



APRS



APRS = Automatic Packet Reporting System

APRS TM Bob Bruninga (SK)

- APRS is a real-time digital communications protocol for exchanging information between a large number of stations covering a large (local) area. As a multi-user data network, it is quite different from conventional packet radio.
- Developed 1982 WB4APR → GPS introduced in 1992 → Internet in 1997
- Digital mode based on AX.25 packet protocol (A=amateur)
 - Automated “one to many” ½ second packet bursts – unnumbered information
 - Utilizes digipeaters to extend range with goal of reaching i-gate
 - Transmits packets over & over (duplication). Can appear chaotic with collisions.

APRS Terminology

Digipeater – APRS repeater that listens on APRS frequency. Re-transmits heard station packets to other listening digipeaters or igate.

igate – Internet gateway for APRS packets.

TNC – **T**erminal **N**ode **C**ontroller. A device used to transmit & receive APRS packets, similar to a modem.

Baud – Symbol duration reporting time. APRS uses 1200 baud or 1200 characters per second.

GPS – Global Positioning System. Important for positioning, but not required to use APRS.

What is APRS?

What APRS is would be best described by its many uses.

- **Station position & movement reporting using GPS or Latitude/Longitude coordinates**
 - **ARES/SKYWARN – net control can track spotters in the field: !GCARES**
- **Weather reporting**
 - **Fixed weather stations in area capturing info and on APRS network**
- **Bulletins**
 - **Set location and status of event; disaster info, instruction, field day info...**
- **Messaging**
 - **Station to station messaging (40 characters)**
 - **Winlink message notifications**
 - **SMS messaging – HT using RF to phone network (ON HOLD working out regulation issues)**
- **Satellites**
- **Linked to Internet**

View of APRS stations in Grayson County, TX

aprs.fi

National APRS Frequency
144.390 MHz



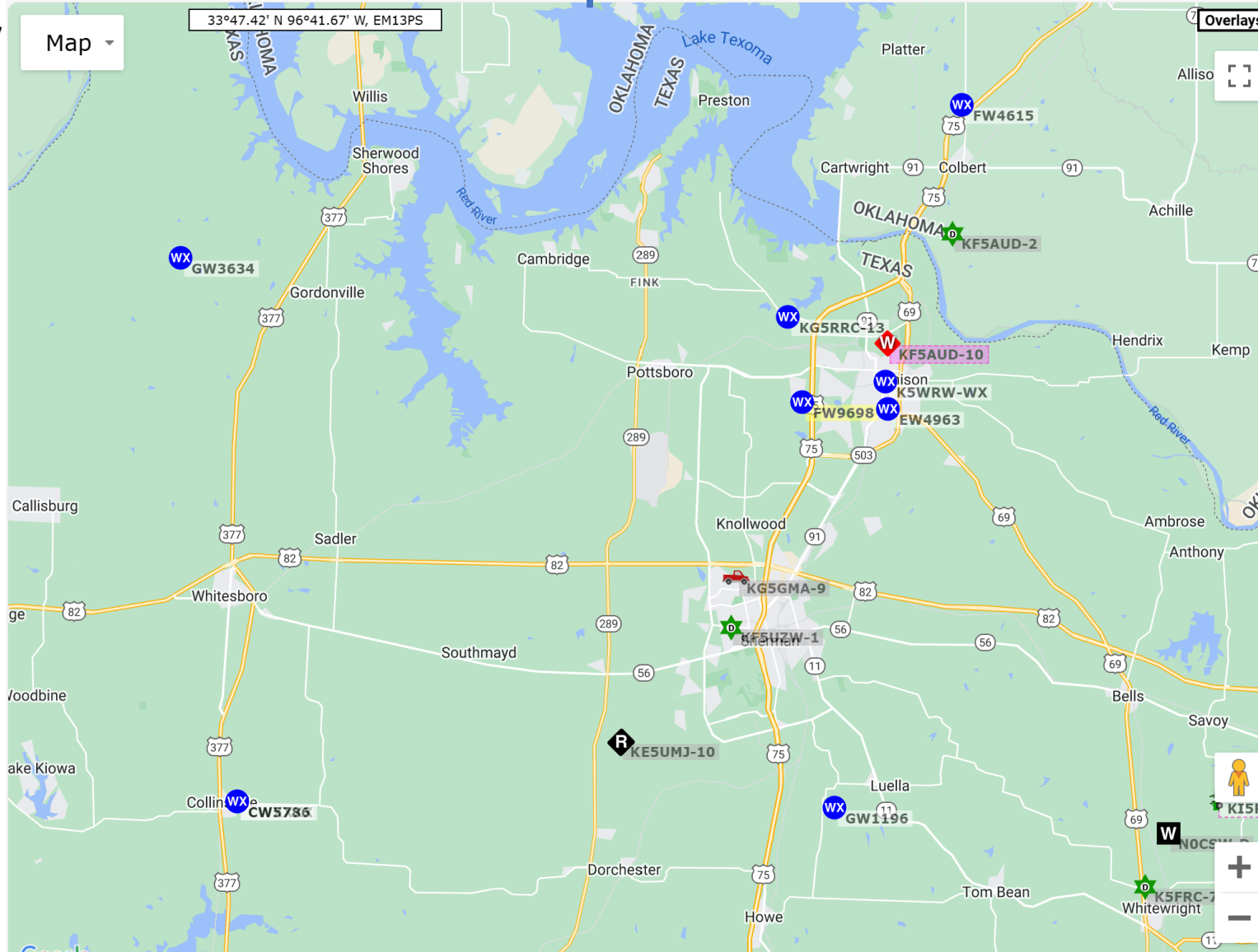
Weather Stations



APRS mobile station
KG5GMA-9



igate = internet gateway
KE5UMJ-10



Winlink packet gateway
KF5AUD-10

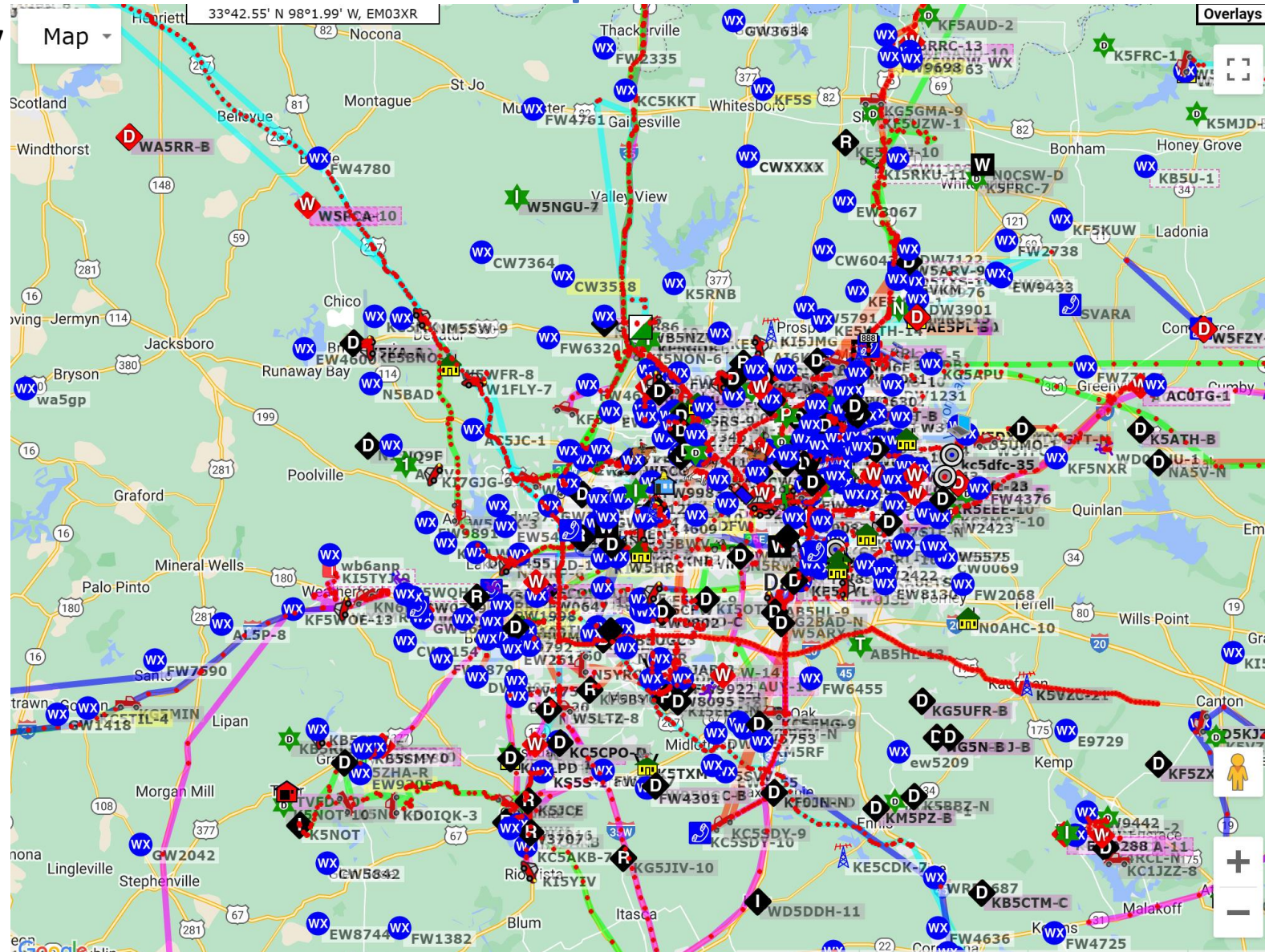


Digipeater's
KF5AUD-2
KF5UZW-1
K5FRC

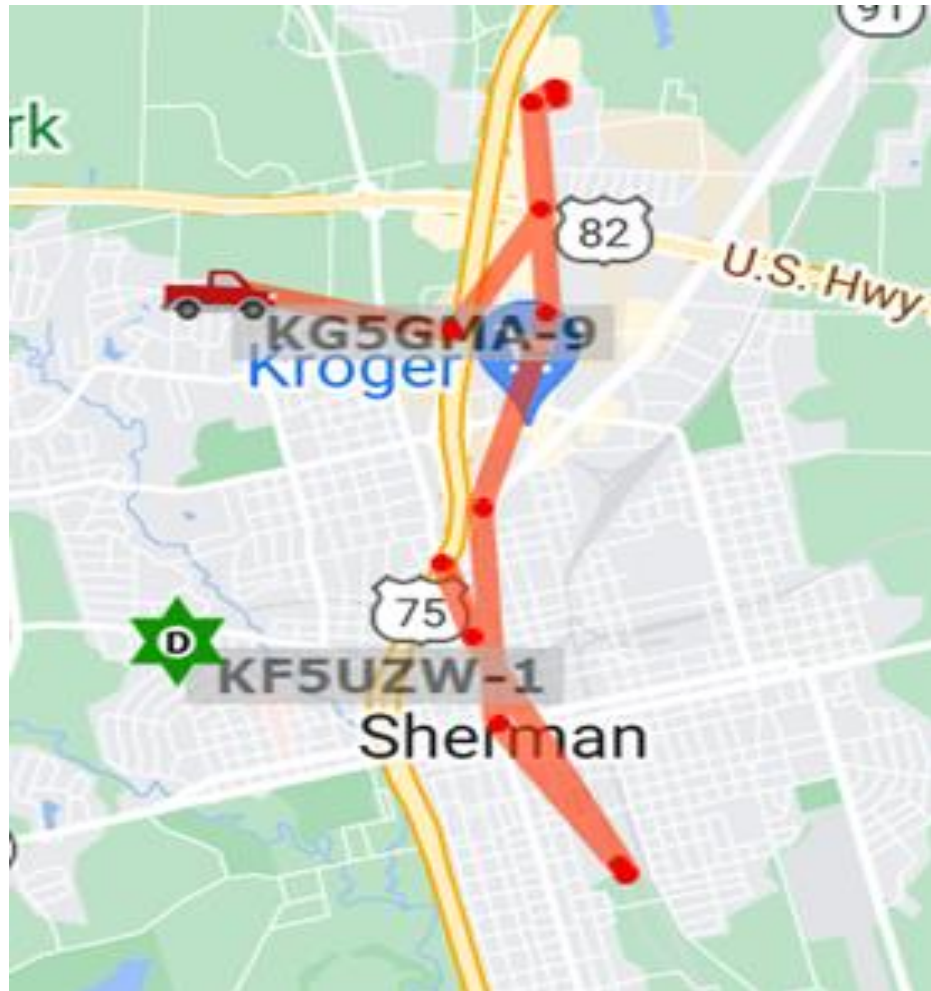
View of APRS stations in North Texas

aprs.fi

National APRS Frequency
144.390 MHz



Example of location reporting or tracking

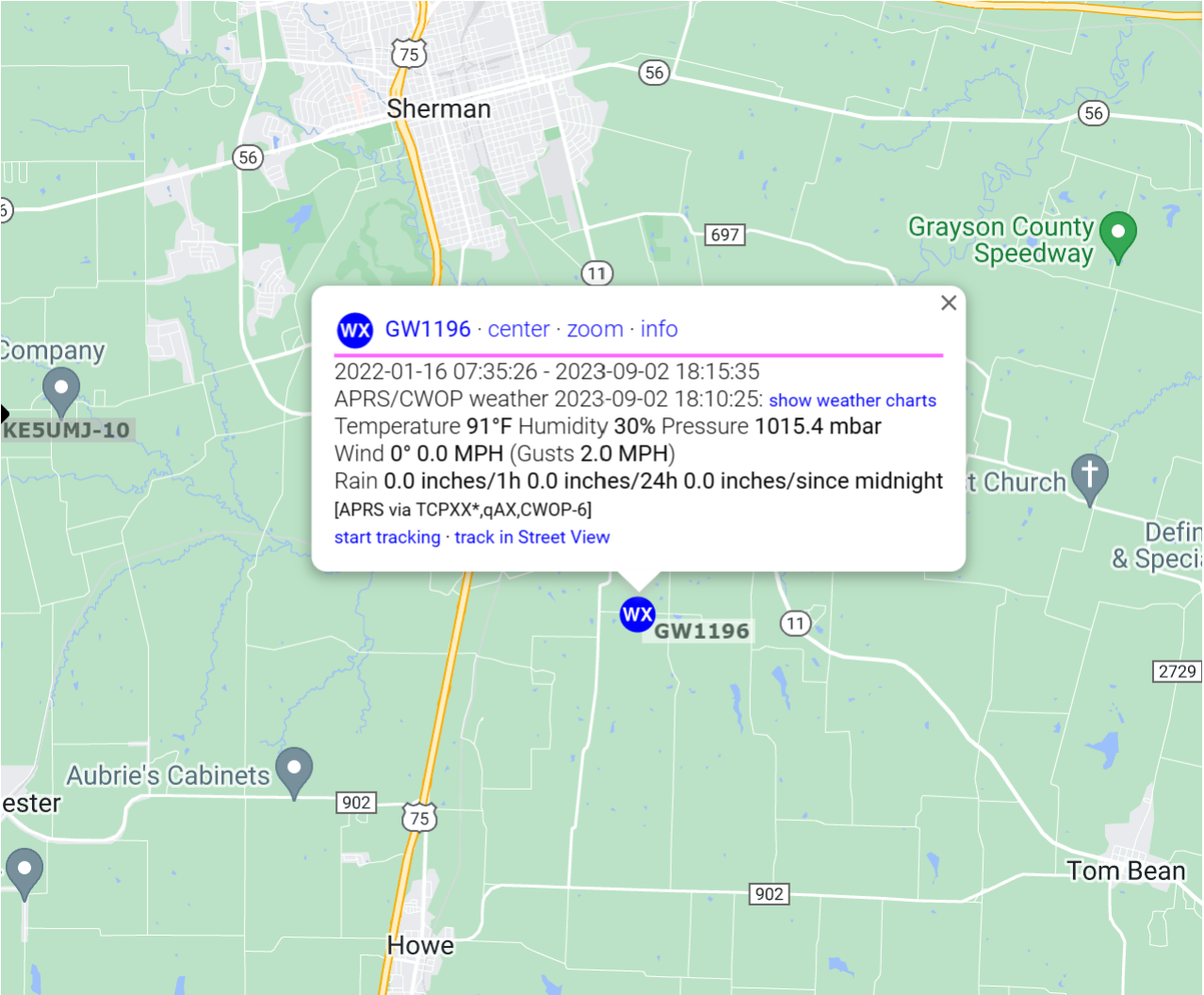


SKYWARN benefits of NET control keeping track of spotters in the field.

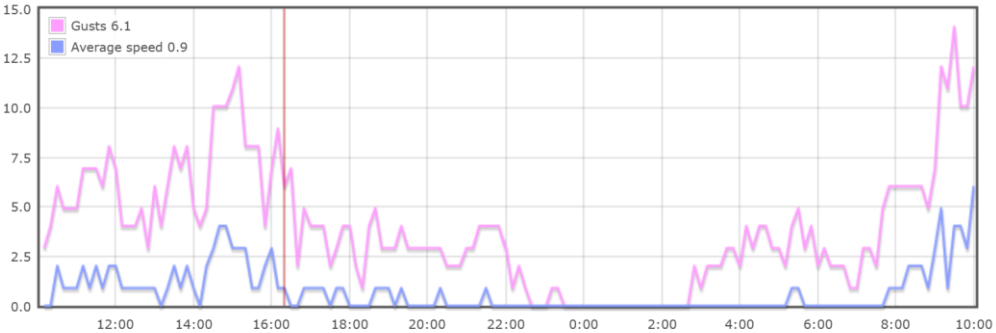
Grid tracking - Search & Rescue tracking of search teams

Weather Station Info

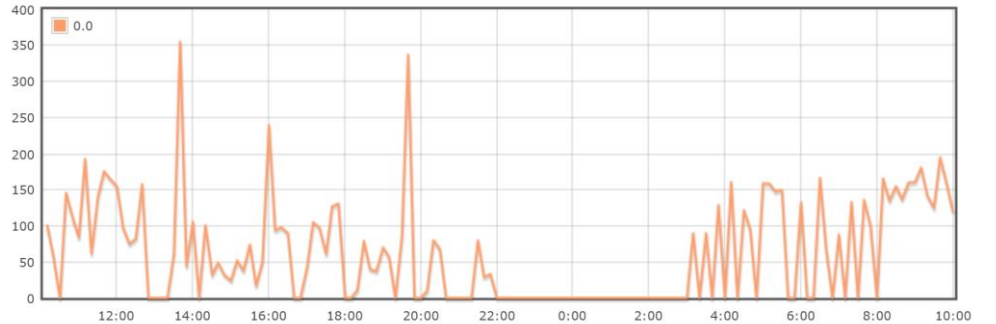
Info from APRS.fi



GW1196 Wind 2023-09-02 10:10:27 -> 2023-09-03 10:00:37 CDT
MPH



GW1196 Wind direction 2023-09-02 10:10:27 -> 2023-09-03 10:00:37 CDT
°



Messaging & Bulletins

Messages on APRS.fi

Callsign: Show: ▾

Found 50 packets. 206 seconds between packets on average during 10117 seconds. Lookup took 0.056 seconds.

APRS messages are stored for 14 days. It is possible to search using wildcards (*) after a prefix.

2023-09-03 07:19:14 CDT: [WLNK-1](#)>[KD8K](#): APRSLink v5.0
2023-09-03 07:23:14 CDT: [WLNK-1](#)>[KD8K](#): APRSLink v5.0
2023-09-03 07:31:14 CDT: [WLNK-1](#)>[KD8K](#): APRSLink v5.0
2023-09-03 07:37:01 CDT: [WLNK-1](#)>[PH3J-10](#): You have 1 Winlink mail messages pending
2023-09-03 07:38:01 CDT: [WLNK-1](#)>[PH3J-10](#): You have 1 Winlink mail messages pending
2023-09-03 07:40:01 CDT: [WLNK-1](#)>[PH3J-10](#): You have 1 Winlink mail messages pending
2023-09-03 07:44:01 CDT: [WLNK-1](#)>[PH3J-10](#): You have 1 Winlink mail messages pending
2023-09-03 07:51:46 CDT: [WLNK-1](#)>[KD8K](#): You have 1 Winlink mail messages pending
2023-09-03 07:52:01 CDT: [WLNK-1](#)>[PH3J-10](#): You have 1 Winlink mail messages pending
2023-09-03 07:52:47 CDT: [WLNK-1](#)>[KD8K](#): You have 1 Winlink mail messages pending
2023-09-03 07:54:47 CDT: [WLNK-1](#)>[KD8K](#): You have 1 Winlink mail messages pending
2023-09-03 07:58:47 CDT: [WLNK-1](#)>[KD8K](#): You have 1 Winlink mail messages pending
2023-09-03 08:06:47 CDT: [WLNK-1](#)>[KD8K](#): You have 1 Winlink mail messages pending

Station to station message on HT

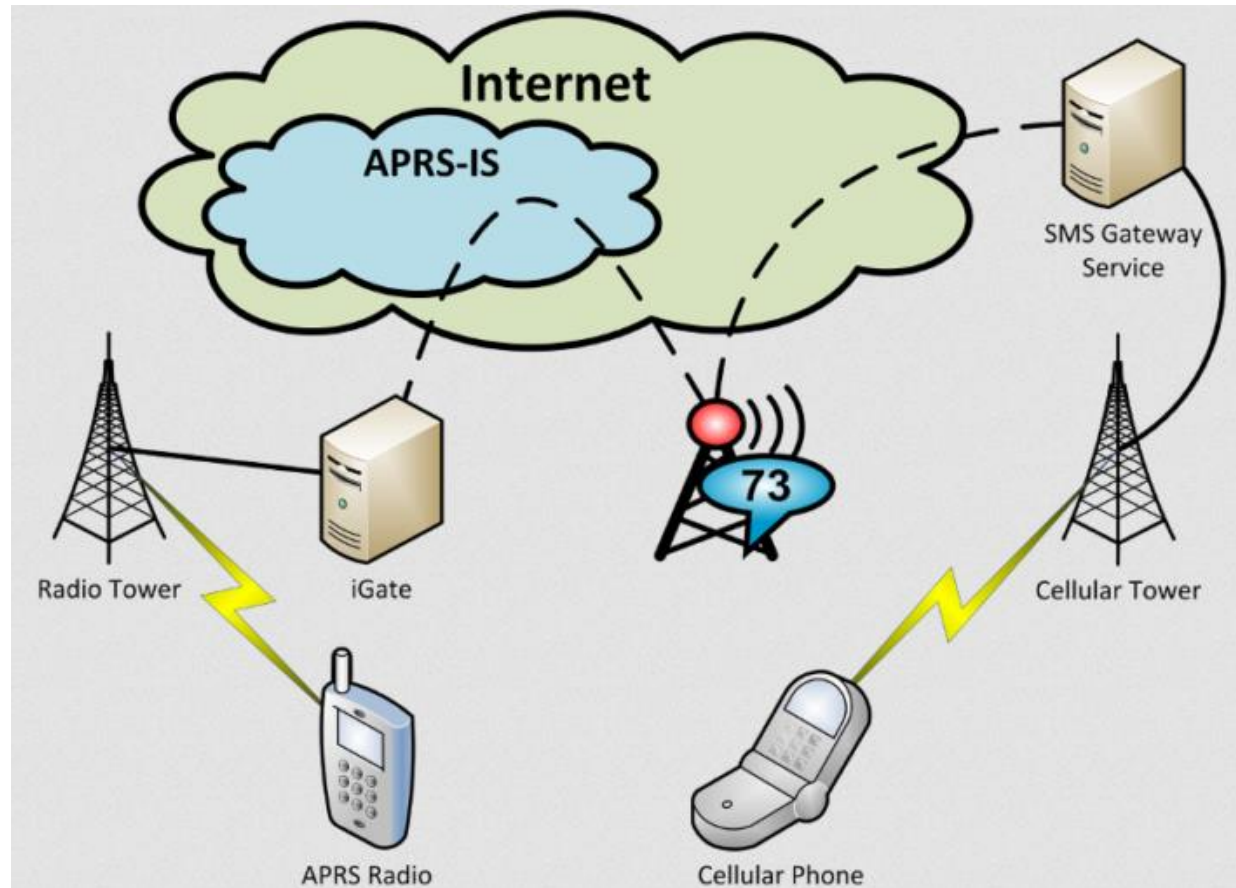


Example of Bulletin Postings

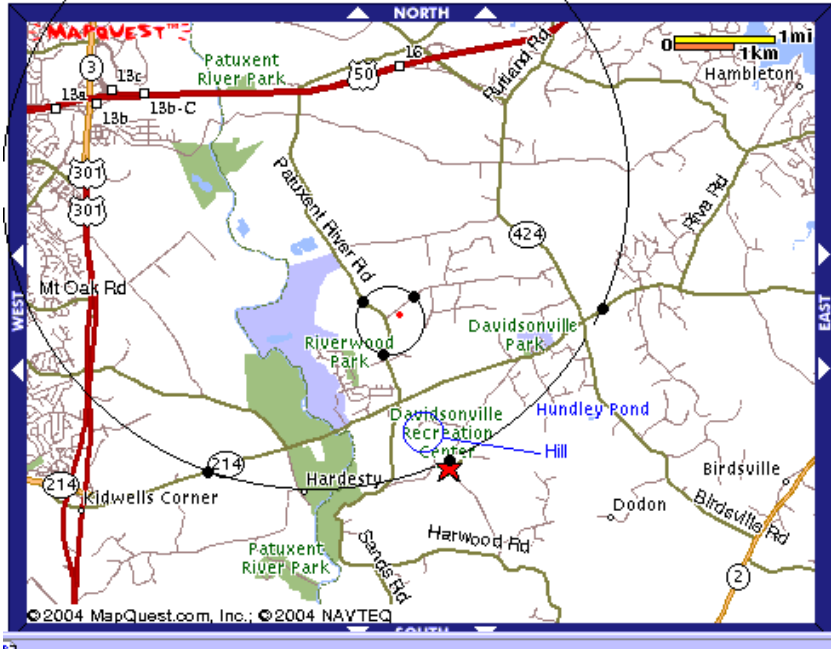
KC1HHO-9	BLN3	EASTERN MA 2M Traffic Net Daily 2000 hrs W1BOS Rpt 145.230 pl 88.5 / send NTS Radiogram to KC1HHO	20m55s
KC1HHO-9	BLN4	Great Hill Gang Radio Club K1GHG ham meet up Sunday, August 20 - 7am https://www.qrz.com/db/k1ghg ... call 146.520	12m55s
KD0TLS-1	BLN0	Gopher Radio Club weekly meet, Sat. 2 PM, U of MN hamshack	1h15m
KD0TLS-1	BLN1	Hams in the Park, 9/9, Long Lk Regional Park, New Brighton noon	22m12s
KO4UZI-10	BLN0	Catch Me on 442.300 pl123. Wires X Repeater	46s
LU4EOU	BLN0	Boletin de prueba	9h42m
LW1DSE	BLN1	Estación parcialmente alimentada con energía solar (24 celdas 10Wpk)	5h19m

Messaging

SMSGTE - APRS to phone text messaging – Currently on hold working out regulation concerns



APRS – Direction Finding Examples



Fade Circle Technique

This is another solution to the same fox hunt. The signal was barely readable at the starting point so let that be the first "fade point".

Then two more fade points were found along route 214 and then returning to the center and driving north quickly peaked and then using the max "S-meter" as set point they were within 1/10th of a mile.

Then using an HT with no antenna, they walked the final 100 or so feet to find the Fox.

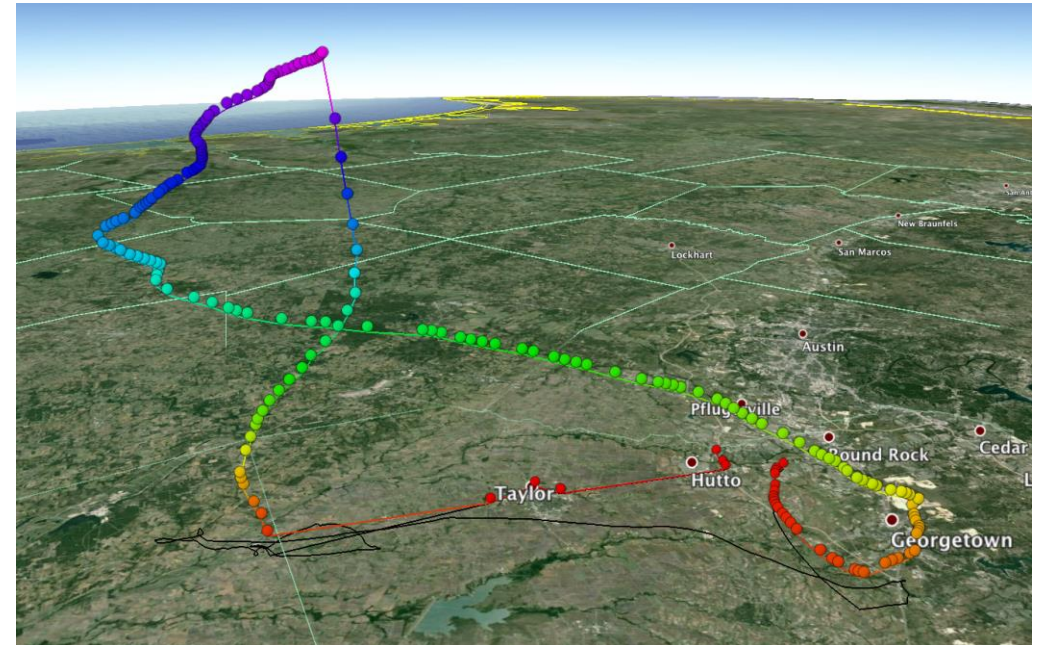
Note how the hill blocked the initial starting fade point and significantly skewed the first circle. But as the signal gets stronger, the smaller circles get more and more correct!

Use APRS to help you plot directions, signal strengths in direction finding.

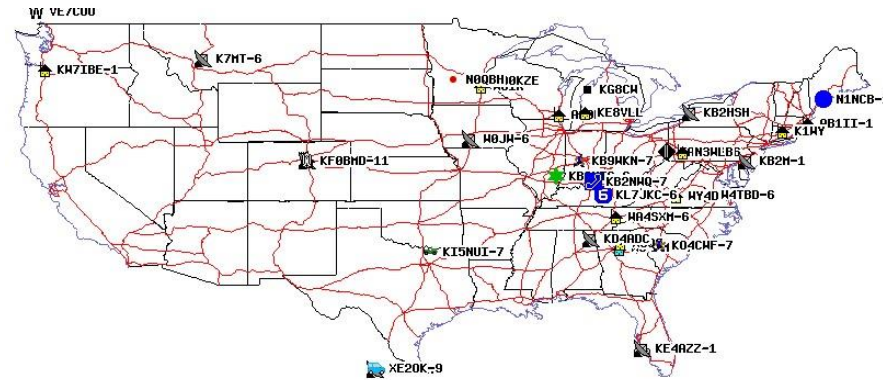
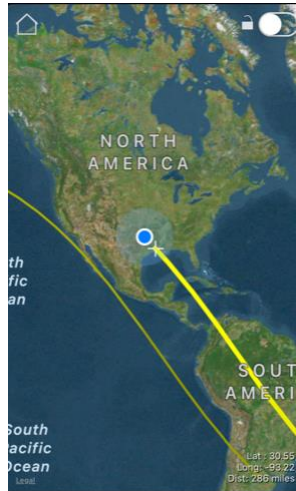
Fox Hunting!

APRS tracker for weather balloon.

Capture elevation as well as coordinates.



APRS – Satellites & ISS



ISS or other Satellite prediction apps

GoSat Watch

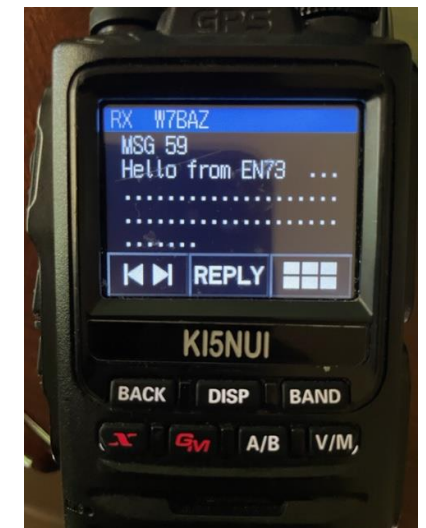
Simons World Map

APRS on ISS 145.825 MHz

Digipath

1: ARISS

2: WIDEn-N n/a



Common APRS Station Setup



HT or mobile radio with APRS capability



Or, Radio + TNC's & Trackers



Tracker4
APRS Tracker / TNC / Gateway
MANUAL



ARGENT
DATA SYSTEMS
Version 1.02 Revised 9-2-2008



APRS.fi IOS devices*

APRSdroid Android devices*

*Internet only vs RF unless paired with TNC



Common APRS Station Setup

HT or mobile radio with APRS capability



- **Some APRS stations have message capability, some are beacon only.**

PROS: Easier operation once configured, ready to work, mobile up to 50 watts provide good coverage

CONS: \$\$\$, recent lack of options of new mobile radios. HT using 5 watts can be challenging to reach digipeater, often requires fill in digipeater or home station to relay.

Mobilinkd TNC

- **Mobilinkd TNC + radio (mobile/HT) + phone/tablet + APRS.fi app**

PROS: \$\$, very versatile, can work with multiple radios mobile or HT, can be configured as igate, easier messaging with phone (with or without internet), perfect for kits ready when needed. Works great as fill in digipeater.

CONS: Some practice to configure sound for radio, but not many cons.



Tracker4
APRS Tracker / TNC / Gateway
MANUAL



TNC's & Trackers



ARGENT
DATA SYSTEMS
Version 1.02, Revised 9.2.2008

- **Either Fixed or Mobile options**

PROS: Common on fixed locations like weather stations, circuit board add on for some radios, or options for mobile. \$ to \$\$

CONS: experience to set up mobile, some GPS add on.

HOW APRS OVER RF WORKS

Radio+APRS + Digipeaters (144.390MHz) + igate

IMPORTANT! For illustration purposes, this example uses a path setting with three digipeater hops (WIDE1-1,WIDE2-2), in order to clearly show how WIDEn-N decrementing works.

In actual use, **one should ALMOST NEVER use more than TWO hops**, to minimize congestion in distant locations on the shared APRS radio channel. The recommended path setting for a mobile station is:

WIDE1-1,WIDE2-1

The recommended path setting for a fixed station is:

WIDE2-1 only.

The recommended path setting for an airborne station is **NO** path at all above a few thousand feet, or at the maximum, only one hop:

WIDE2-1 only.

HOW APRS OVER RF WORKS

WIDEn-N paths

WIDE1-1, WIDE2-2

WIDE1-1

WIDE2-2

WIDE2-1

WIDE2-0 (Stops)

vs

Fill-In Digipeater

1st High Level Digipeater

2nd hop – next level digipeaters

3rd Hop (3 hops causes congestion)

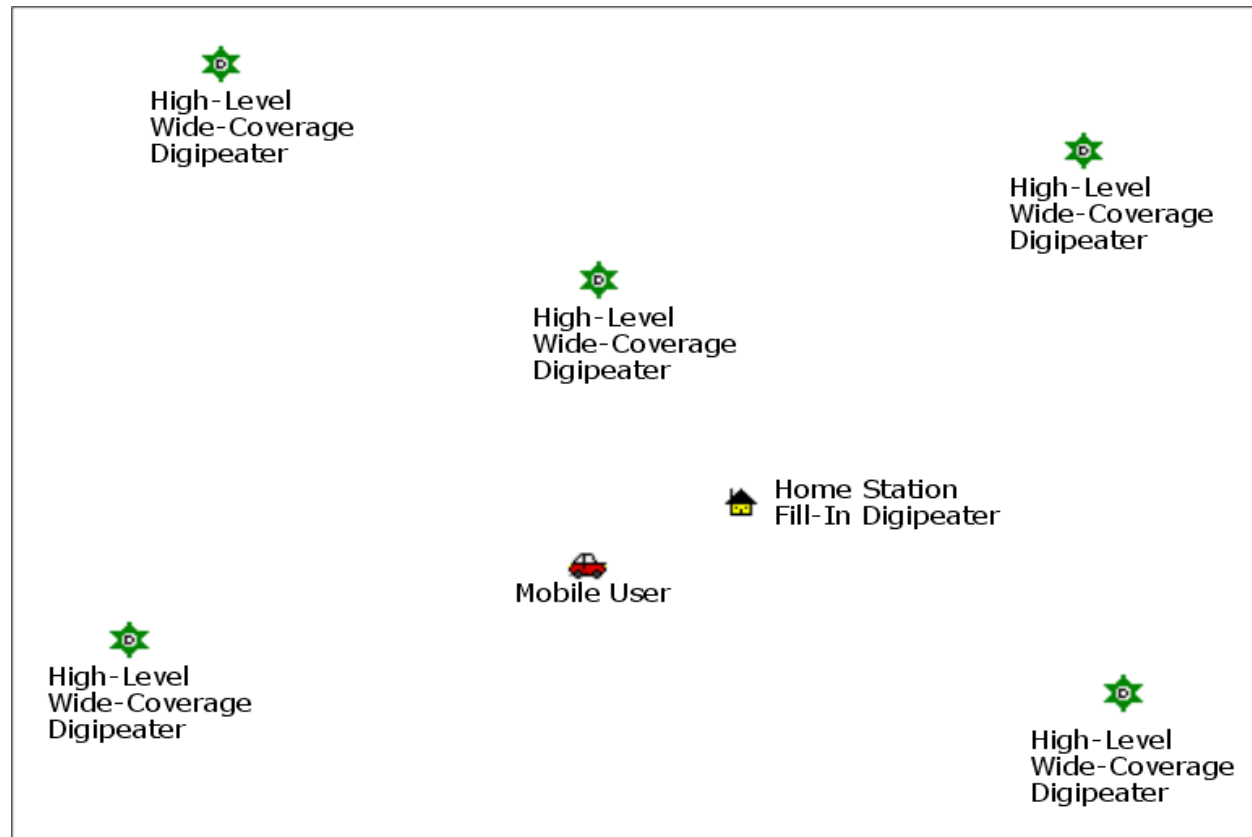
WIDE1-1, WIDE2-1

WIDE1-1

WIDE2-1

WIDE2-0 (Stops)

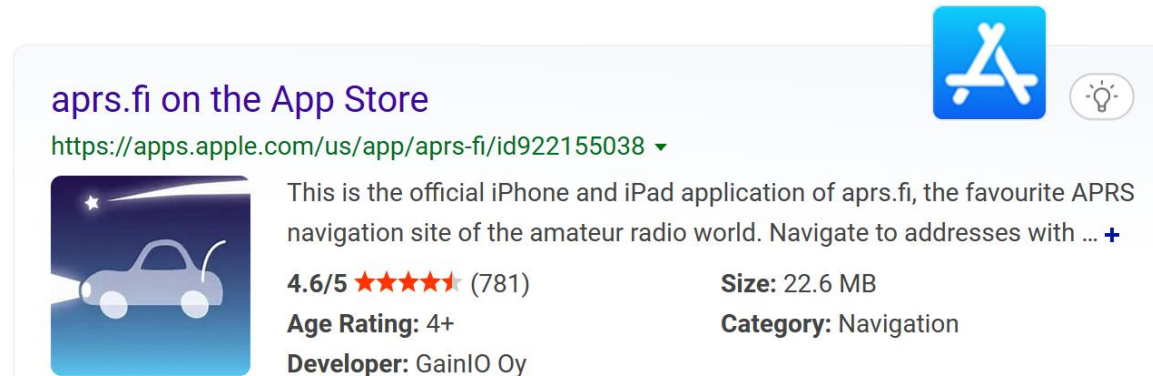
n/a



APRS APPS

Applications for both IOS and Android

APRS.fi – IOS devices



APRSdroid – also supports AFSK (audio connection between your radio & smart phone)

APRSdroid - APRS Client

Apps · Tools · Georg Lukas



APRSdroid is an APRS application for Amateur Radio (HAM) operators. It allows reporting your position as well as sending and receiving messages. It also conveniently displays nearby stations as a list or on a map. Feel free to contact the author via e-mail with any issues you might encounter. If you are not satisfied, ...

It MUST be assumed that every packet on APRS-IS will be gated to or was gated from RF. This means that beacon rates, packet contents, etc. MUST be considered to be acceptable for RF.

References

APRS Main Site - <http://www.aprs.org>

APRS Map - <https://aprs.fi>

APRS Pathways explained - <http://wa8lmf.net/DigiPaths/NNNN-Digi-Demo.htm>

APRS simplified video (HRCC Ham Radio Crash Course KI6NAZ) - <https://www.youtube.com/watch?v=IRHhaRTCh3w>

APRS to SMS messaging - https://docs.google.com/document/d/1Orcbw0DyZJHd_Xlw-kRu1agG67cZM5fesGKiiTd0I3U/edit#heading=h.rj0odwh20y0i

APRS WIDEn-N explained - <https://blog.aprs.fi/2020/02/how-aprs-paths-work.html>

APRS via ARISS – https://www.amsat.org/wordpress/wp-content/uploads/2014/01/AMSAT_Journal_ISS_Packet.pdf

- 0 Your primary station usually fixed and message capable
- 1 generic additional station, digi, mobile, wx, etc
- 2 generic additional station, digi, mobile, wx, etc
- 3 generic additional station, digi, mobile, wx, etc
- 4 generic additional station, digi, mobile, wx, etc
- 5 Other networks (Dstar, Iphones, Androids, Blackberry's etc)
- 6 Special activity, Satellite ops, camping or 6 meters, etc
- 7 walkie talkies, HT's or other human portable
- 8 boats, sailboats, RV's or second main mobile
- 9 Primary Mobile (usually message capable)
- 10 internet, Igate, echolink, winlink, AVRS, APRN, etc
- 11 balloons, aircraft, spacecraft, etc
- 12 APRStt, DTMF, RFID, devices, one-way trackers*, etc
- 13 Weather stations
- 14 Truckers or generally full time drivers
- 15 generic additional station, digi, mobile, wx, etc