

AG6QO Packet BBS

A Raspberry Pi Project



Agenda

- Joe – who ?
- Packets, Nodes, and Bulletin Boards
- The Plan; AG6QO BBS
- Motives, Future Possibilities
- Operating: Why Packet? Why BBS?
- Reference Material
- Questions



Joe Who?

- Ham since 1974 – WN3YKP, WA3YKP, AA3YKP
- Extra since Nov. 2012 – AG6QO
- Profession – BSEE, M. Eng.
 - Computer / Controls Engineer – Robotics, Flight Controls, UAVs
- Affiliations
 - BARK, Yolo ARES, WVARA, ARRL, IEEE, AOPA
- Find me:
 - Ham info: <http://ag6qo.com/>
 - Professional Info: <http://www.linkedin.com/in/joedeangelo/>
 - Email: jod@online-tek.com
 - BBS: AG6QO@AG6QO.#NCA.CA.USA.NOAM
 - PMBX: AG6QO-1 VIA KBERR (145.050)
- Disclaimer



Packets and Nodes

- Based on AX25 Protocol
 - A “Link Layer” protocol
 - Allows two stations to reliably exchange packets (error-free, due to error correction algorithms).
 - Specification : <http://www.tapr.org/pdf/AX25.2.2.pdf>
- Nodes
 - A “Connection Layer” protocol
 - Hides “ACK” between nodes
 - Allows multiple stations to connect in “circuits”
 - Some NODE networks automatically “discover” nodes that appear or disappear.
 - Some NODE networks do not require you to know the route to a distant Node.



145.050 Nodes

```
cmd:C KBERR
cmd:*** CONNECTED to KBERR
###CONNECTED TO WILD NODE KBERR(K6JAC-6) CHANNEL A
KBERR is the KaNode in the BERRY TNC
ENTER COMMAND: B,C,J,N, or Help ?
N
RMOC      (WB6YNM-12) 09/05/13 05:53:24
KLIVE     (KF6FFU-4)  09/05/13 05:56:56
LPRC3     (ND6C-4)    09/05/13 06:01:35
PENN70    (KF6DQU-7)  09/05/13 06:07:59
KBANN     (KF6DQU-3)  09/05/13 06:12:36
KRDG      (WA6YNG)    09/05/13 06:12:37
KCORN     (W6JEX-4)   09/05/13 06:12:39
A
A
A
(D
D
D
-2) 09/05/13 06:13:29
MOC      (WB6YNM-11) 09/05/13 06:18:37
FCITY    (KI6UDZ-7)  09/05/13 06:19:14
YRGTN    (W7DED-4)   09/05/13 06:27:32
CORN     (W6JEX-5)   09/05/13 06:28:36
BRKNRG   (N6KRV-5)   09/05/13 06:29:45
KVOLC*   (N3CKF)     09/05/13 06:32:58
WINTER   (AG6QO-4)   09/05/13 06:33:11
TAHOE    (WA6EWV-3)  09/05/13 06:34:42
ENTER COMMAND: B,C,J,N, or Help ?
J
ENTER COMMAND: B,C,J,N, or Help ?
J
KG6SJT-5 09/05/13 06:24:37
WA6EWV-1* 09/05/13 06:25:14
KJ6NON-7 09/05/13 06:25:55
W7DED-4 09/05/13 06:27:32
W6PKT-10 09/05/13 06:28:07
W6JEX-5 09/05/13 06:28:36
N6KRV-5 09/05/13 06:30:46
N3CKF* 09/05/13 06:32:58
AG6QO-4 09/05/13 06:33:11
KI6BZR* 09/05/13 06:33:30
AB6CW-1 09/05/13 06:34:28
WA6EWV-3 09/05/13 06:34:42
K6SAT-10 09/05/13 06:36:05
AG6QO 09/05/13 06:36:21
ENTER COMMAND: B,C,J,N, or Help ?
J
```

```
C KLPRC
INVALID CALLSIGN
ENTER COMMAND: B,C,J,N, or Help ?
C KLPRC
###LINK MADE
###CONNECTED TO WILD NODE KLPRC(ND6C) CHANNEL A
Welcome to KLPRC. KaNode on Loma Prieta. LPRC.net
ENTER COMMAND: B,C,J,N, or Help ?
N
FOSN3     (W6TUK-7)  09/01/2013 04:20:38
KYCARE*   (KG6SJT-10) 09/02/2013 15:05:08
KFCTY*    (KI6UDZ)   09/04/2013 11:33:29
KWNTR*    (AG6QO)    09/04/2013 20:46:17
WBAY      (N6ZX-5)   09/05/2013 00:33:03
BERRY     (K6JAC-4)  09/05/2013 02:01:04
KVOLC*    (N3CKF)    09/05/2013 03:03:05
WOODY     (N6ZX)     09/05/2013 03:55:11
KBERR     (K6JAC-6)  09/05/2013 04:55:44
FCITY     (KI6UDZ-7) 09/05/2013 05:42:01
ENTER COMMAND: B,C,J,N, or Help ?
J
K6JAC-6 09/05/2013 04:55:44
N6YP*   09/05/2013 04:56:39
AE6OR*  09/05/2013 05:00:11
K6BLA*  09/05/2013 05:01:52
KI6UDZ  09/05/2013 05:02:02
KI6BZR* 09/05/2013 05:16:15
KI6UDZ-7 09/05/2013 05:42:01
W6PKT-10 09/05/2013 05:50:53
KBERR 09/05/2013 05:51:29
AG6QO-15 09/05/2013 05:51:29
ENTER COMMAND: B,C,J,N, or Help ?
J
```

```
C KRDG
###LINK MADE
###CONNECTED TO WILD NODE KRDG(WA6YNG) CHANNEL A
KRDG is the KaNode in the RDG network node.
ENTER COMMAND: B,C,J,N, or Help ?
N
KI6YJR-3 (KI6YJR) 09/04/2013 18:06:57
KWNTR*   (AG6QO) 09/04/2013 22:42:04
A
A
A
(D
D
D
-2) 09/05/2013 05:51:58
MOC      (WB6YNM-11) 09/05/2013 05:57:07
BANNER   (KF6DQU-9)  09/05/2013 06:50:31
BERRY    (K6JAC-4)   09/05/2013 06:56:47
HANEY    (KI6YJR-7)  09/05/2013 07:07:29
KBANN     (KF6DQU-3)  09/05/2013 07:21:06
KCORN     (W6JEX-4)   09/05/2013 07:21:09
KBERR     (K6JAC-6)   09/05/2013 07:36:27
KMOC      (WB6YNM-12) 09/05/2013 07:36:29
CORN      (W6JEX-5)   09/05/2013 07:37:06
KVOLC*    (N3CKF)     09/05/2013 07:41:27
ENTER COMMAND: B,C,J,N, or Help ?
J
ENTER COMMAND: B,C,J,N, or Help ?
J
KI6YJR-7 09/05/2013 07:07:29
KB8VOM*  09/05/2013 07:11:40
KF6DQU-3 09/05/2013 07:21:06
W6JEX-4 09/05/2013 07:21:09
KG6SJT-10* 09/05/2013 07:31:50
K6JAC-6 09/05/2013 07:36:27
WB6YNM-12 09/05/2013 07:36:29
W6JEX-5 09/05/2013 07:37:06
N3CKF* 09/05/2013 07:41:27
KI6BZR* 09/05/2013 07:41:59
KBERR 09/05/2013 07:49:11
AG6QO-15 09/05/2013 07:50:06
ENTER COMMAND: B,C,J,N, or Help ?
J
```



Node Hopping

```
cmd:C KBERR
cmd:*** CONNECTED to KBERR
###CONNECTED TO WILD NODE KBERR(K6JAC-6) CHANNEL A
KBERR is the KaNode in the BERRY TNC
ENTER COMMAND: B,C,J,N, or Help ?
C WOODY
###LINK MADE
###CONNECTED TO WILD NODE WOODY(N6ZX) CHANNEL A
ENTER COMMAND: B,C,J,N, or Help ?
C KI6ZHD-1
###LINK MADE
//SP KI6ZHD
LinPac version 0.17pre3 channel 3
Type //I for info, //H for command list.

Welcome, AG6QO-14 !
Last sysop activity was 40326 sec. ago. Try //B if he doesn't respond.
```



Full-Service Bulletin Boards

- “Store and Forward” messaging
 - No need for the recipient to be online.
- Hierarchical message addressing
 - No need to know route – White Pages
- S AG6QO@AG6QO.#NCA.CA.USA.NOAM
 - The BBS system will route the message to the recipient’s location, if they exist.
- ST 95694@NTSCA
 - Built-in accommodation for NTS message formats

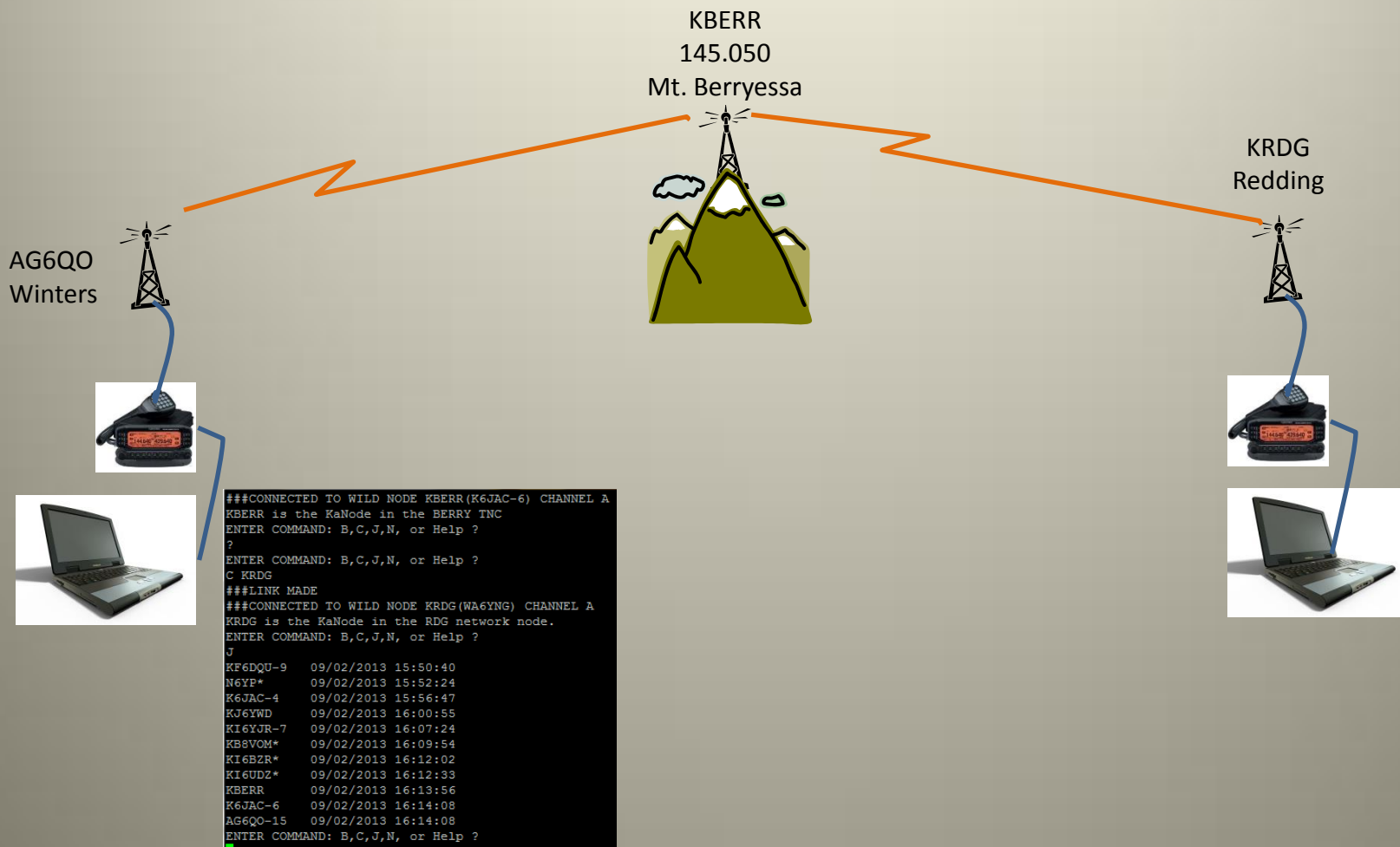


Some Typical BBS Services

- Message Forward
- File Server
- Gateway / Node
- APRS/WinLink/other gateway services
- Multiple connect “chat”
- DX Cluster
- Satellite Tracking (Server)



Existing Node Connections



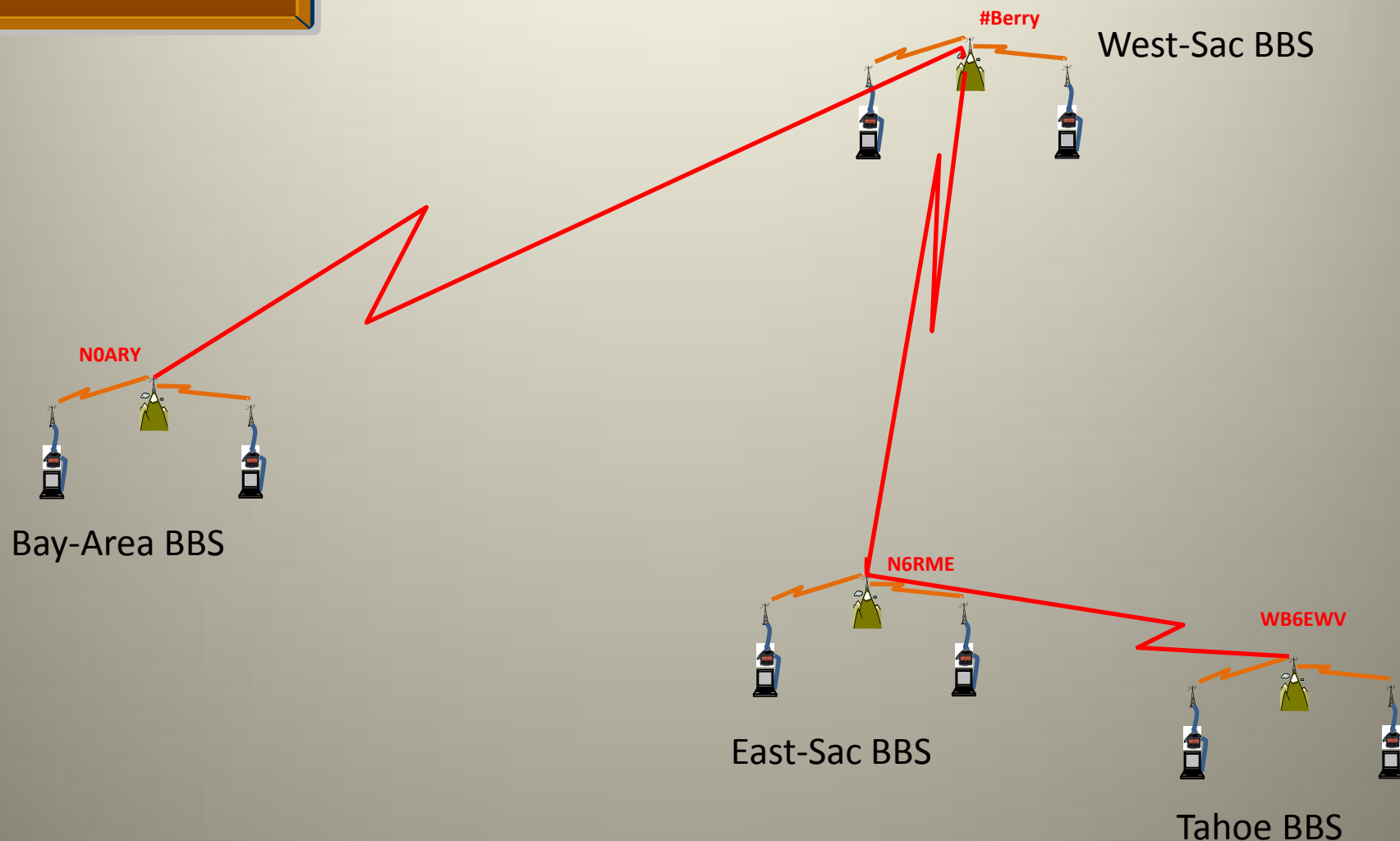


The Plan

- Phase 1 – Nodes at Berryessa Site
 - 144.370 Packet Node – User channel
 - 223.6 MHz Packet Node - Forwarding only
 - BBS located at AG6QO home QTH in Winters
 - Access coverage greatly expanded by Berry nodes.
 - Internet access provided by AG6QO
- Phase 2 – BBS at Berryessa Site
 - BBS on repeater site; add Internet internet service
 - Removes messaging latency (delays)



BBS “Backbone” Fwd.





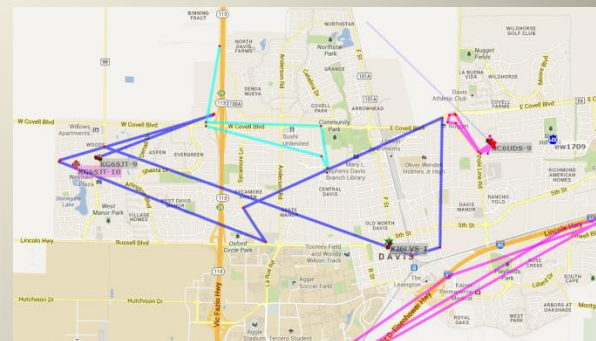
Motives

- Re-establish local, regional, and state amateur vhf message forwarding network
- Provide a hub for regional emergency services (ARES)
- Promote formal (NTS) message handling access
- Participate in the development of next-generation amateur forwarding/switching software (BBS 2.0 * ∞)
 - Open source ; add your own improvements
- As with all of amateur radio:
 - Not intended as a replacement for the internet
 - Is intended as backup communications
 - Provides rich platform for experimentation and innovation



Diverse Uses

- Commercial-channel independent
 - If the internet is down, we're still UP !
- Club, ARES, NTS, public service
 - Tactical Hub – auto-forward, forward to PMBX
 - Out-of-area message handling
 - File sharing – tactical data storage and retrieval
- APRS Gateway
 - Can be used to forward position, weather, or other information of a tactical nature via APRS-IS or locally without APRS-IS.
- Endless possibilities with “open-source” add-on “servers”.
- Accessible via POP/SMTP mail client and Outlook “front-ends”.
- Future: Accessible via WinLink





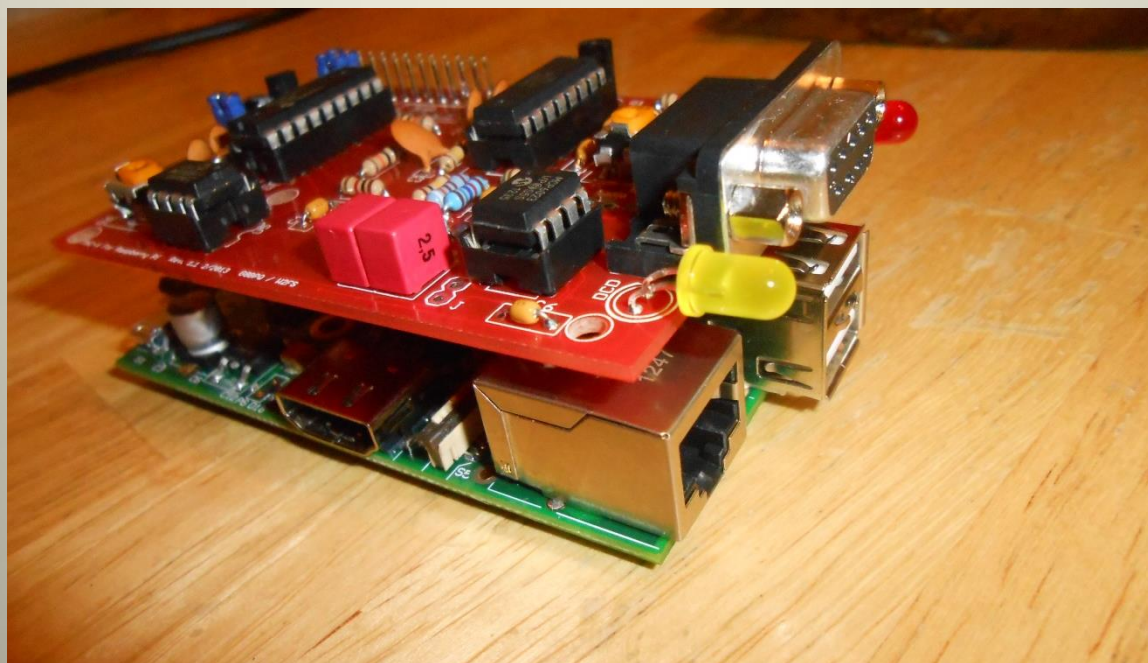
AG6QO BBS Hardware

- Computer - Raspberry Pi Model B
 - 700 MHz ARM11
 - Videocore 4 GPU - HDMI
 - 100 base T – network
 - <http://www.raspberrypi.org/faqs>
 - Running Debian Linux
- TNC - TNCPi
 - KISS-mode TNC sized to mate with RPi
 - <http://www.tnc-x.com/TNCPi.htm>
- RF User-channel
 - Kenwood TM-V71A
 - 2m transceiver – 25W – 144.370 MHz
 - http://www.kenwoodusa.com/communications/amateur_radio/mobiles/tm-v71a



TNC-Pi and Raspberry Pi

As they arrived.



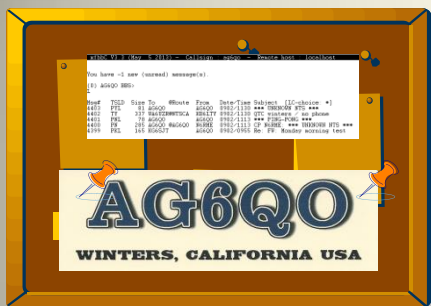
Finished

Raspberry Pi with one TNCpi
Basis of AG6QO BBS



AG6QO BBS Software

- F6BVP bundled distribution
 - Debian Linux / AX25 – with all the trimmings !
 - FPAC node package (ROSE, NETROM, FlexNet, etc.)
 - FBB Bulletin Board System
 - Includes webserver, telnet, bluetooth, APRS daemon, DX cluster, etc, etc etc!
 - http://f6bvp.org/AX25_BBS_Node_RaspBerry_Pi_install.html



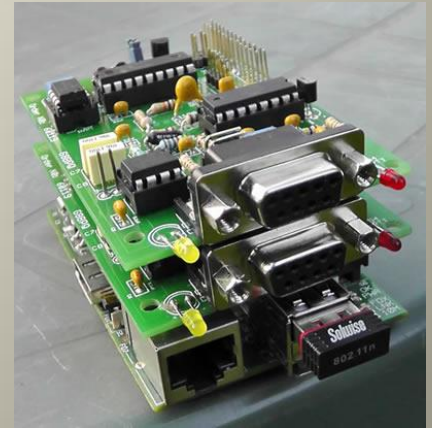
Current Status

- Online and On-air 24/7
- Emergency Power Available, but not automatic.
 - Fully automatic emergency power with 2 weeks.
- Forwarding via internet; N6RME, N0ARY, N6MEF, and W2XSC
 - General traffic
 - NTS traffic
- User Channel available: 144.370 MHz
- Telnet access on request



Very Soon

- Local 223.6 MHz forwarding “backbone”
 - RF Forwarding-channel
 - Alinco DR-235T - 1.25 m transceiver - 25W
 - Two stacked TNCpi's
- APRS Gateway
- DX Cluster
- Satellite Tracking (Server)
- Regional user-access via wide-coverage 2m node
- Regional forwarding via wide-coverage RF “backbone”





Proposed 2m BERR37 Node

BBS in Winters

WINTBB
AG6QO-1
(WINTBB)
Winters



BERR37
Node
144.370 MHz
Mt. Berryessa



Relay Node Mt. Berryessa

Yolo User



```
xifbbC V3.3 (May 5 2013) - Callsign : ag6qo - Remote host : localhost
(0) AG6QO BBS>
IM
Msg#  TSID  Size  To    @Route  From  Date/Time  Subject [LC-choice: *]
4400   PY     285  AG6QO  @AG6QO  N6RME  0902/1113  CP N6RME: *** UNKNOWN NTS ***
4393   PYL     693  AG6QO  @AG6QO  K6SJT  0902/0754  FV: Monday morning test
4386   PY     1008  AG6QO  @AG6QO  K4GEB  0902/0430  Re: Y
4383   PY     940  AG6QO  @AG6QO  N6RME  0902/0030  Re: CP N6RME: reply to 14
4375   PVL     419  AG6QO  @AG6QO  K6SJT  0901/2128  Hi Joe
4365   PY     736  AG6QO  @AG6QO  N6RME  0901/1631  CP N6RME: reply to 14
4352   PY     934  AG6QO  @AG6QO  N6RME  0901/1013  Re: NTS Traffice for 95694
4337   PY     391  AG6QO  @AG6QO  KB6LTY 0831/1736  Dupl reply to 14
4241   PY     1373  AG6QO  @AG6QO  WA6EWV 0827/1536  Re: Introduction
```



Proposed 1.25m #BERRY Node

BBS in Winters

AG6QO-1
(WINTBB)
Winters



#BERRY
223.6 MHz
Mt. Berryessa



Backbone Relay Node Mt. Berryessa

Forwarding Partners

N6RME
BBS





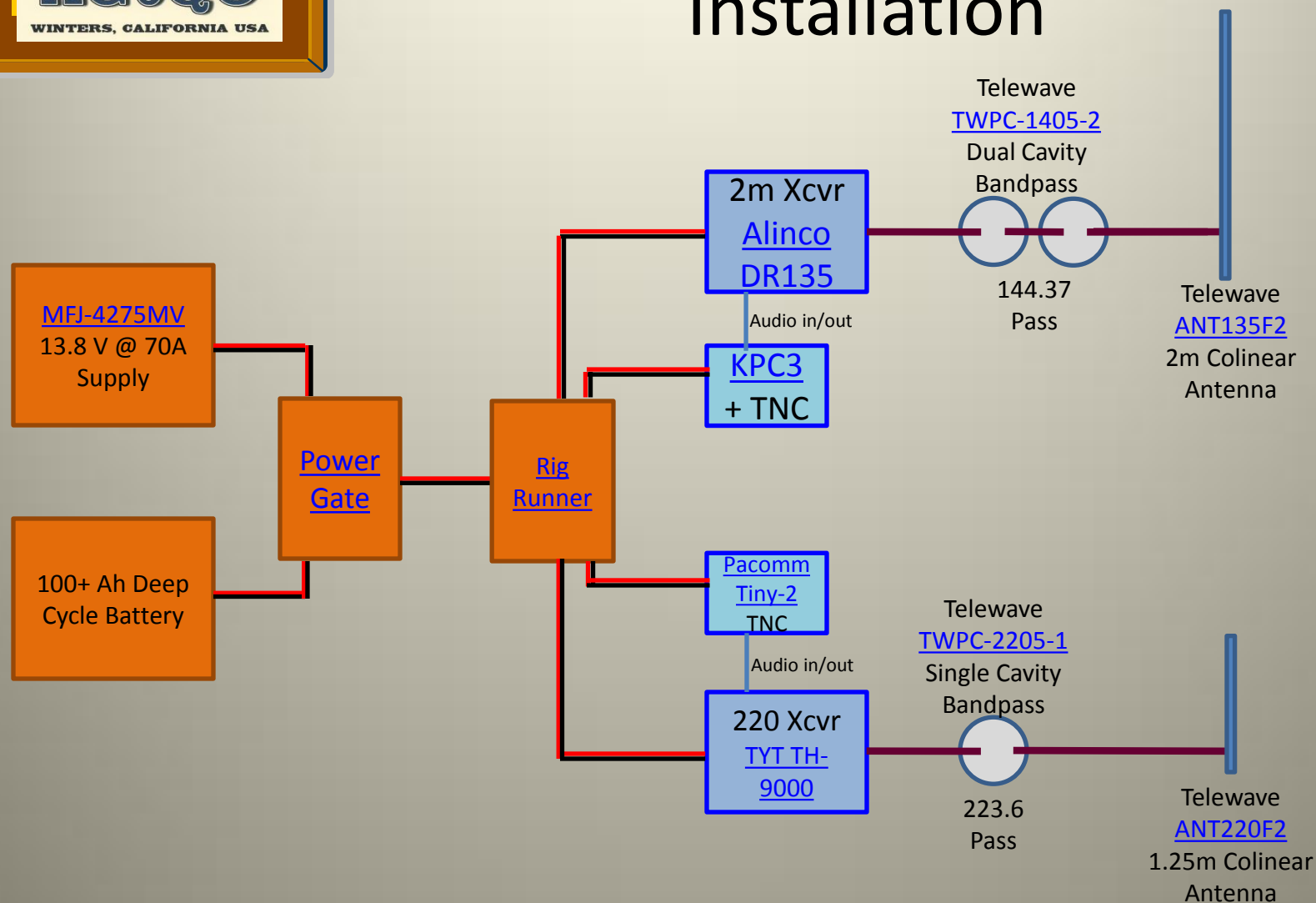
Proposed #BERRY Node

- TYT TH-9000 Transceiver (55 Watts)
 - With a Pacomm Tiny-2 Mark II with TheNet node firmware version 2.08B.
- Telewave Antenna





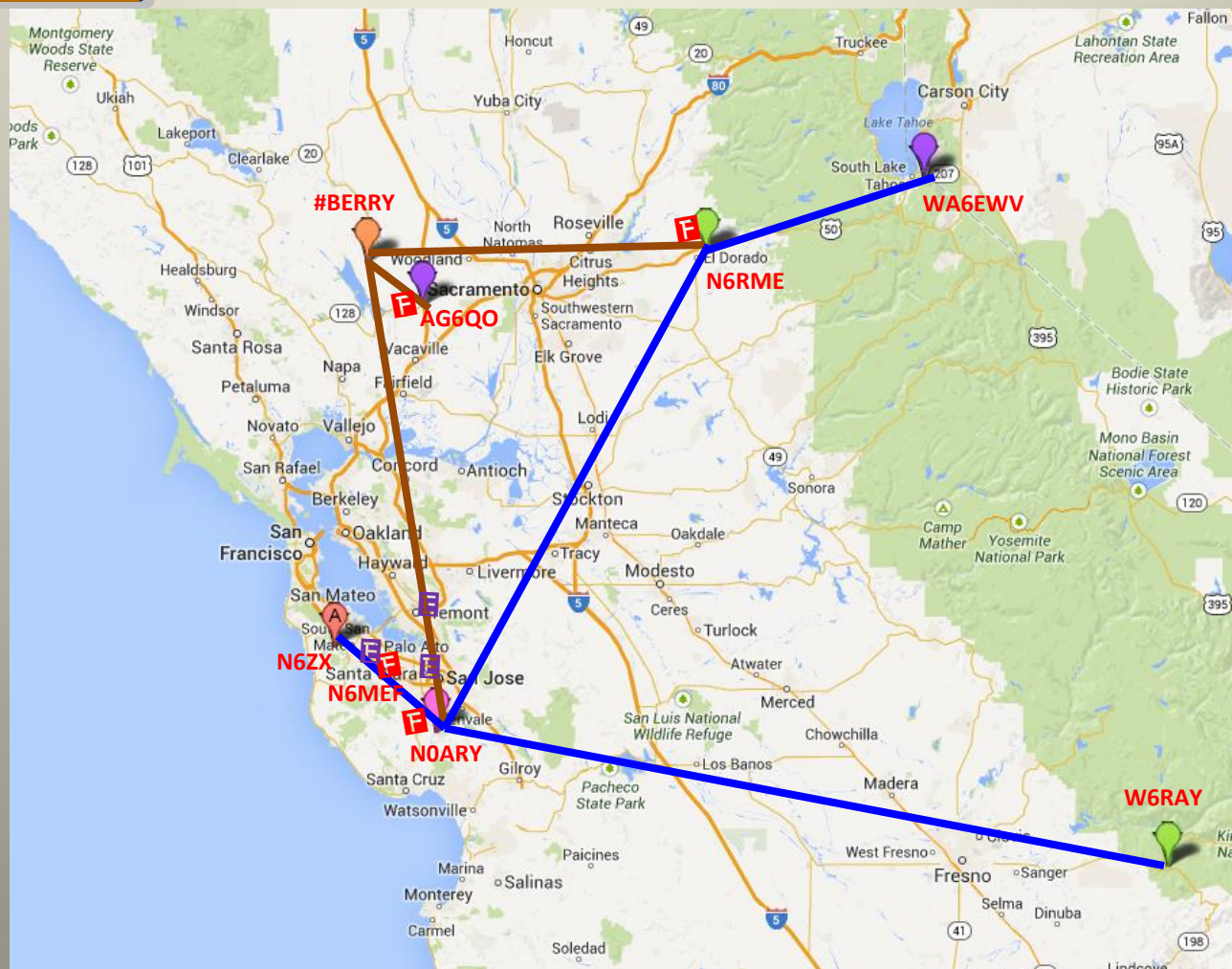
Schematic of Berryessa Installation





223.6 MHz Backbone

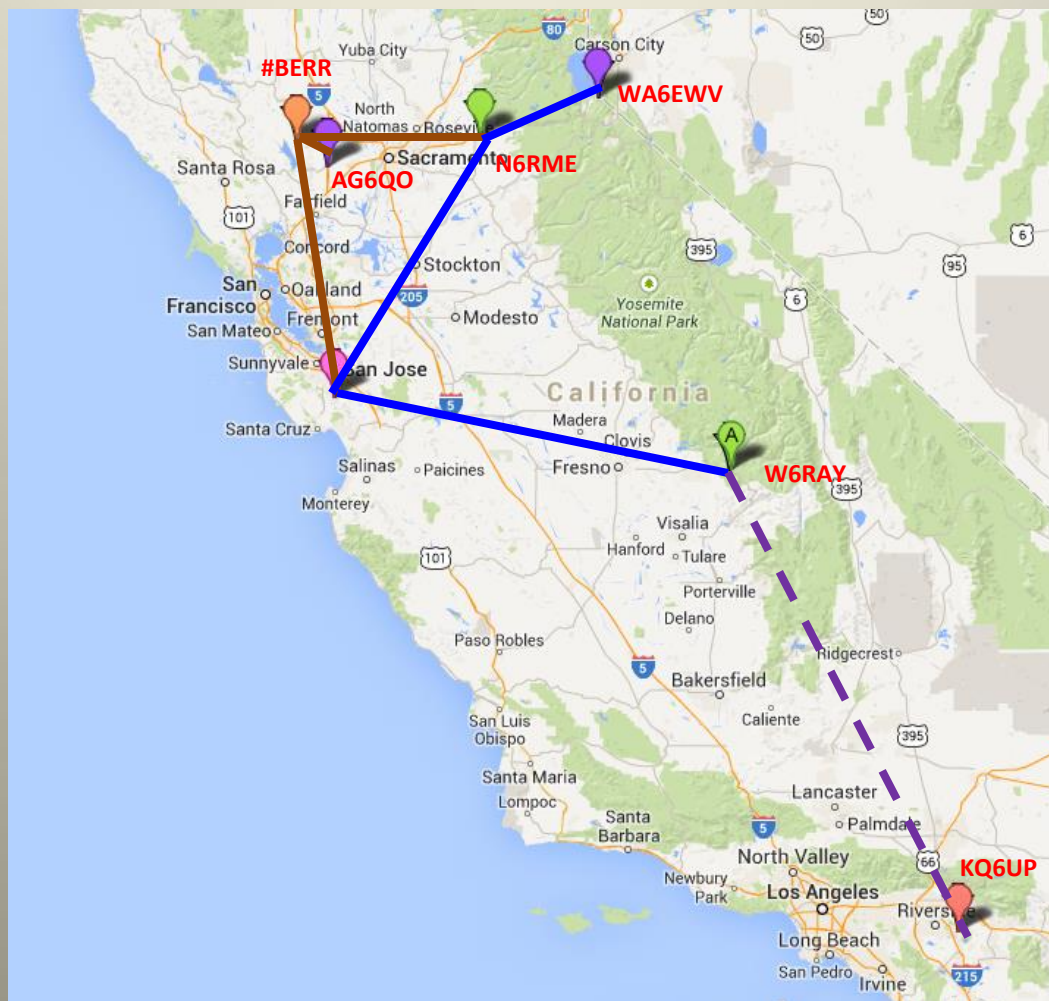
- Existing
- Proposed
- F Currently Internet Forwarding
- E Planned Link w Santa Clara ARES/RACES/CERT





223.6 MHz Backbone

- Existing
- Proposed
- Possible





#BERRY to N6RME

223.6 MHz Link

Great-circle distance between two points

Enter the co-ordinates into the text boxes to try out the calculations. A variety of formats are accepted, principally:

- deg-min-sec suffixed with N/S/E/W (e.g. 40°44'55"N, 73 59 11W), or
- signed decimal degrees without compass direction, where negative indicates west/south (e.g. 40.7486, -73.9864):

Point 1: 38.66394 , -122.18870

Point 2: 38.69585 , -120.81667

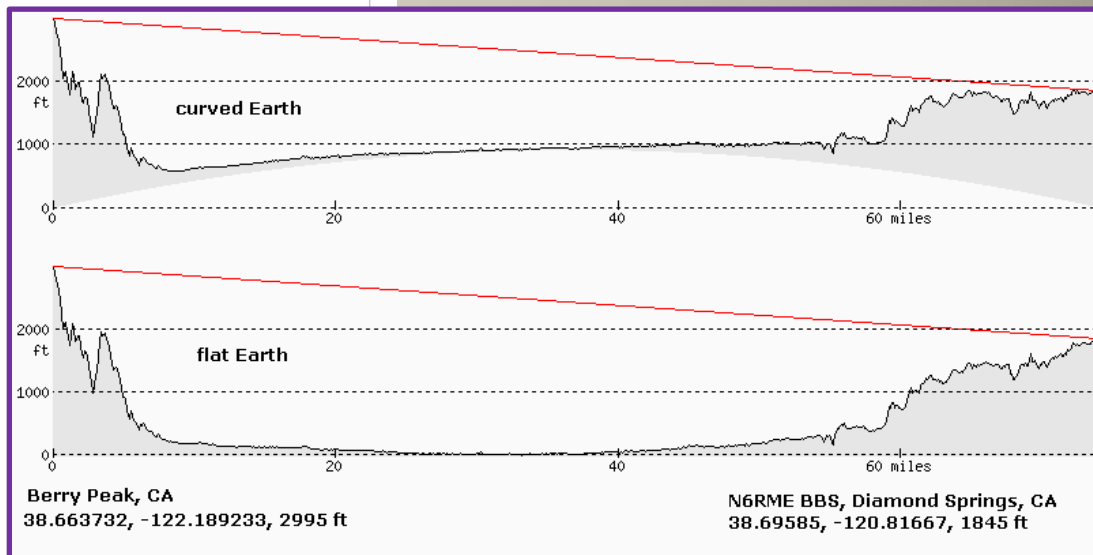
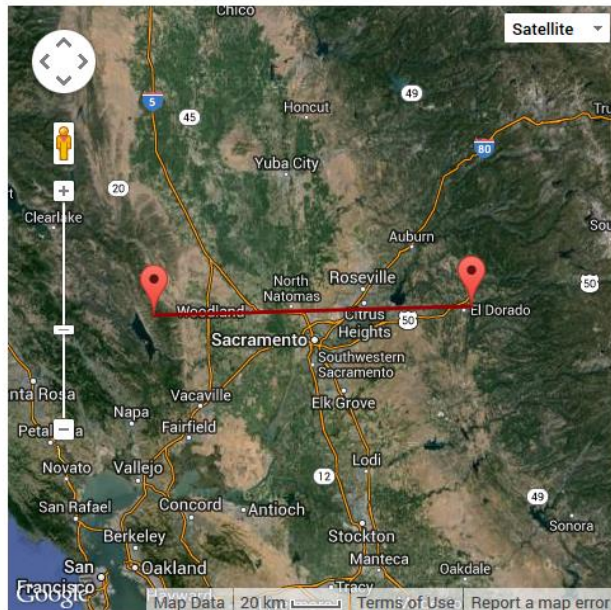
Distance: **119.1 km** (to 4 SF^m)

Initial bearing: **087°51'53"**

Final bearing: **088°43'20"**

Midpoint: **38°40'55"N, 121°30'10"W**

... hide map





#BERRY to NOARY

223.6 MHz Link

Great-circle distance between two points

Enter the co-ordinates into the text boxes to try out the calculations. A variety of formats are accepted, principally:

- deg-min-sec suffixed with N/S/E/W (e.g. 40°44'55"N, 73 59 11W), or
- signed decimal degrees without compass direction, where negative indicates west/south (e.g. 40.7486, -73.9864):

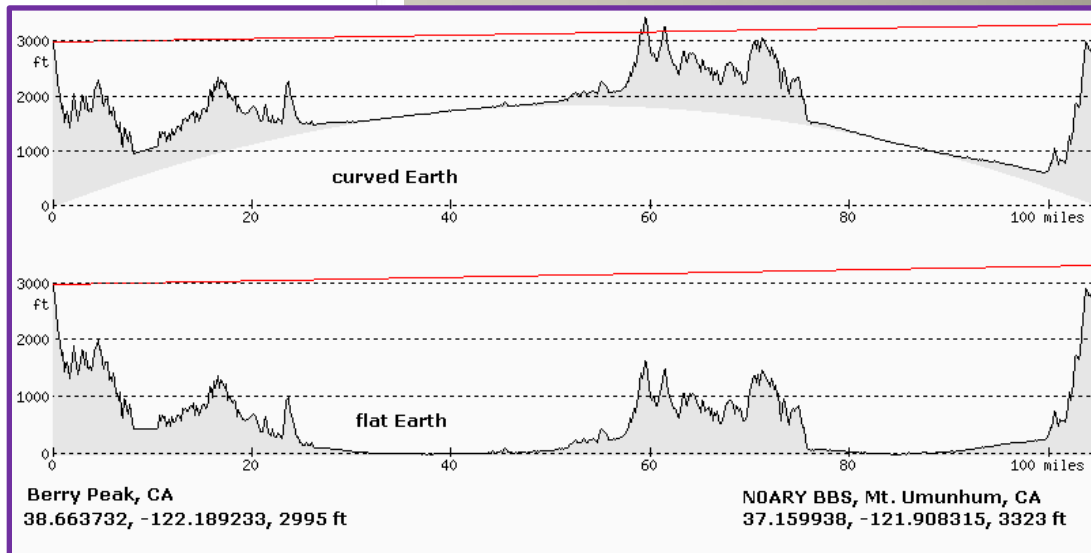
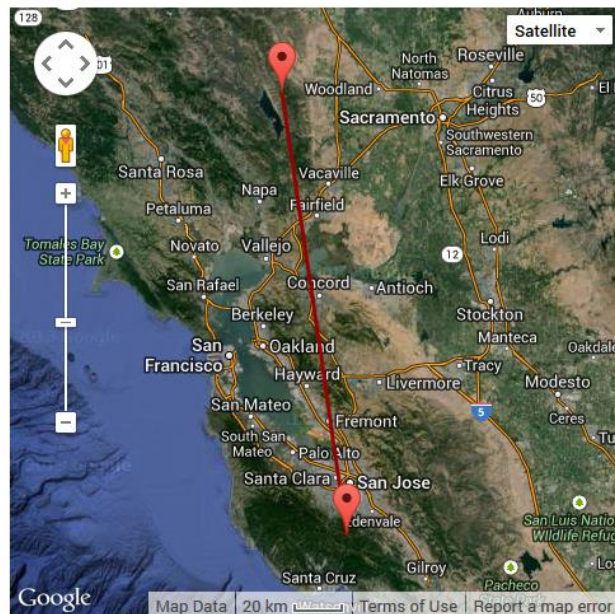
Point 1: , Distance: **169.0** km (to 4 SF⁰⁰)

Point 2: , Initial bearing: **171°32'47"**

Final bearing: **171°43'07"**

Midpoint: **37°54'43"N, 122°02'49"W**

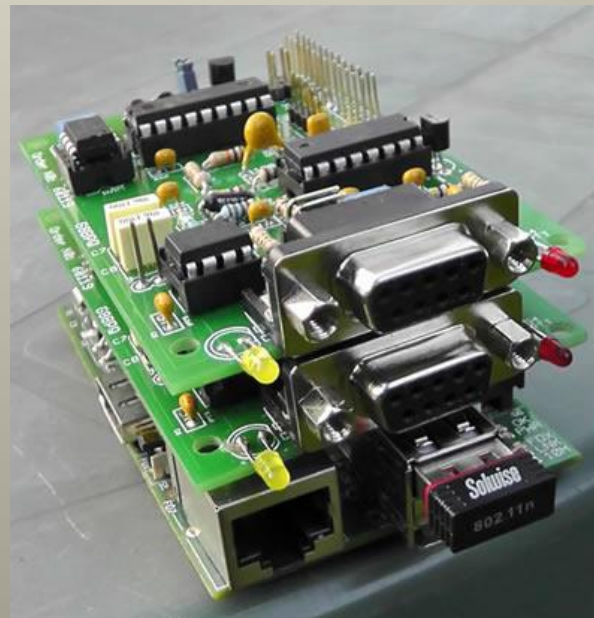
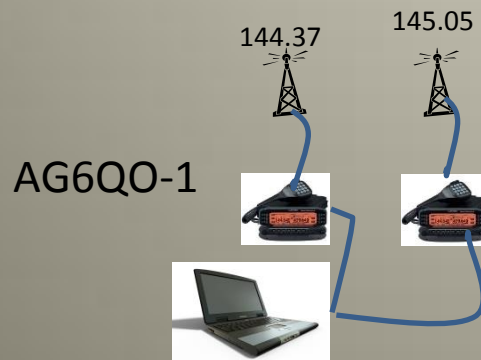
... hide map





Future Embellishments

- Multiple RF ports
 - Multiple Serial port TNCs
- HF ports
 - Long-haul, commercial-independent message forward.
- WinLink gateway
 - To internet email
- APRS Gateway
- More – ideas?





Why Packet / BBS for EC ?

- Fast:
 - Packet is much faster than voice
- Accurate:
 - Packet is far more accurate than voice, especially for data and difficult items like drug names.
- Deployable:
 - Packet is way more deployable than wifi or cellular data
- Meets served agency needs:
 - Agencies need data/forms.
 - Automatic logging, statistics, message tracking.



Currently used in EC

- Packet and BBSs are in use nationwide
- See the Sunnyvale and [Santa Clara](#) presentations.
 - <http://www.scc-ares-races.org/packet/presentations/SCCo Packet & CERT for San Mateo Co 121025.pdf>
- CT ARES - <http://www.ctares.org/>

Situation

1. Today, Cupertino uses packet to pass digital message traffic between Cupertino EOC and County EOC.
2. There are ham radio operators (some CARES, some not) staffing ICS positions at the ARCs.
3. During a full-scale emergency response, we may not have the staffing to cover voice communications and packet support at the ARCs.
4. Some alternatives for ARC communications staffing are:
 - SUVs... but first need to be trained
 - CERT as Packet Operators... with a Ham as a "Control Operators"
5. Cupertino OES has invested in packet kits for the ARCs

Packet Radio and Cupertino CERT

How will we deploy packet?

1. Operate in the EOC for EOC to County message handling
2. Start with the ARCs for ARC-to-City EOC message handling
3. Need to define the message requirements and develop message templates for ARC-to-EOC (structured) message handling
4. Leverage the County Packet infrastructure (BBSs)
5. Continue to align to the state message hierarchy protocol



Packet Radio and Cupertino CERT



Why Packet/BBS for Messaging?

- Store and Forward
 - Don't need to be online when sent
 - Like non-internet email
- White Pages
 - No need to remember complete address
 - Automatic routing to destination
- Full support for NTS
 - Zip code based addressing well established



Standard Message Interface

```
xfbbc V3.3 (May 5 2013) - Callsign : ag6qo - Remote host : localhost
[FBF-7.05e-AHMR$]
AG6QO BBS, Winters, CA
Hello Joe. 198 active messages, last is 4760, last listed is 4755.

Assigned channels:
BBS AG6QO-1 (software by F6FBB Linux version 7.05e)
OS : Linux Raspbian (Debian Wheezy) - kernel 3.6.11+
Local Time is 20:24 (+/-30 s)
Type I for more information - 73's Joe, AG6QO

You have 4 redundant message(s).
Please kill them with KM.

(0) AG6QO BBS>
lm

Msg#   TSLD   Size To      @Route From      Date/Time Subject [LC-choice: *]
4755   PYL    534 AG6QO   @AG6QO KG6SJT 0916/1338 RE: Welcome back
4751   PF     622 AG6QO   @AG6QO N6RME 0916/0729 another one...
4743   PF     115 AG6QO   @AG6QO N6MEF 0915/2313 DELIVERED: Testing
4718   PF    2007 AG6QO   @AG6QO N6RME 0915/1059 Re: test

(0) AG6QO BBS>
r 4755
From      : KG6SJT
To        : AG6QO
Type/Status : PY
Date/Time  : 16-Sep-13 13:38
BID (MID)  : 4755_AG6QO
Message #  : 4755
Subject    : RE: Welcome back

(This message has been read 6 times so far in this BBS).

HI Joe!

Back in Davis and the BBS is working great! THANK YOU!
It was lovely in the mountains. Actually caught a nice 14 inch trout that was de
licious!
```

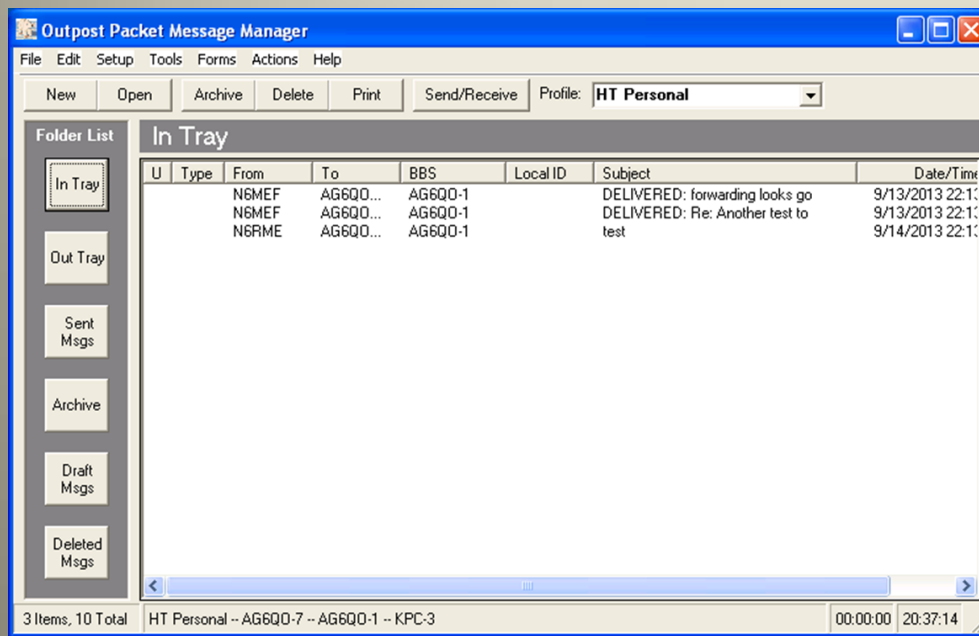
Requires “connect” command and login.

Requires individual commands to list, Read, and delete messages.



Outpost

Ideal for EMCOMM. “Focus on the message, not the medium.”



- Does all the connections and login for you.
- Automatically gets a message listing.
- Automatically downloads, and stores messages locally.
- Automatically “deletes” the messages from the BBS.
- Automatically logs out.
- Contains standard message forms.

<http://www.outpostpm.org/>



References

- AG6QO BBS web log
 - <http://www.ag6qo.com/PiPBBS.html>
 - Links, Hints/Tips, Status, more links @ ag6qo.com
 - Presentation: <http://www.ag6qo.com/AG6QO Packet BBS YARS.pdf>
- Sunnyvale EMCOMM
 - <http://www.outpostpm.org/docs/fbb-implementation-guide.pdf>
- Santa Clara ARES/RACES
 - <http://www.scc-ares-races.org/packet/presentations/SCCo Packet & CERT for San Mateo Co 121025.pdf>
 - <http://www.scc-ares-races.org/packet/presentations/Alameda Packet 110325.pdf>
- CT ARES - <http://www.ctares.org/>
- NCPA – N CA packet BBS frequency coordination
 - <http://ncpa.n0ary.org/bbsindex.html>



QUESTIONS?



THANK YOU !

BACKUP SLIDES



BARK Antennas

Possible

144.37MHz

BBS user

Proposed

BBS 223 MHz

Forwarding

BERRY

Packet

Antenna

Possible

144.37MHz

BBS user

KE6YUV Transmit

KE6YUV Receive



Note: Key Antenna position consideration: Coupling between BERRY antenna and 144.37 antenna. Only 680 kHz separation !



Shack Roof Location

Possible
144.37 MHz
Location



Guy
Wires

BERRY
Antenna

Close
coupling



Path To NOARY

Point 1: 38.66394 , -122.18870

Point 2: 37.159938 , -121.908315

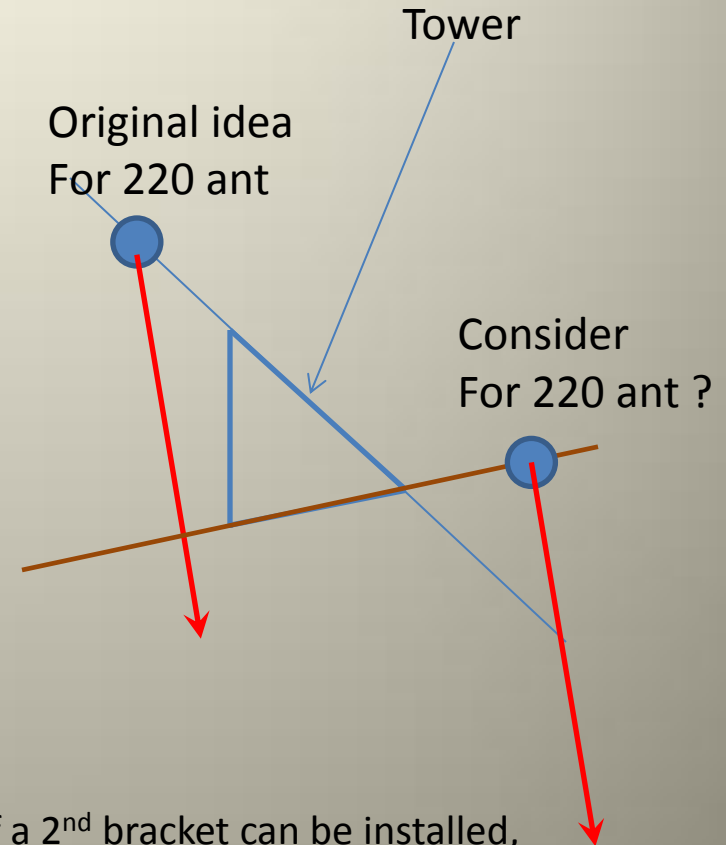
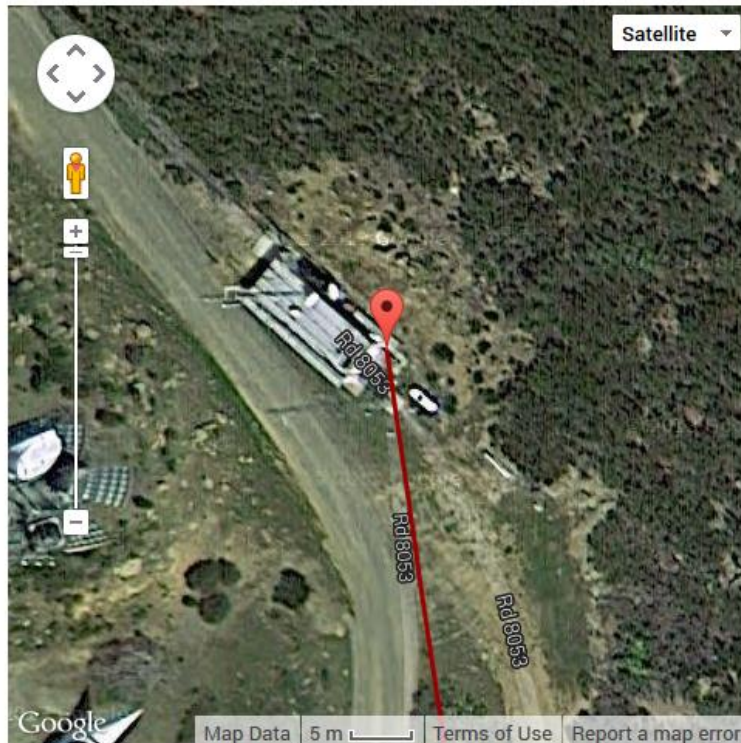
Distance: **169.0** km (to 4 SF^{*})

Initial bearing: **171°32'47"**

Final bearing: **171°43'07"**

Midpoint: **37°54'43"N, 122°02'49"W**

... [hide map](#)



If a 2nd bracket can be installed,
Perhaps the original position should be
The 2m antenna, which is for local access
Rather than 220 which is for N6RME and
NOARY forwarding?



K6WLS Mobile



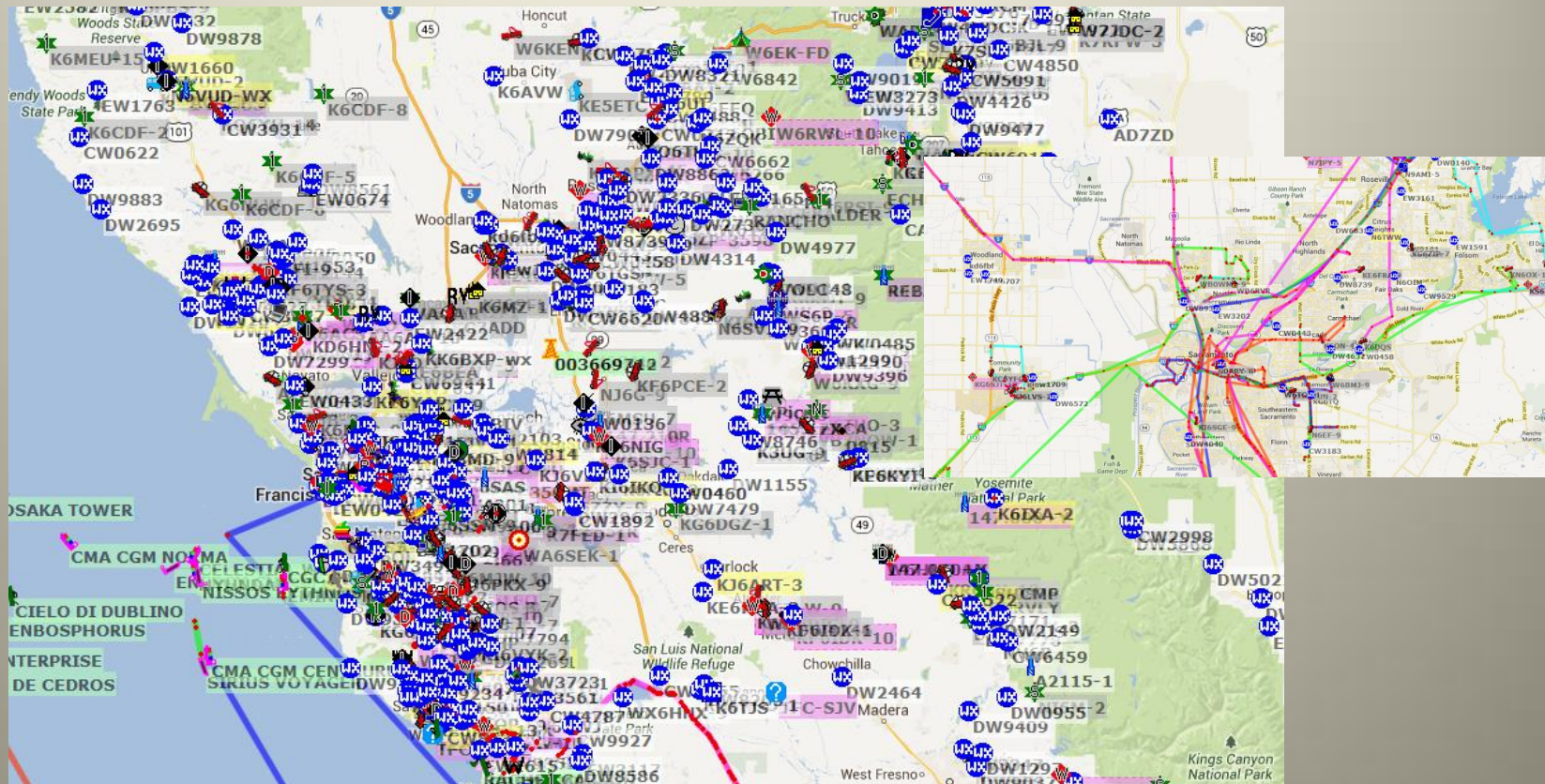


BBS Node Location





Proliferation of Packet



Each APRS station represents a packet user and potential BBS user.