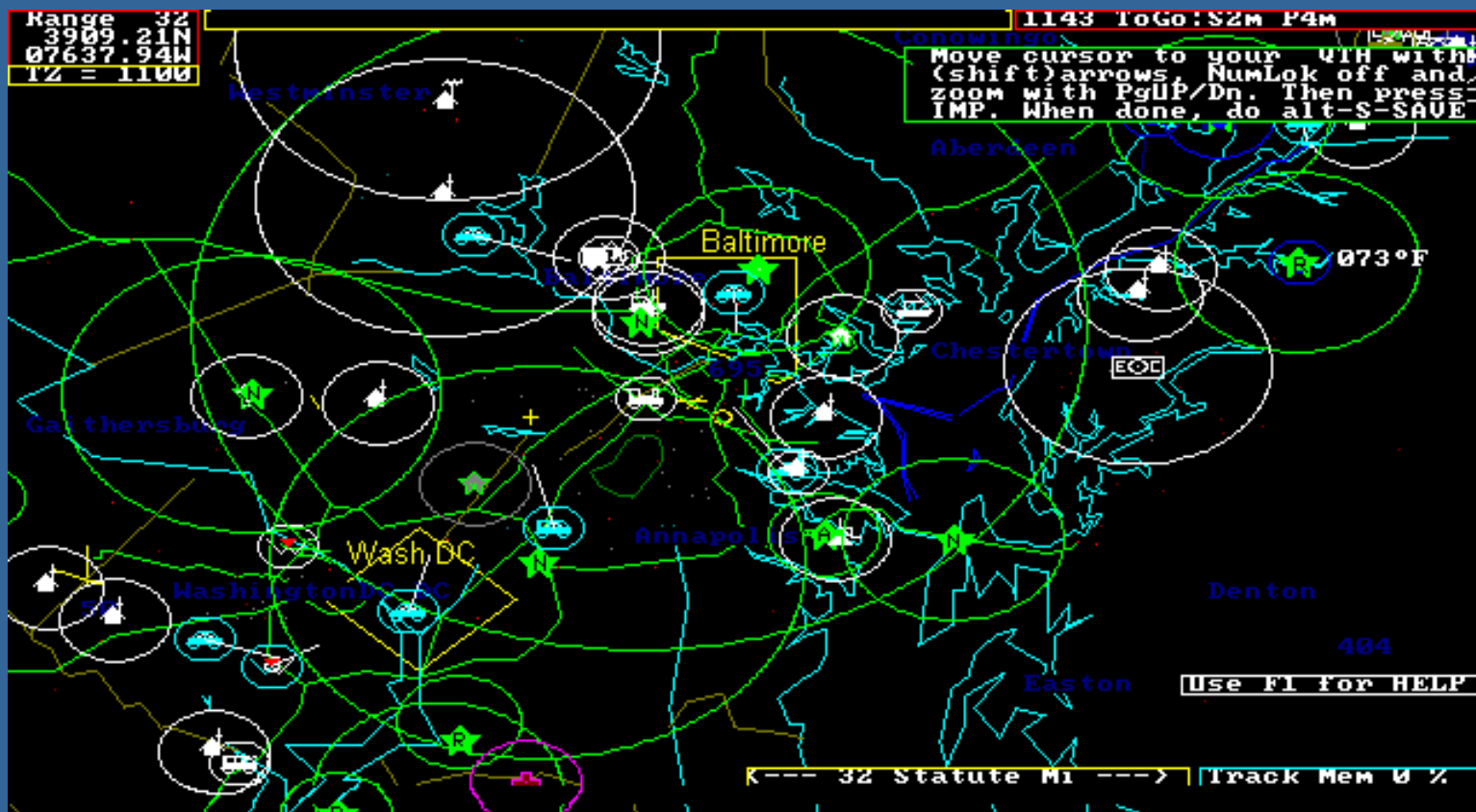
This data is plotted from Steve's FINDU data for 10 days and plotted on APRSdos shows the user density in the USA in Feb 05. Although it appears that most of the USA is low density, remember that a WIDE5-5 launched anywhere in the remotest area will still get to the closer cities and add to the QRM there. And there are 100 times more low density users surrounding these cities hitting them from all sides that really adds up to heavy QRM. We recommend WIDE2-2 in ■ ■ ■ and surrounding areas

The grid size is 30 miles and each is averaged with all 8 of its surrounding adjacent grids.. The file is over 11,000 stations.

But the great news is that the New n-N Paradigm is the right approach. It encourages WIDEn-N everywhere while letting the high density areas trap large values of N to prevent overload in their areas only.

WB4APR

# APRS (Range Circles)

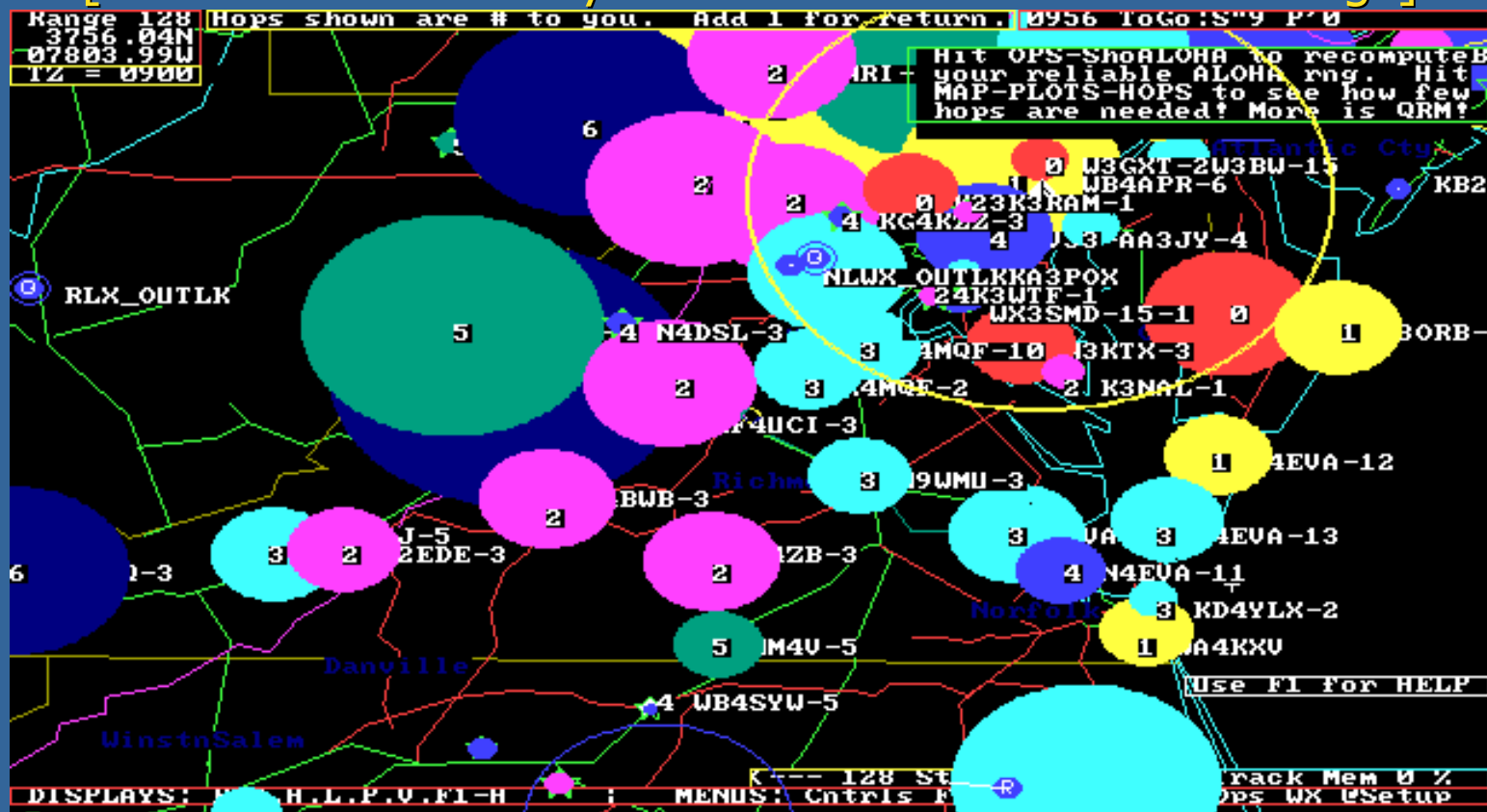


APRSdos map with PHG circles displayed and calls, roads, and rivers turned off to reduce clutter. The green interstates remain and you can see WashDC in the lower left and Baltimore in the upper center. Notice the three WIDEN-N digis cover the area though there are more than 15 digis around. Two stations in the upper center live on hills... 2 hops covers everywhere.



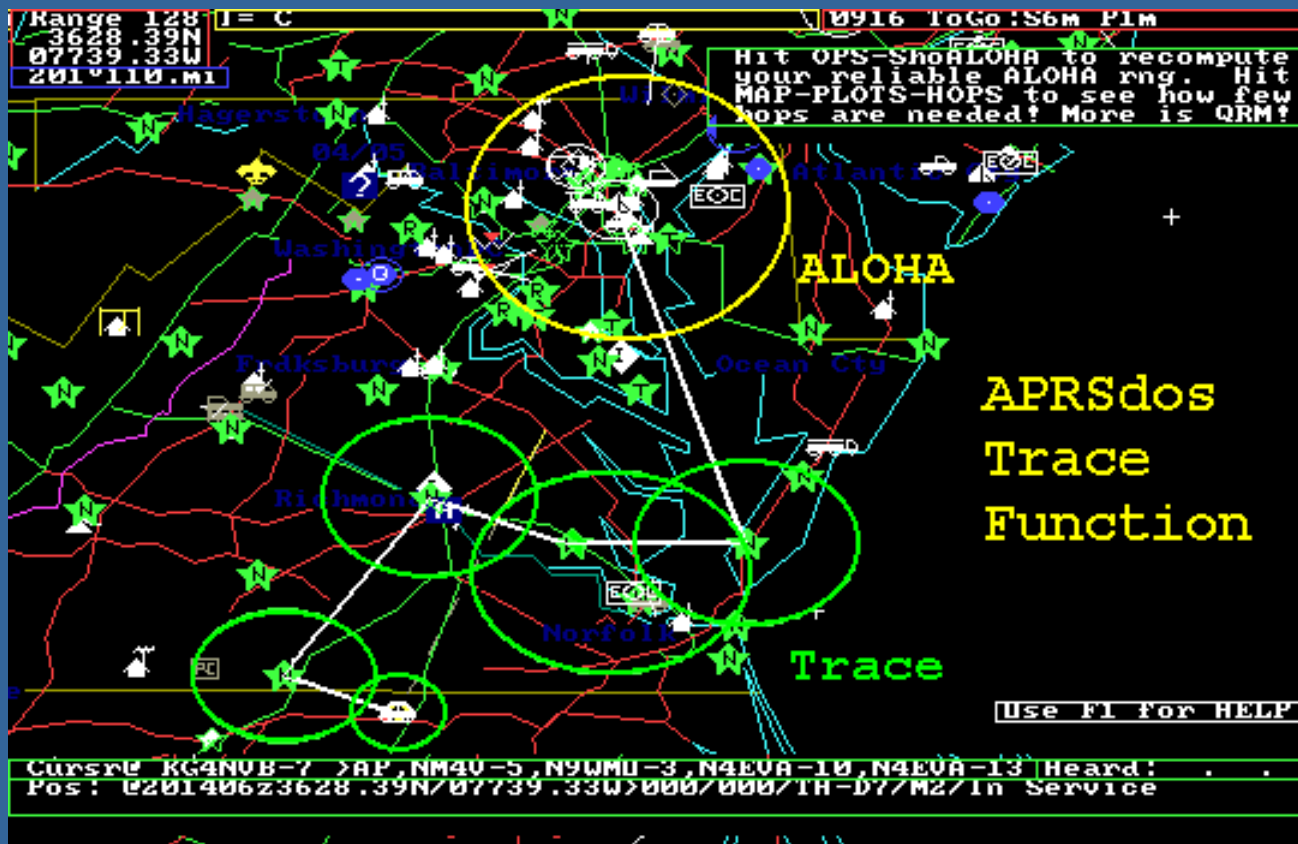
# APRS (ALOHA circle and digipeater hops)

[Your ALOHA circle is your 100% saturated channel range]



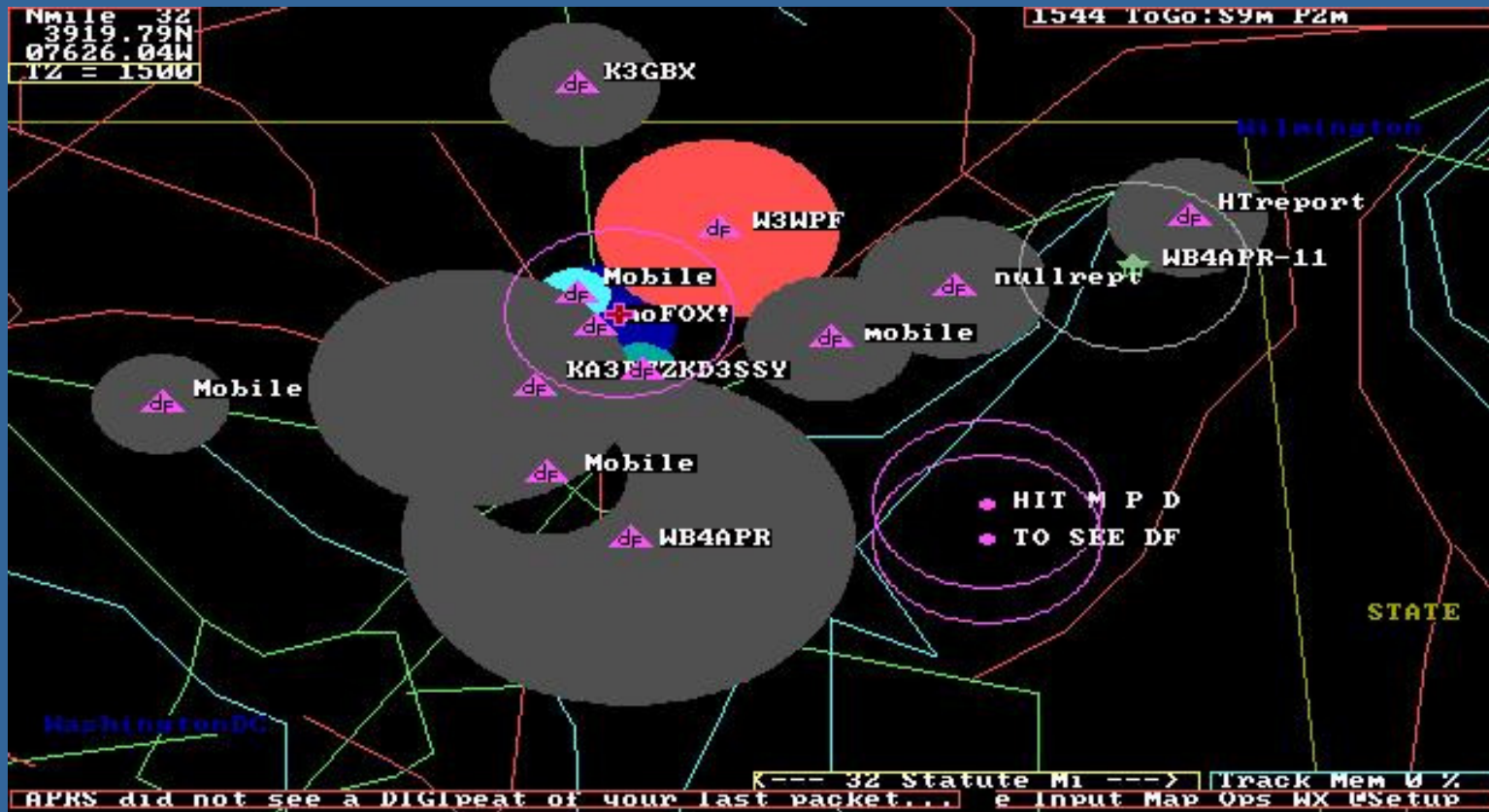
MAPS-PLOT-HOPS display shows snapshot of number of hops from each digipeater to my station in Baltimore (at center of my ALOHA circle). Data is plotted from last-packet-received, so needs to be observed several times to average out circuitous packets and lucky shots.

# APRS Range circles and Path tracing



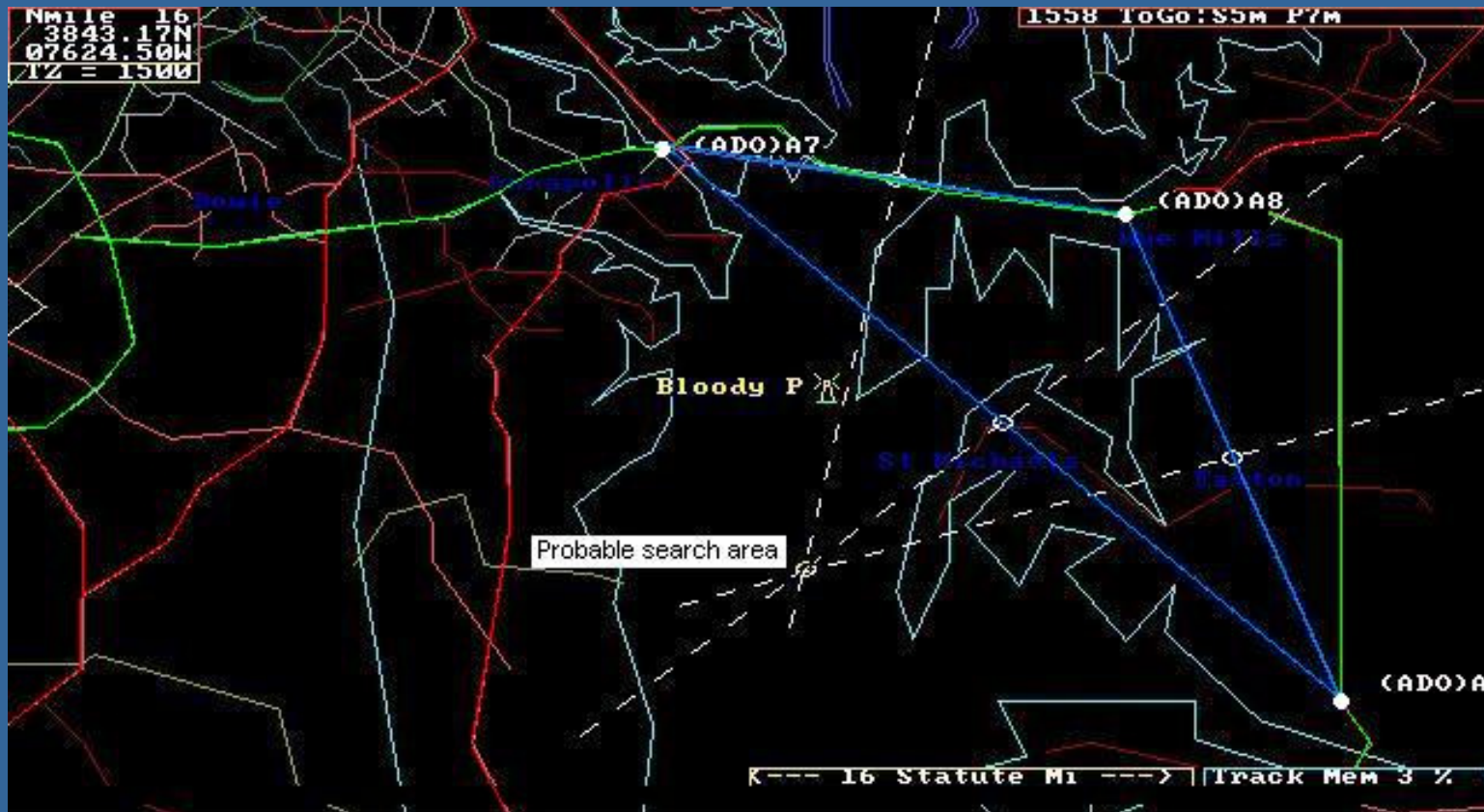
The TRACE function shows the path through the digipeaters it took to get to your station. This is a 5 hop mobile well outside of my ALOHA circle that got a lucky hop over water up the Bay from Norfolk to Baltimore. The fixed PHG RF range of each digi is also shown

# APRS (DFing by signal strength)



MAPS-PLOTS-DF-OMNI display of overlapping signal strength contours. All of these "voice" signal reports were entered rapidly on APRS as objects, and everyone can see that the FOX was found near the intersection of the colored circles. Notice how VALUABLE the "no-signal" reports were. They show you almost immediately where the fox is NOT. Great info!

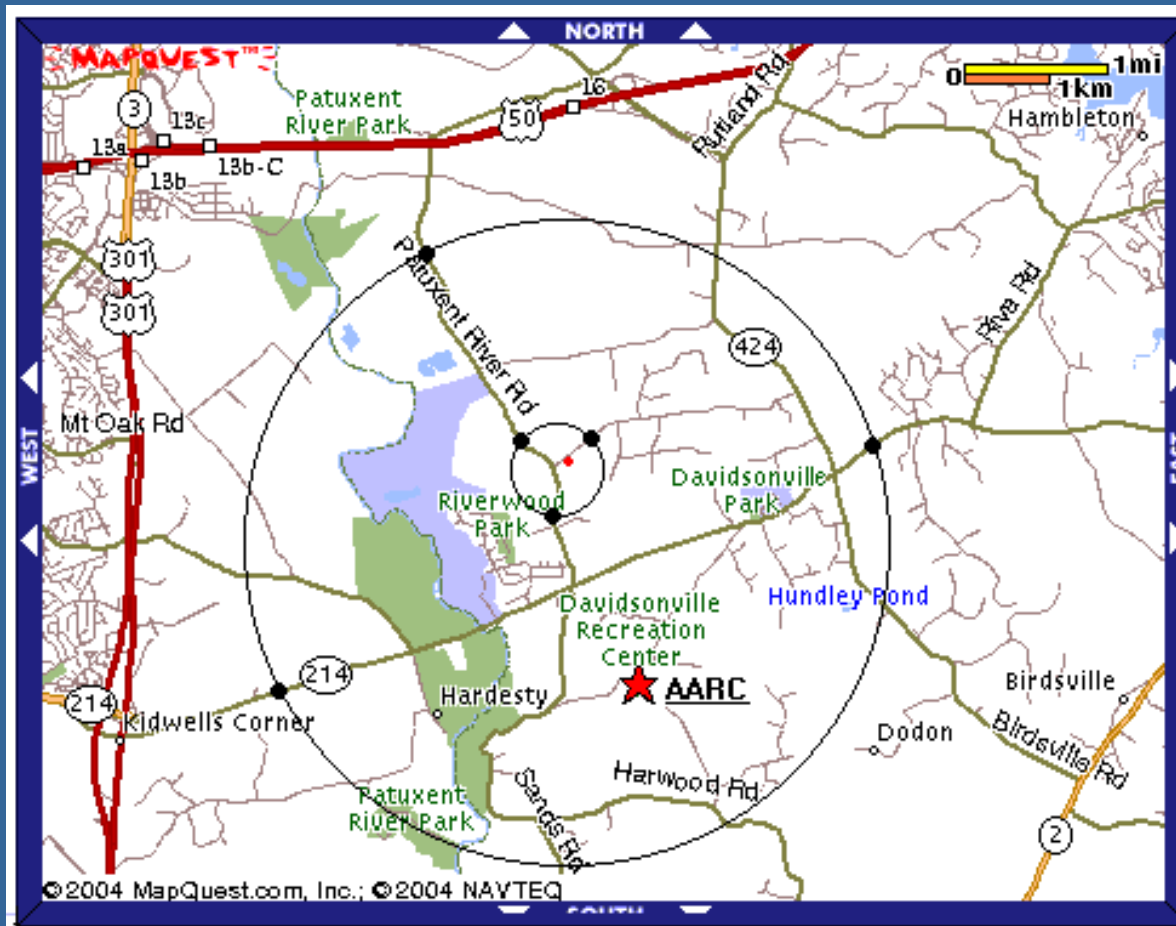
# APRS ( Solo DF Fade Circle Technique )



MAPS-PLOTS-DF-FADEcircle - This technique allows a single individual to locate the approximate source of a signal. Just Drive until the signal fades out. Hit F5 key. Turn around, drive the other way to the fade. Hit F5 key. Go a third direction until it fades again. Hit the F5 key. Then hit MAPS-PLOTS-DF-FADE and APRS will compute the approximate location of the signal. Then drive to the indicated area and do it again! This time mark equal points of signal level X. Do it again. Go to the center, do it again... and again! You WILL find the signal as long as you have enough gas...



# APRS ( Solo DF Fade Circle Technique )



## Fade Circle Omni DF-ing

Technique was driving E/W on 214, then back to center and N/S on PaxRvrRd

First fade-circle based on loss of signal.

Second fade-circle based on full-scale.

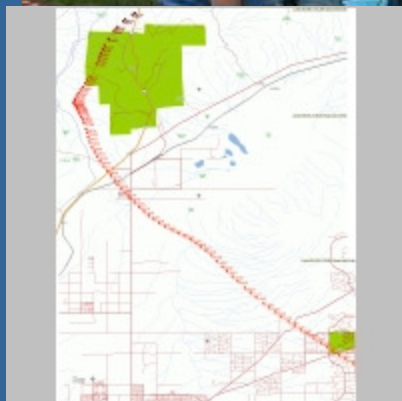
Notice river valley skewed the big circle.

- Fox was 100 mW HT with rubber band

# APRS Balloons



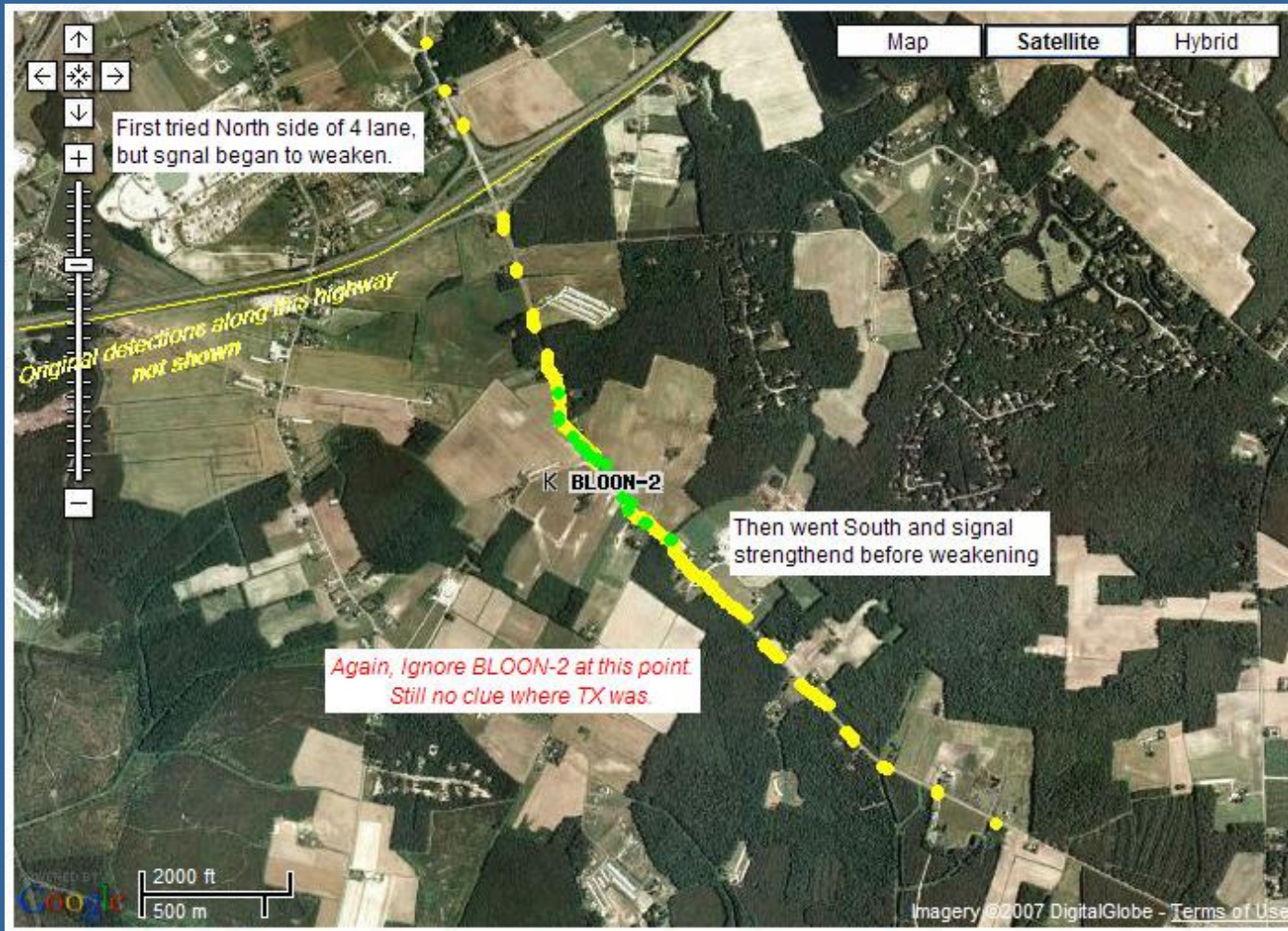
Very Simple



APRS is a registered trademark Bob Bruninga, WB4APR

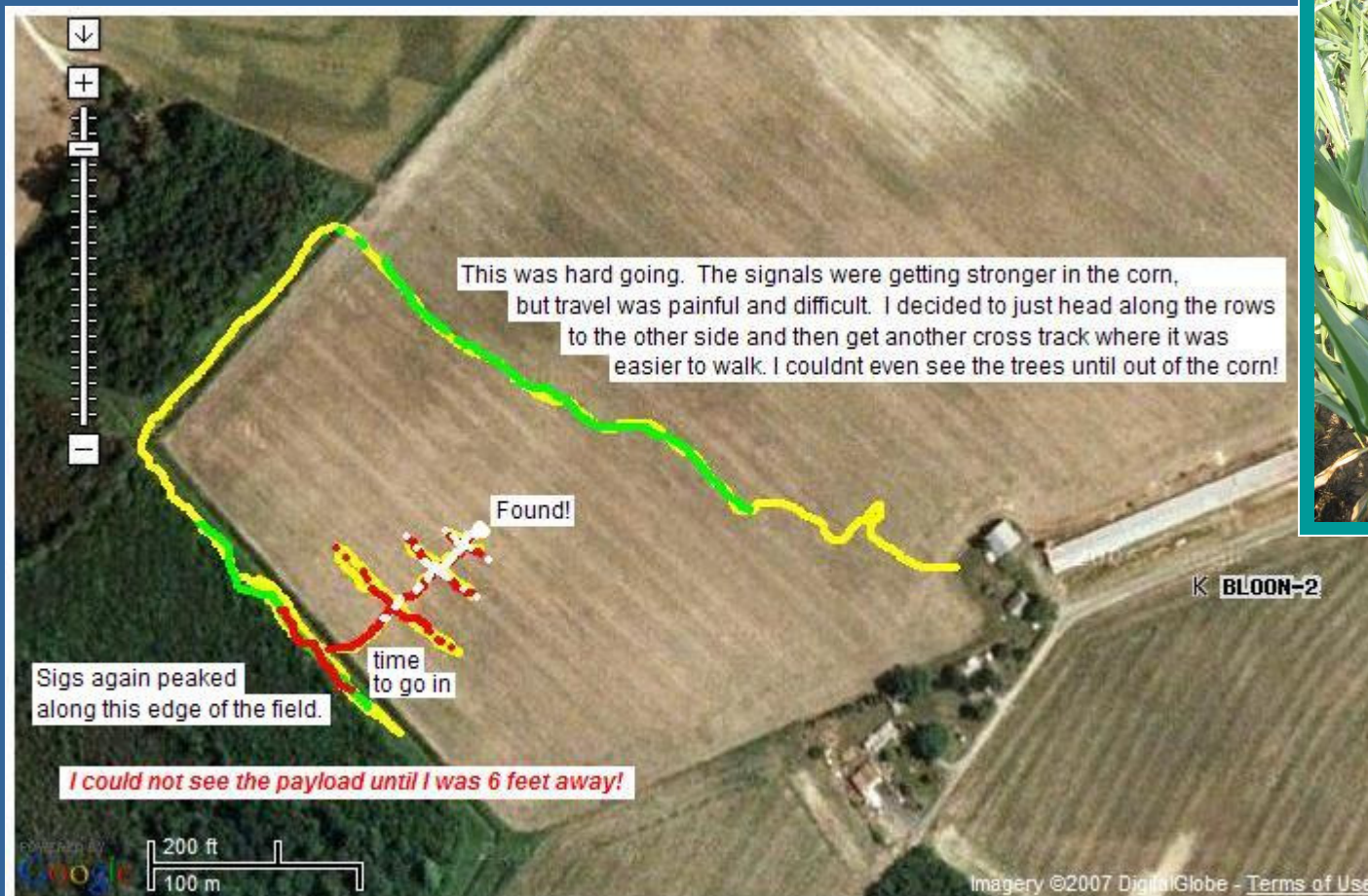


# APRS ( Solo DF Fade Circle Technique )





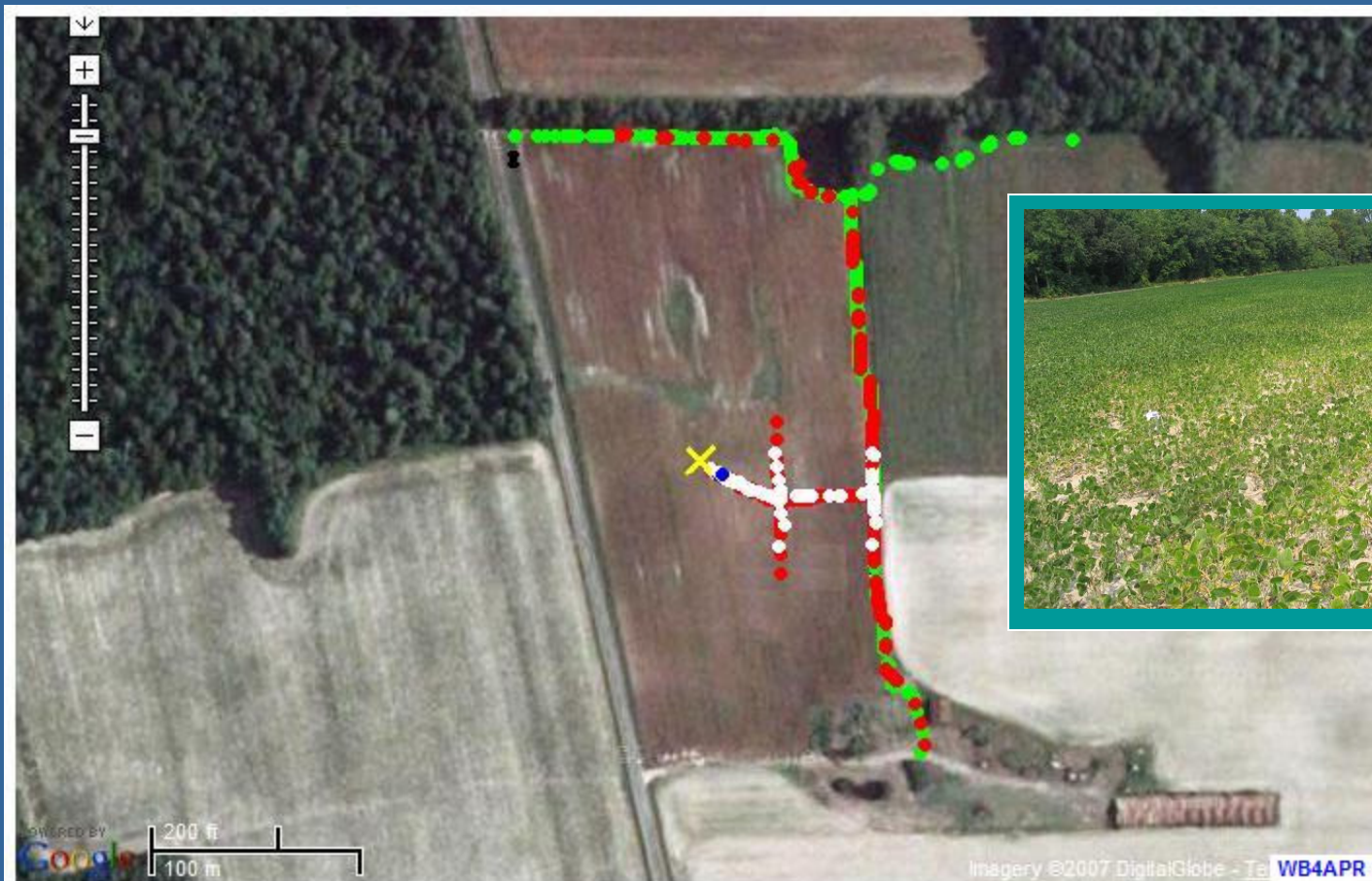
# APRS ( Solo DF Fade Circle Technique )



I have changed color scale down on this view, since I was now much closer than previous views. On previous views, RED showed places where signals were beginning to sometimes hit S9 full scale on my D7 HT. On this view, however, red shows where it was SOLID S9 with no dropouts. White shows where I could begin to hear signals without the HT antenna.

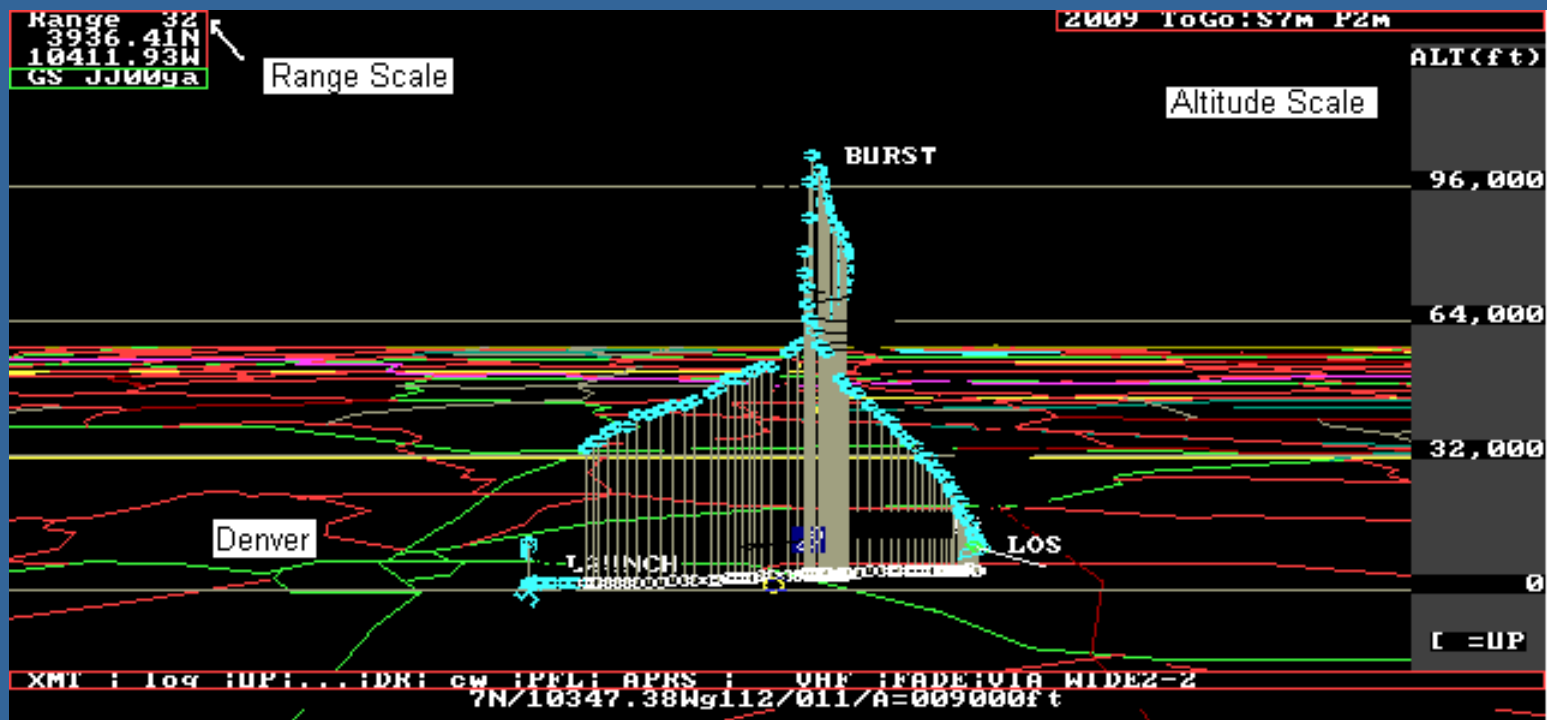


# APRS ( Solo DF Fade Circle Technique )



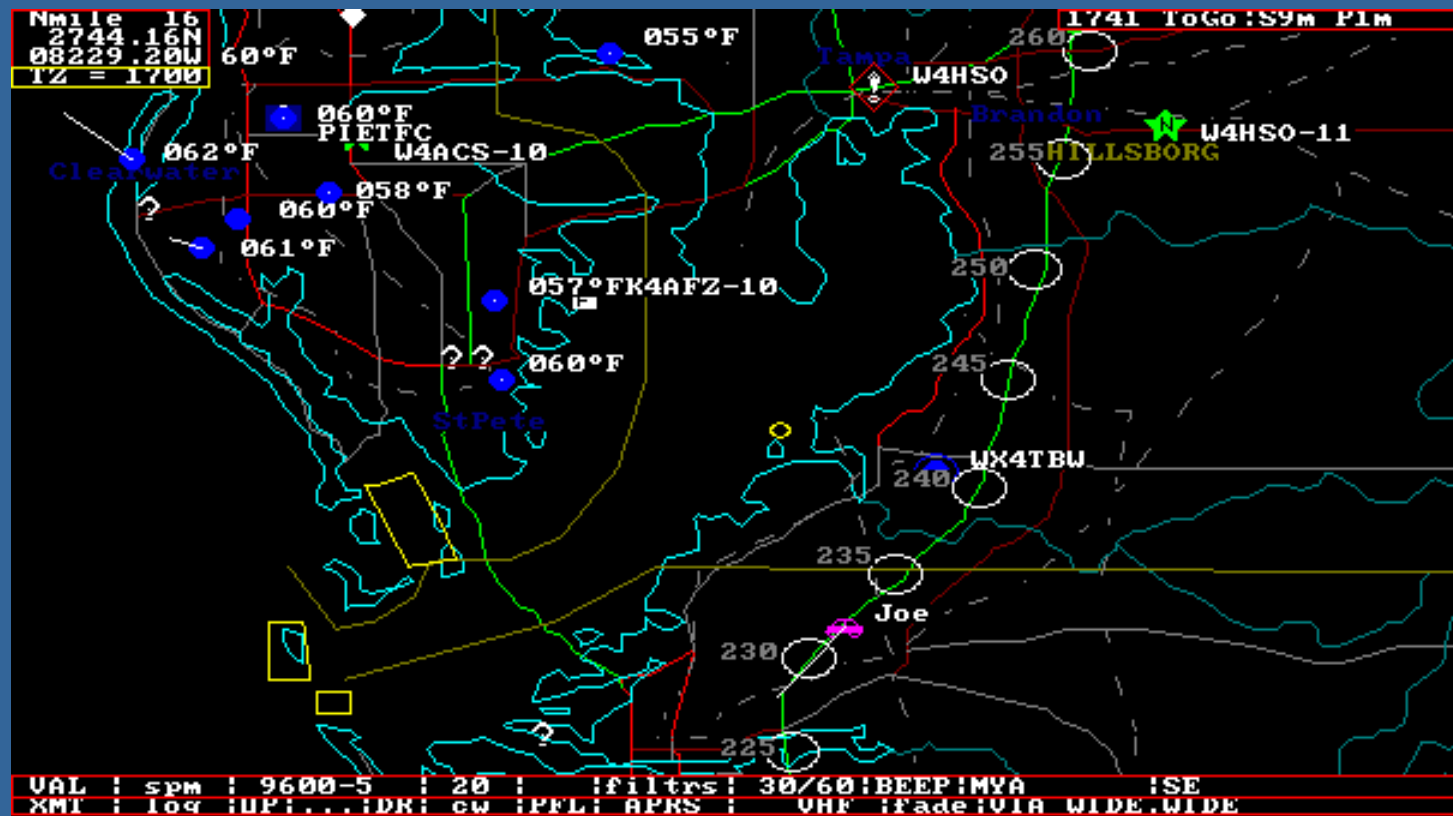
We knew Balloon was headed north at last posit, so I walked along North edge of field where Murphey's law would predict it would land in the thin tree line. Then headed south and sigs got stronger. In this field I was using short 3/4" antenna on my HT. White shows where I removed antenna completely. Blue is where I first could see package in summer crops.

# APRS 3D views for Balloon tracking



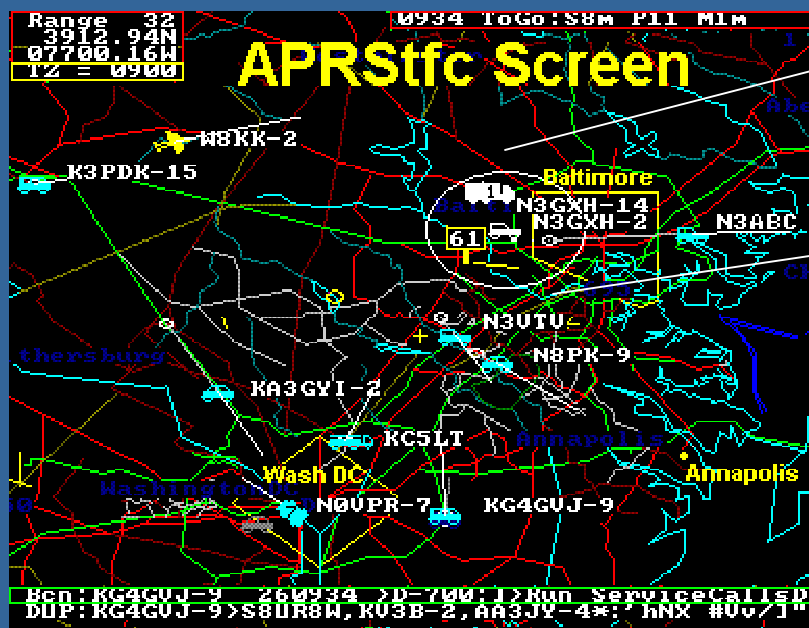
APRSDos has a 3D map display mode. The vertical scale can be separately set from the normal Range Scale depending on the altitude of objects. This is a typical APRS balloon track.

# APRS Tracking with Milemarks

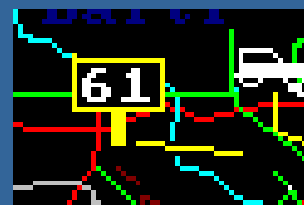


This APRSdos map of Tampa shows how Mile Marks can be overlayed on the map with the "MM" keys. Notice how I have placed the non-APRS mobile "Joe" on the interstate at mile mark 232 headed south west. Since APRSdos deadreckons all objects, Joe will continue to move on my map without update. This is very handy going to Dayton with many folks on the road. You can keep an eye on all the other non-APRS travelers that are in QSO range even though they have no APRS capability.

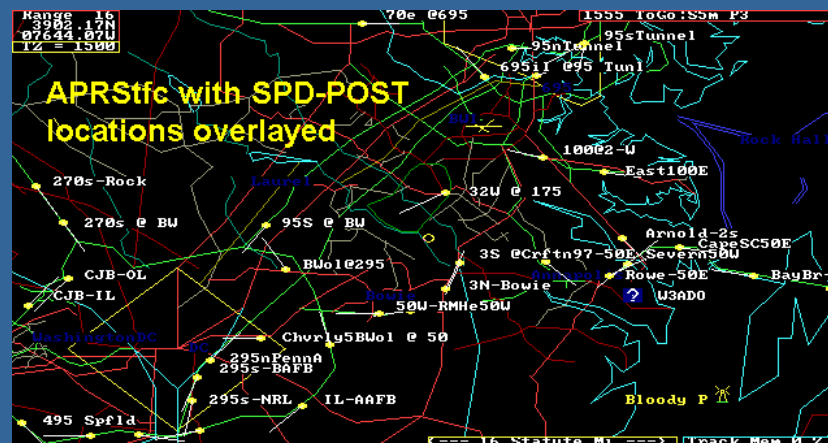
# APRS – Traffic Speed Posts



SPEED-POST showing 61 MPH E bound I-70 approaching Baltimore Beltway  
Dead Reckoned age of KA3GYI's position (probably 10 minutes or more)



Shows speed of traffic past special points



Use MAPS-OVERLAY-Traffic (MOT) command for this view:

Notice how it is important to place the SPEED-POST in the middle of where the typical backups occur. These are usually at different locations even on the same road between morning and evenings (see the route 3N and 3S near the middle of the map.) APRS objects can only be 9 characters in length and should not contain any punctuation, so it takes some creative work to come up with meaningful names. I used "il" and "o" for inner-loop and outer-loop of the beltway. W3AD0 is the APRStfc server located in Annapolis. [?](#)

How a SPEED-POST looks on the TH-D7 HT's displays

1: Bowie-50W  
{45} MPH  
Time 0735

Speed measured  
and Time

1: Bowie-50W  
FM19sx  
3 mi

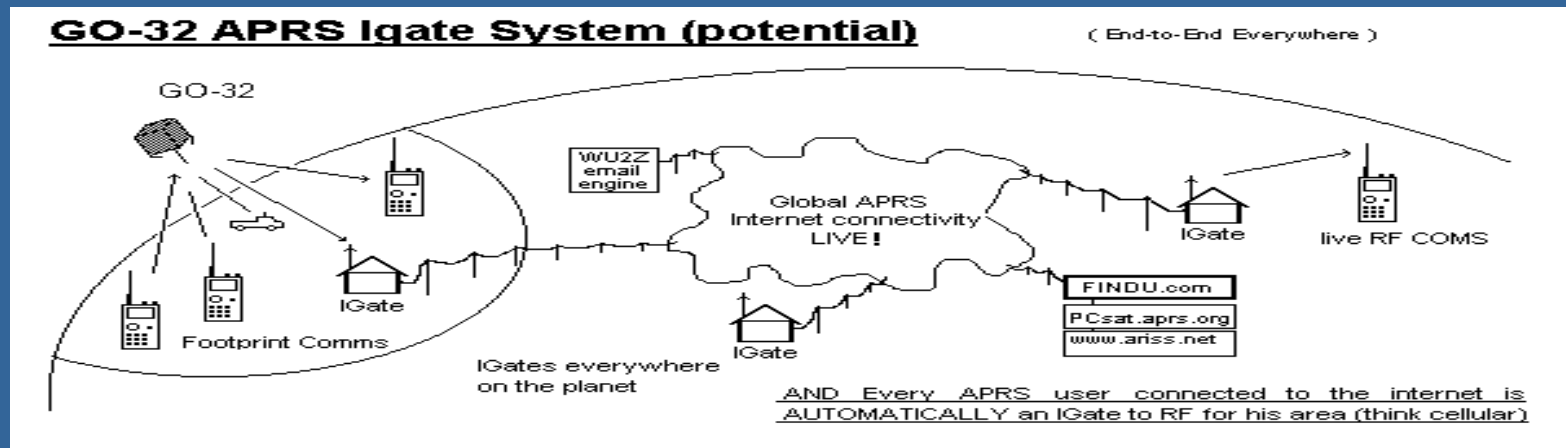
Direction and distance  
from you to Speed-Post

1: Bowie-50W  
CSE214 s038  
fm: W3AD0

Direction of measured vehicle  
and call of APRStfc server



# APRS IGates (Global APRS!)



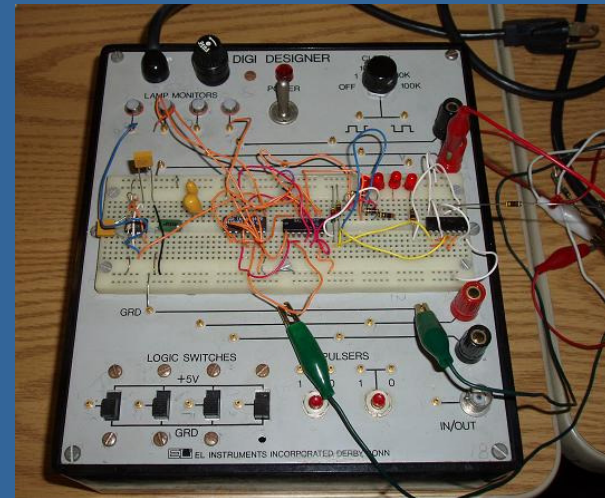
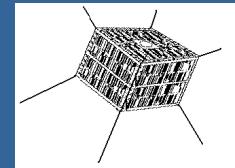
- An IGATE is a local APRS station that utilizes the APRS-Internet network to pass all packets heard on their local RF back to the Internet. (Gives global views to local activity.)
- Also act as two-way gateways for ALL APRS MESSAGES worldwide (Internet ⇔ RF).

# APRS for Special Uses

- Bicycle rallies, races
- Walk-a-thons, Parades
- Skywarn
- Weather Nets
- Crime prevention patrols
- Damage assessment
- Direction Finding – Foxhunts
- Voice for communications, APRS for visual mapping
- Now integrating into APRN (Automatic Picture Relay Network)



# Sensor Buoy Prototype



## • Naval Academy Student Project •

- \* If free-floating, do not disturb.
- \* If aground, move to deep water and advise [bruninga@usna.edu](mailto:bruninga@usna.edu)
- \* If later than 30 Nov 2006, recover and advise above.

See Buoy Location and Telemetry at

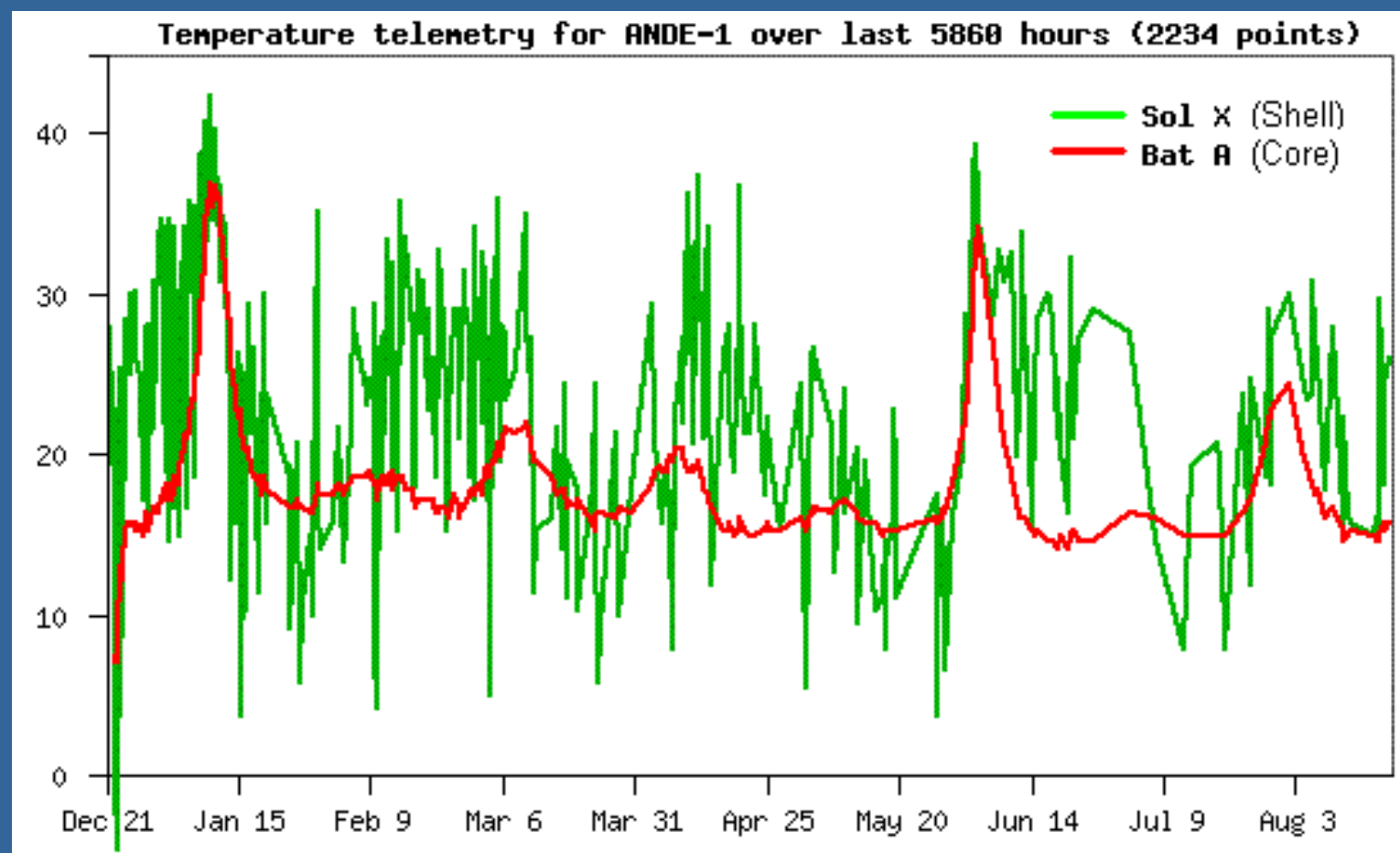
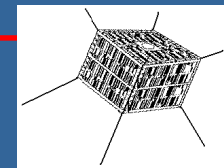
<http://www.ew.unsa.edu/~bruninga/buoy.html>

APRS is a registered trademark Bob Bruninga, WB4APR



Piggrem 77

# Findu.com Telemetry Plots

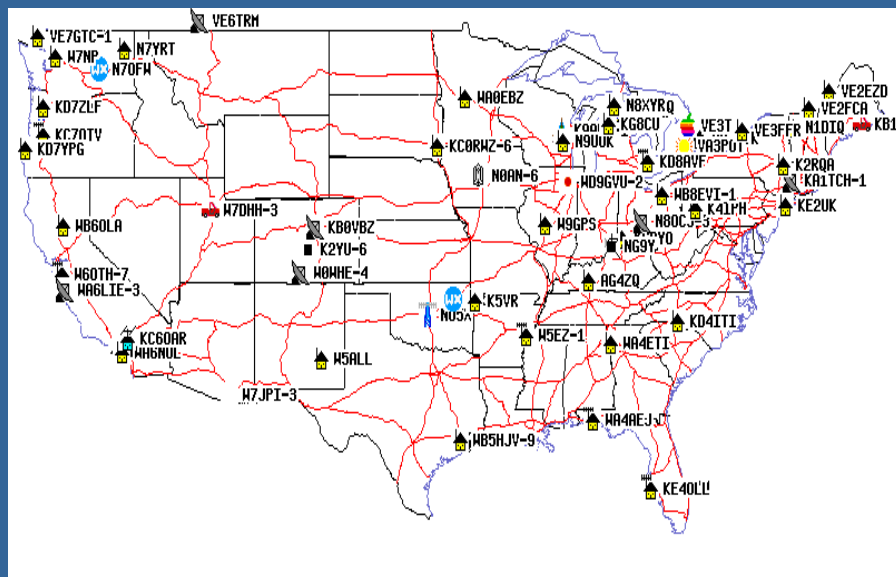


APRS is a registered trademark Bob Bruninga, WB4APR





# APRS via Space

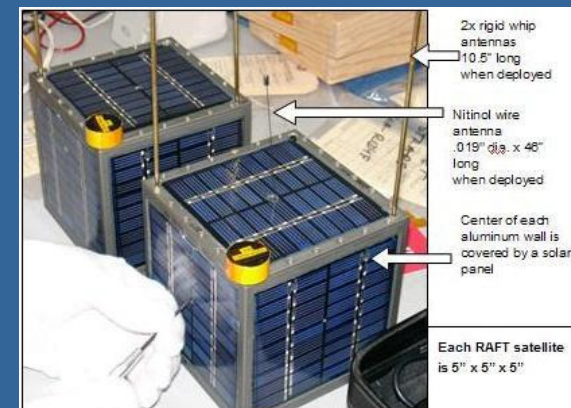
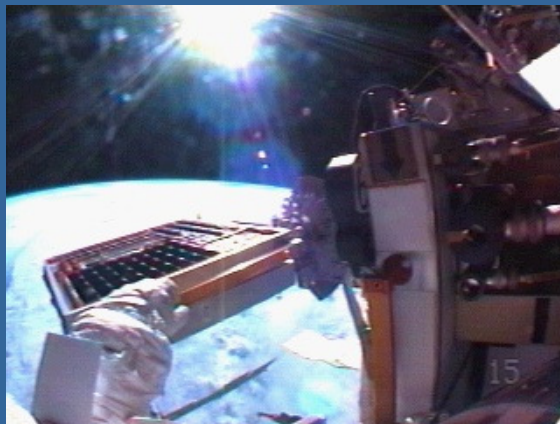


- APRS space frequency is **145.825 MHz**
- Also via GO-32 on 435.225 downlink, **145.85 MHz** up



# APRS in Space

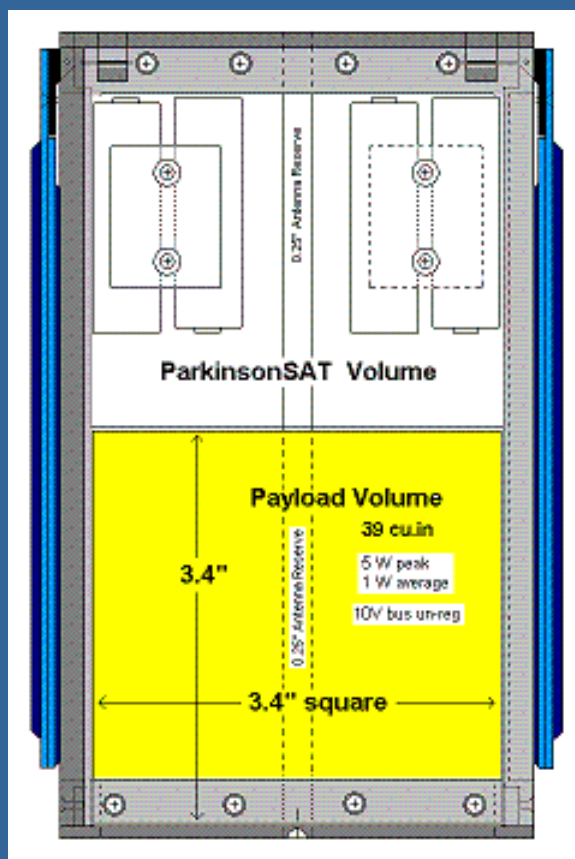
- 2001 PCSAT-1 Prototype Comms.
- 2006 PCSAT2 on ISS
- 2007 ANDE
- 2008 RAFT



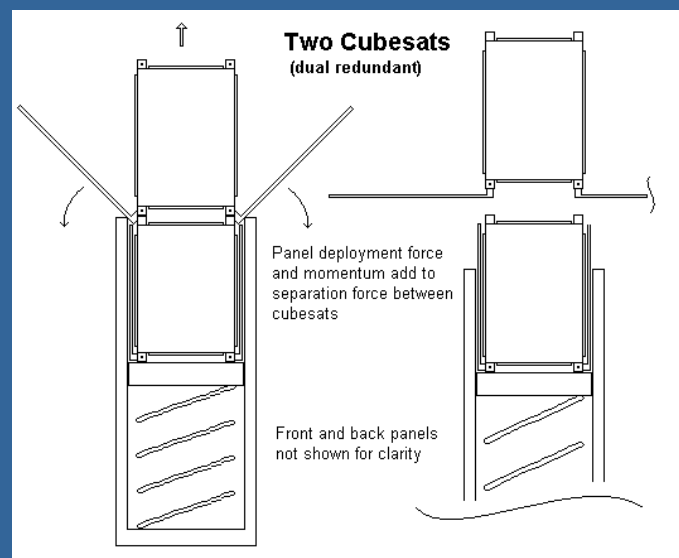
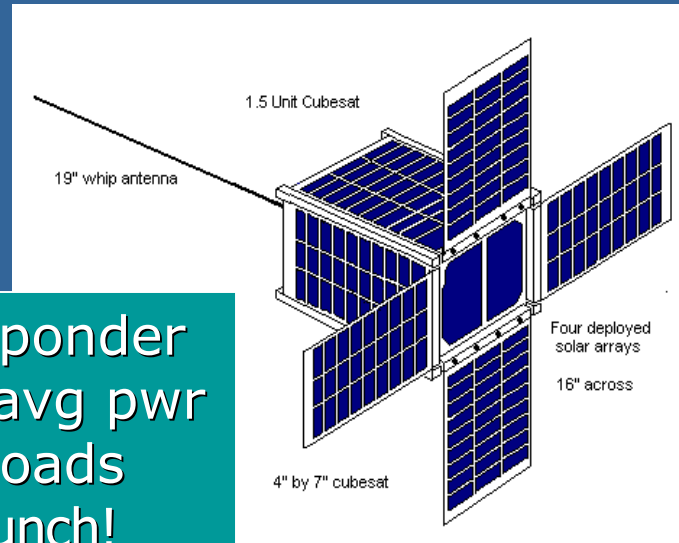
- APRS space frequency is published as 145.825

See live downlink on <http://pcsat.aprs.org>

# Psat 2009?

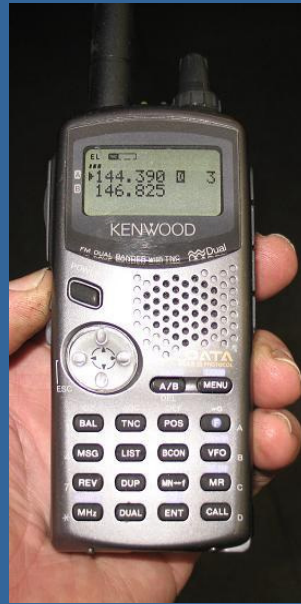


- 145.825 Xponder
- 4.5 watts avg pwr
- Other Payloads
- Two-per Launch!



See live downlink on [www.ariss.net](http://www.ariss.net)

# Now GO-32 TECHSAT-1b



- GO-32 now supports APRS on its 435.225/145.85 packet system.

- APRS up on 145.85 (PC's and messages)

- Mic-E up on 145.93 (D7 and D700's)

**9600 Baud!**

See live downlink on [www.ariss.net](http://www.ariss.net)



# GO32 -EZ - MOBILE Satellite Prediction and Tracking

This table is for Washington/Baltimore but works for all points north and south.

| 01Aug | 11Aug | 21Aug | 31Aug | 10Sep | 20Sep | 30Sep | 09Oct | 19Oct  |
|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 0930  | 0910  | 1025  | 1005  | 0940  | 0920  | 1040  | 1015  | 0950   |
|       | 1050  |       |       |       | 1055  |       |       |        |
| 2050  | 2030  | 2005  | 2125  | 2100  | 2040  | 2015  | 2135  | 2110   |
|       | 2210  | 2145  |       |       |       | 2155  |       |        |
|       |       |       |       |       |       |       |       | WB4APR |

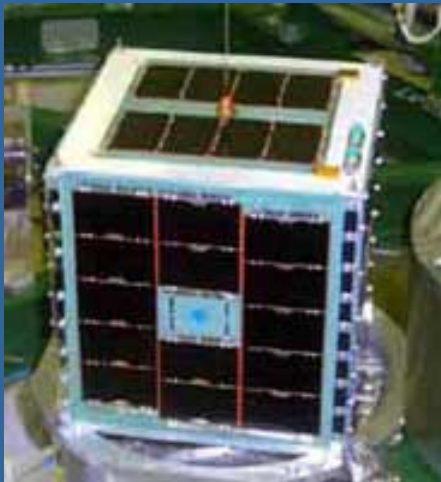
Tracking GO-32 in the mobile is easy, because the passes repeat every 10 days. Just prepare a table like the above and stick it on your mobile dashboard, and then any day, morning or evening, you will know when the next pass you can hear will be in range. For uplink there will be a pass 100 minutes before and 100 minutes after too.

- No computer needed
- Two or more solid TX/RX passes every day
- Two additional TX passes 100m before and after!

Fri 26 Oct is day8



# Tracking ECHO (AO51) too!



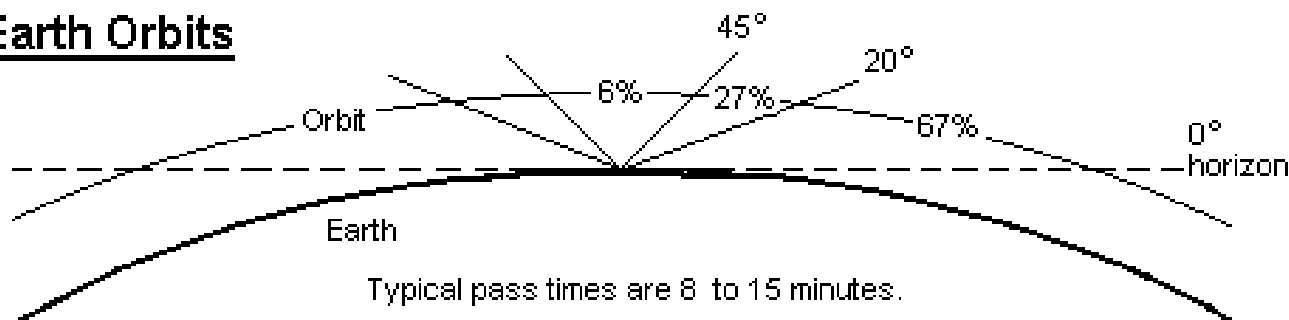
| 01Aug               | 07Aug | 13Aug | 19Aug | 25Sep |
|---------------------|-------|-------|-------|-------|
| -----               | ----- | ----- | ----- | ----- |
| 0850                | 0950  | 0910  | 0830  | 0930  |
|                     |       |       | 1005  |       |
| 2000                | 2100  | 2020  | 1940  | 2040  |
|                     |       |       | 2120  |       |
| for Wash DC and N/S |       |       |       |       |

Friday 26 Sep is here!

- No computer needed
- Two or more solid passes every day

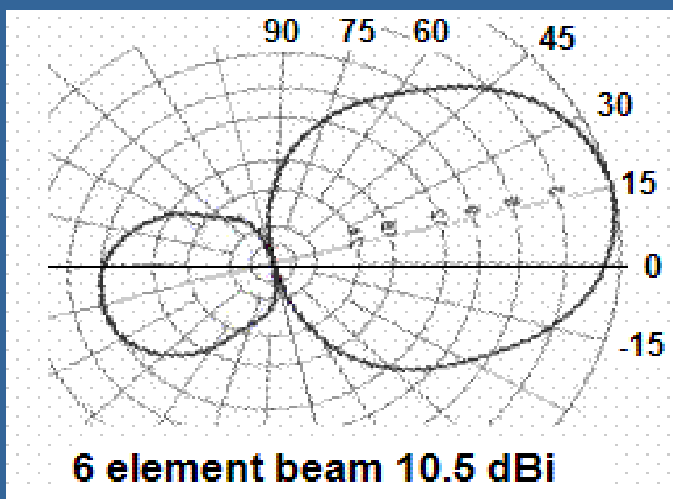
# LEO Pass Geometry

## Low Earth Orbits



Most of the time LEO satellites are in view, they are below 20 degrees elevation.

Rarely do they pass directly overhead. Only 2% of the time are they above 60 deg.



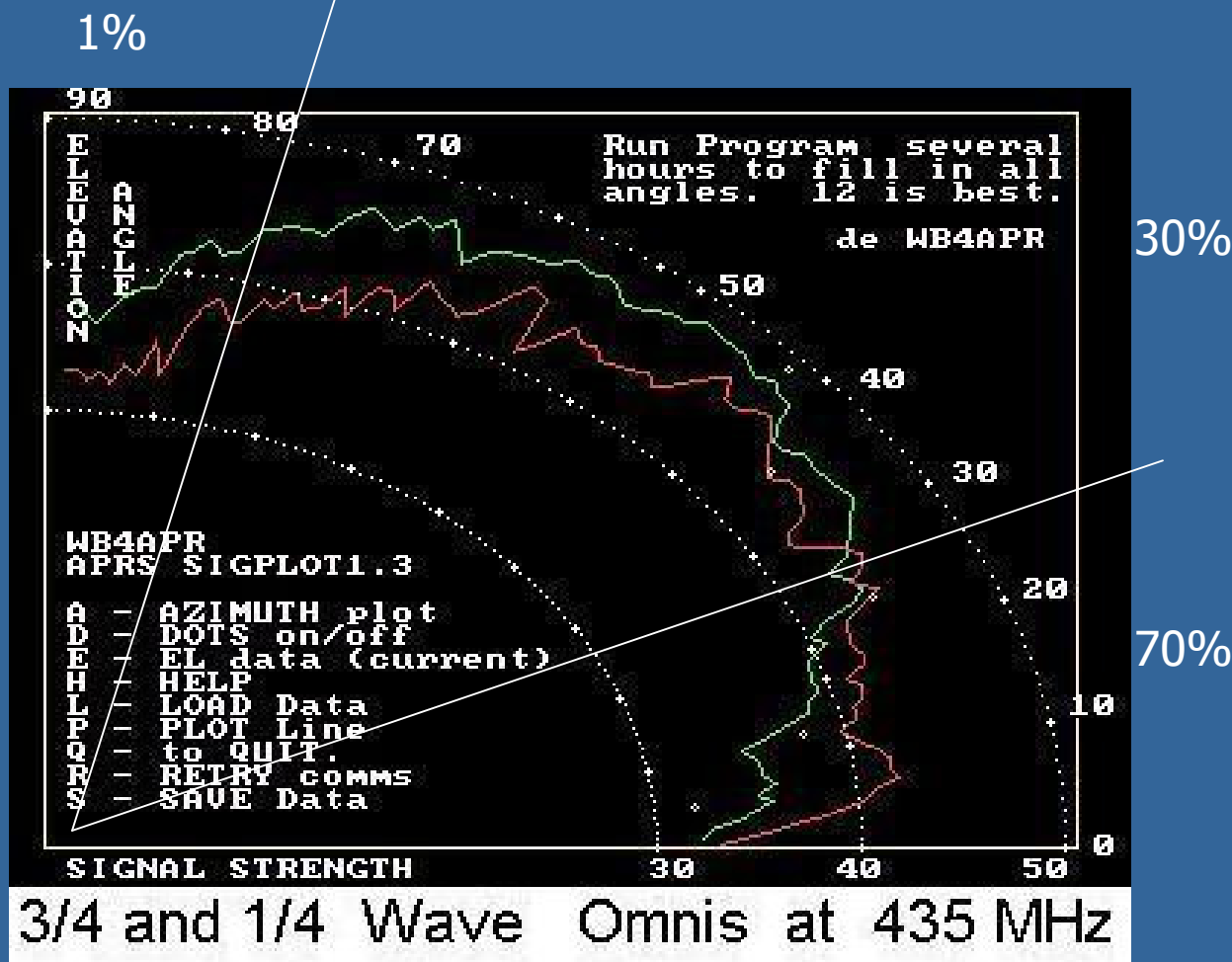
## Bottom line:

- 10 dB gain Horizon-to-horizon
- 98% of all in-view times
- Using \$75 TV rotator only

# Omni Antenna Gain 7 dBi !

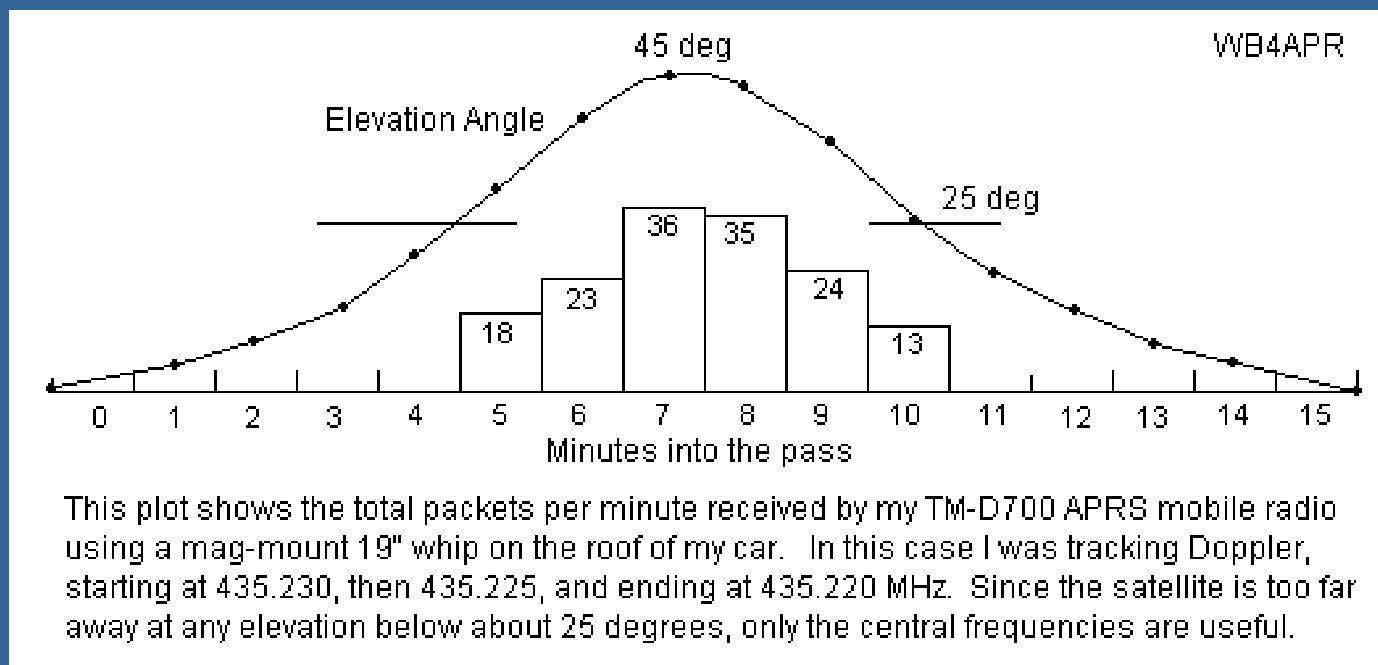


SATgate!

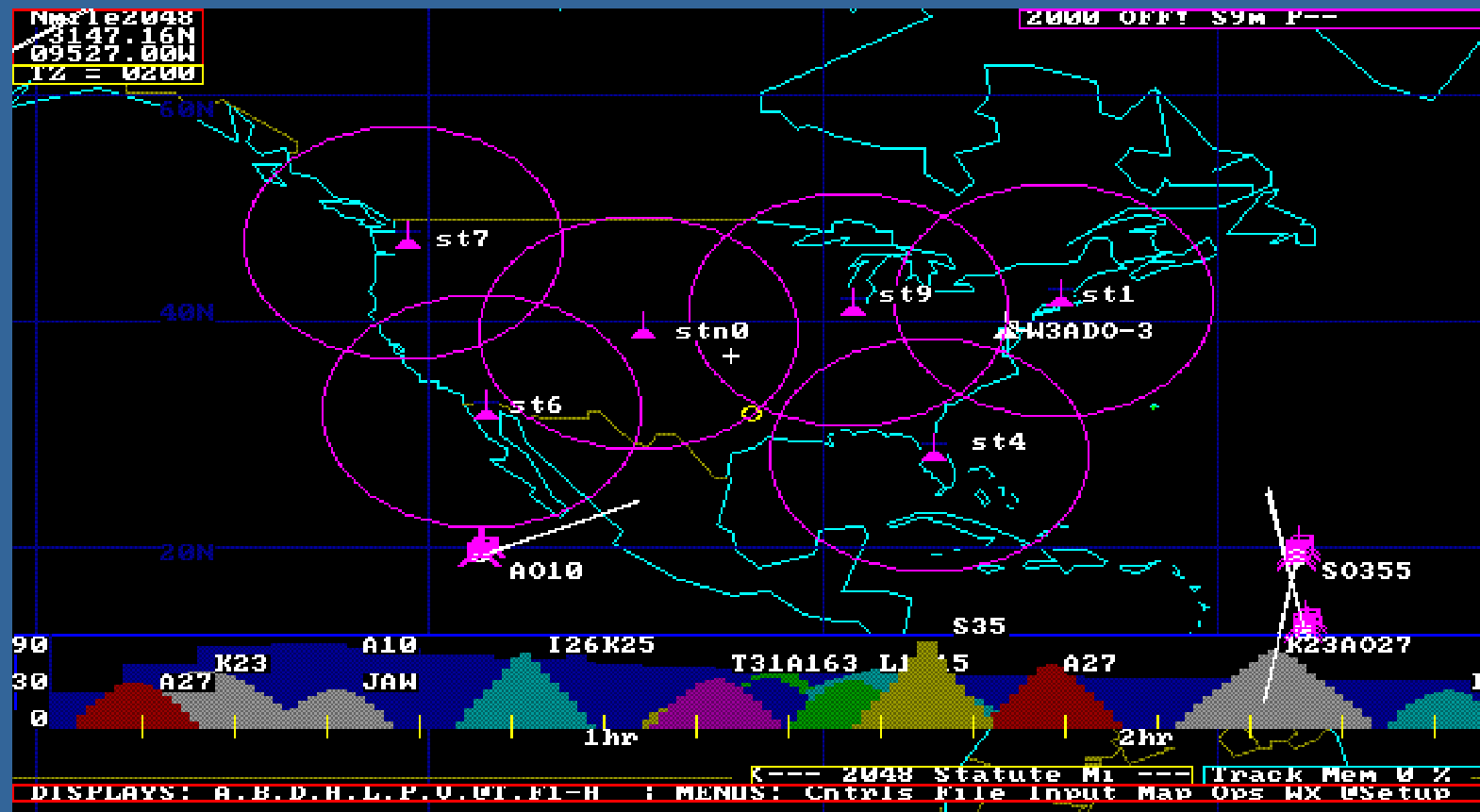




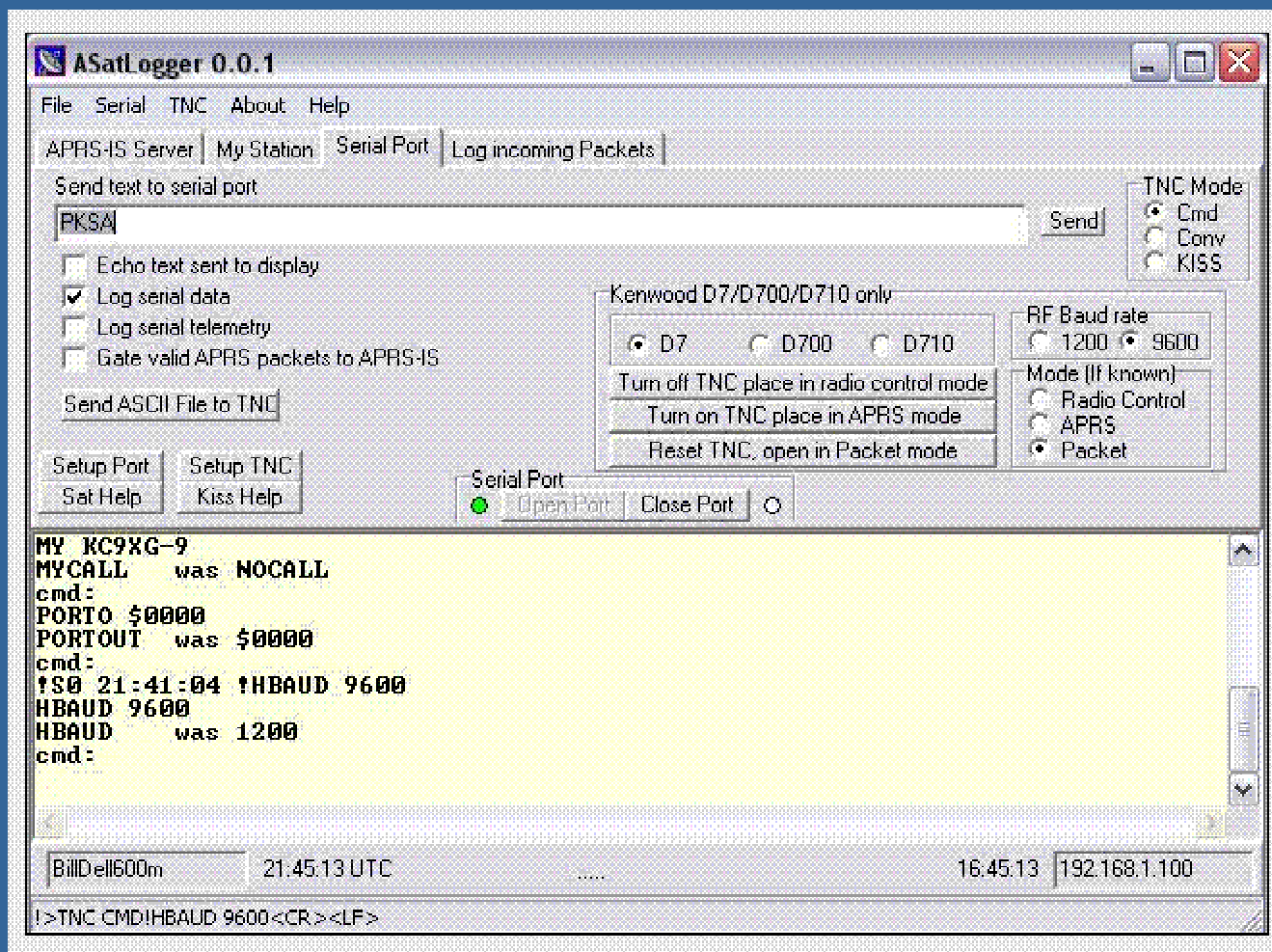
# Omni SatGates



# Omni SatGates



# Omni SatGates (Alogger)



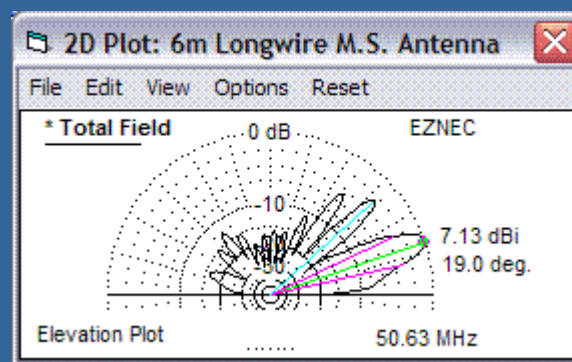
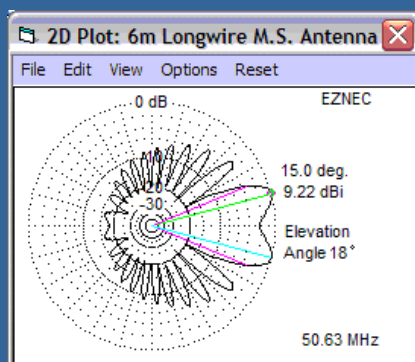
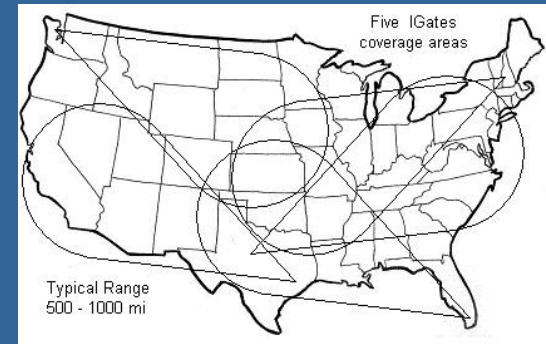
# APRS Emergency Comms

## Satellite-Simulated Emergency Test – SSET

- Send an emergency Email via Satellite

## Meteor-Scatter Monitoring Network (6 meters)

- Dozens of Igates monitoring 50.62 MHz
- Message Throughput in minutes
- Using surplus 110 Watt 6m radios
- Simple 100' long wire gain antennas





# APRS Emergency Power

200W Solar Power

- Continuous

10 kW gas Generator 220 VDC

- Auto-runs as needed
- lightweight wires



\$1 Universal Power Connector



# APRS Home Power

## **Solar Power.. It aint what it used to be!**

- ✓ 40% drop in price this year
- ✓ 1% what it cost in 1970
- ✓ 95% efficient now (no batteries (70%))
- ✓ 50% total cost Government Rebates!
- ✓ \$500-\$3000 annual rebates
- ✓ FREE Electricity for LIFE



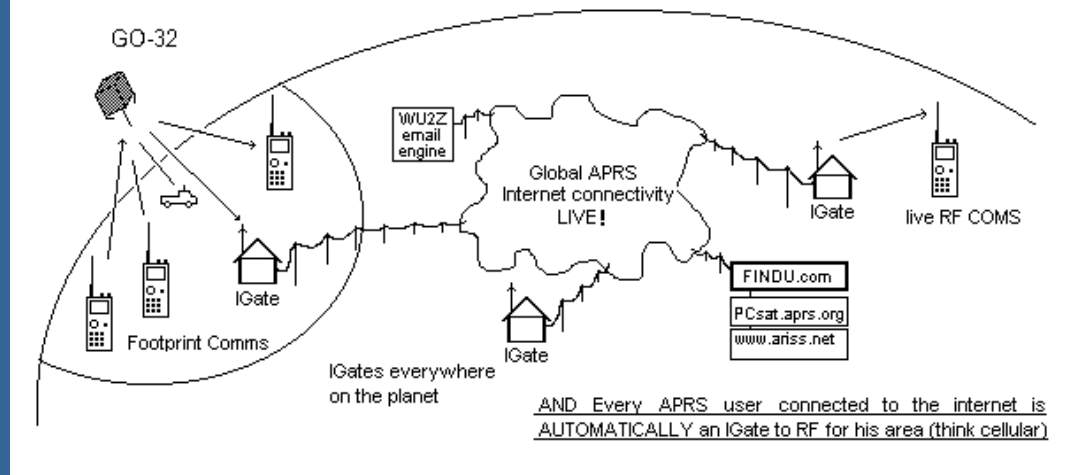
**\$1 Universal Power Connector**



# APRS is INFO. not just tracking!

## GO-32 APRS Igate System (potential)

( End-to-End Everywhere )



APRStt?

Milemarks?

Field Data?

Voice Alert?

Signal Finding?

Nets?  
Meetings?

Tracker-Voice?

Frequency?

RF Range?

AVRS (Ham Radio Mobile Cell via APRS=>VOIP)?

Traffic?

