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2013 End of Year Summary

Santa Clara County ARES®/RACES
Last Updated 10-Dec-2013

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Learning Objective

By the end of this class, you will:

- Understand the changes to training classes and operations procedures that occurred during 2013

- Be aware of some additional changes that are coming soon

Agenda

- Enhancements to "Antenna Fundamentals" class
- Enhancements to packet network
- Enhancements to training program
- Message passing and logging

Antenna Fundamentals
End of Year Summary

Santa Clara County ARES®/RACES

Last Updated 12-02-2013

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All You Need to Know about Antennas

$$\nabla \cdot \mathbf{D} = \rho$$

$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$$

Maxwell's Equations

6

What is a decibel?

- The **decibel** (**dB**) is a logarithmic unit that indicates the **ratio** of a physical quantity (usually power) to a specified reference level.

$$dB = 10 \ Log_{10} \ (P_{meas}/P_{ref})$$

1 dB =	26% change
3 dB =	2 times change
10 dB =	10 times change
20 dB =	100 times change

- 1 dB is the smallest change in sound detectable by an average listener

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Antenna Gain

Gain – ratio of power received (or transmitted) in a specific direction (azimuth and elevation) relative to a reference source

- Gain is quoted for the point of maximum gain
- May be for antenna in free space (typical)
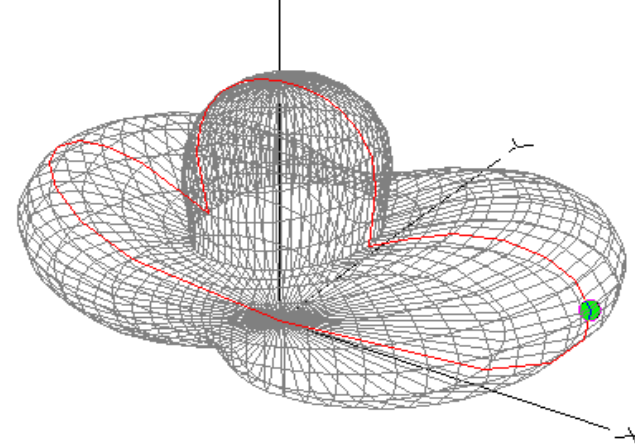- Or above the ground and includes ground effects

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Antenna Pattern

Pattern – a collection of gain measurements for a range of angles in azimuth and elevation

May be a table or graphical view

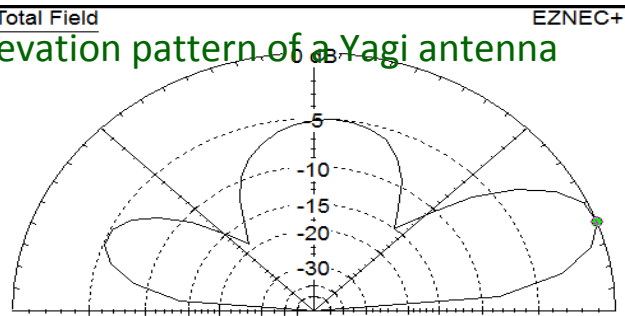9

3D Pattern of a Yagi (beam) Antenna

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Elevation pattern of a Yagi antenna

11

Azimuth pattern of a Yagi antenna

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½ Wave Vertical Dipole in Free Space

3 D view   Elevation Pattern

½ Wave Vertical Dipole 10 ft high

3D View   Elevation Pattern

- Note the null directly above the antenna

Typical Antenna Gain Specifications

- dBi – dB referenced to an isotropic antenna
  - Isotropic antenna radiates equally in all directions
- dBd – dB referenced to a dipole antenna

        0 dBd = 2.15 dBi

Typical gains

¼ wave ground plane	0 dBd	2.15 dBi
½ wave dipole	0 dBd	2.15 dBi
J-pole (end fed ½ wave)	0 dBd	2.15 dBi

- For antennas likely to be used for ARES/RACES other factors will be important
  - Portability, mounting, weight, supporting structure, etc.

Antenna Placement

- Perform a site survey and assess
  - Overhead wires and other hazards
  - Traffic patterns, non-intrusive to others
  - Location relative to operating position
  - **Where will the cables go?**
- Clear path to intended users
  - Height
  - Building blockages
- Tradeoffs
  - Minimize trip/fall hazards
  - High enough for needed coverage, low enough to be safe
    - Wind
    - Stability of supporting structures, tripods, etc.

Antenna Placement

- For multiple radios, exploit the pattern nulls
  - Use vertical separation
  - Horizontal separation may help, as well
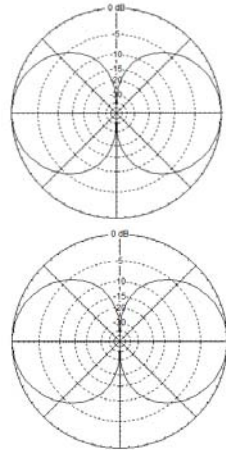
Coax Cable

Connecting the radio to the antenna

Anatomy of Coax Cable

Outer Conductor

Dielectric
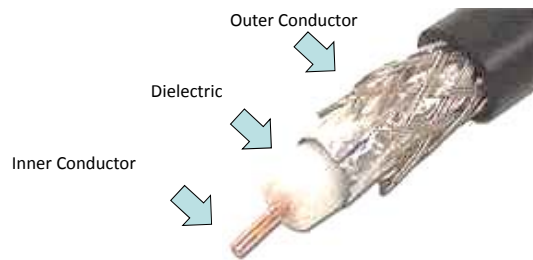
Inner Conductor

- Impedance depends on ratio of diameters of Inner and Outer conductors and type of dielectric
- Power handling and loss depends of insulating qualities of the dielectric

Common Types of Coax Cable

- Table of common cable types and approximate losses at VHF/UHF

		Loss per 100 ft.		
	Dia	144 MHz	440 MHz	Cost/ft
RG-58	0.195"	7.6	13.0	$ 0.59
RG-8X	0.242"	4.8	8.4	$ 0.59
LMR 240	0.240"	3.4	5.2	$ 0.79
RG-8U	0.405"	2.6	4.4	$ 1.59
RG-213	0.405"	3.0	5.0	$ 1.69
9913	0.405"	1.8	2.9	$ 1.49
LMR 400	0.400"	1.7	2.7	$ 0.99

What is SWR?

- Standing Wave Ratio (SWR)
  - Measure of the amount of power that goes into the antenna compared to the power reflected back to the radio
  - 1.0   No reflected power, perfect match
  - 1.5   20% reflected power
  - 2.0   33% reflected power
    For VHF/UHF, you should keep SWR below 2.0

- Most commercial antennas will be below 2.0 SWR "out of the box"
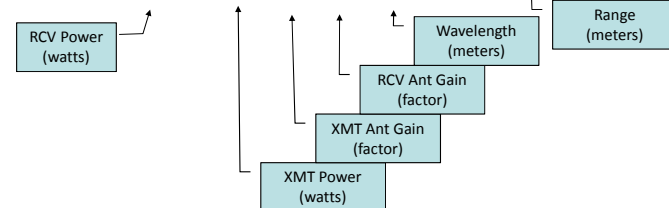- Can be checked with an SWR meter or Antenna Analyzer

"On a clear day, you can talk forever"

All you need to know….
(in real numbers, not dB)

$$P_r = P_t\ G_t\ G_r\ \lambda^2/(4\ \pi\ r)^2$$

RCV Power (watts)

Wavelength (meters)

Range (meters)

RCV Ant Gain (factor)

XMT Ant Gain (factor)

XMT Power (watts)

In Decibel form…

$$P_{r(dBw)} = P_{t(dBw)} + G_{t(dBi)} + G_{r\ (dBi)} - \alpha$$

Path loss $\alpha = 20 \log(Rf) + 37.8$

R = range in NM, f = freq in MHz

- How far can you talk with a 5 w HT on 2m with dipole antennas? ARRL says -117dBm is a good FM signal

$$-117_{dBm} = 37_{dBm} + 2.1_{dBi} + 2.1_{dBi} - \alpha_{dB}$$

$$\alpha = 117 + 37 + 2.1 + 2.1 = 158.2$$

$$158.2 = 20 \log (R * 146) + 37.8$$

$$R = 7,172\ NM$$

Limitations to Line of Sight

- Obstacles
  - Buildings, hills, mountains, canyons, etc.

- Curvature of the earth –
  - Signal travels in a straight line
  - When it hits the horizon it goes straight into space

- Farthest you can on Earth is when both parties share a common horizon
- Radio Horizon = $1.4 * \sqrt{H(ft)}$ miles

Radio Horizon at 146 MHz

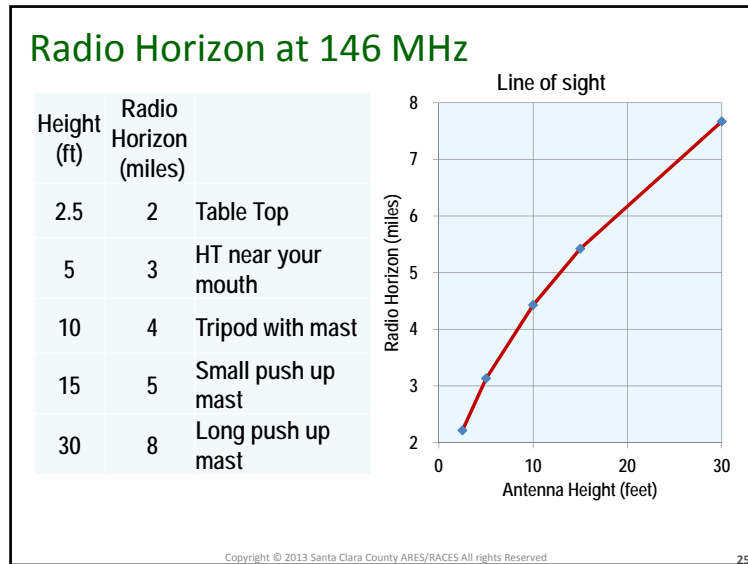| Height (ft)	Radio Horizon (miles)	
2.5	2	Table Top
5	3	HT near your mouth
10	4	Tripod with mast
15	5	Small push up mast
30	8	Long push up mast

Line of sight

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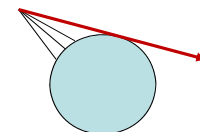
RF Safety Evaluation

- License requires evaluation
- FCC Bulletin OET 65 Appendix B is written specifically for hams
- Keep human exposure below specified levels
- Table shows when evaluation is required
- Power level includes both transmitter power and isotropic gain of antenna
  - Dipole => 2.15dBi

Band	Power	Band	Power
160m	500 W	6m	50 W
80	500	2	50
40	500	1.25	50
30	425	70	70
20	225	33	150
17	125	23	200
15	100	13	250
12	75		
10	50		

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From OET Bulletin 65 Appendix B…

- VHF/UHF - Less than 50 watts radiated, no evaluation needed
- Safe exposure distance from the antenna for 50 watt transmitter and antenna from Bulletin 65 (worst case)

Safe Distance (includes antenna height

	(dBi)	(feet)
144(2m)	3	10.6
	6	14.9
222(1.25m)	3	10.6
	6	14.9
450 (70 cm)	3	8.6
	6	12.2

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Packet Networking
2013 End of Year Summary

Santa Clara County ARES®/RACES

Last Updated 10-Dec-2013

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Agenda

- Outpost Enhancements
- PacFORMS Enhancements
- Network Enhancements
- Preview of Upcoming Enhancements

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Outpost Enhancements

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Profiles

- Allows different combinations of Outpost settings to be stored under a single profile name
  - Example: Primary and backup BBS, TNC selection
- Switch between profiles without restarting Outpost
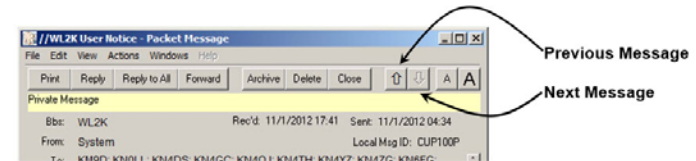- "Outpost" profile is set with the default Santa Clara County Settings
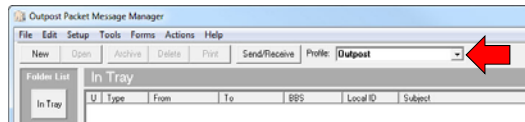
31

Message Navigation

- Up and Down arrows on message forms allow easy movement to previous or next message
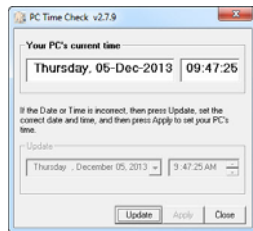- No need to close message, then open next message

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PC Time Check

- Old and/or seldom-used PCs are usually not set to the correct time
- Outpost and PacFORMS use PC time
- Causes incorrect and confusing information
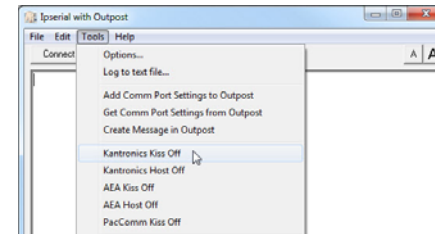- On startup, Outpost now displays current time and offers chance to update it

Ipserial: Turn off KISS and HOST modes

- Some other packet applications may not properly exit KISS or HOST mode
- Return to command mode requires sending obscure control characters to the TNC (or else full reset!)
- New Ipserial menu options do this for you!

New Serial Comm Library

- Previous
  - Worked great with hardware comm ports
  - Struggled with USB-to-Serial adaptors on Windows7 64 bit machines.
- This new library offers several improvements
  - Better USB-to-serial adaptor tolerance
  - Outpost now recognizes comm ports up to COM99
  - Better Linux/Wine operability. While Outpost still does not run native on Linux and it has not been fully tested, it now works with both hardware serial ports and USB-to-Serial adaptors on Linux.
    !!! Until fully tested, Outpost on Linux should be considered a Pilot.

USB-to-Serial Adapter Testing

- 13 of the most common USB-to-Serial adapters were tested with Outpost
- Information on selecting adapters posted to web site
  - http://www.scc-ares-races.org/packet/usb-serial-adapters.html
- Adapter test results summarized and posted to scc-packet
  - http://groups.yahoo.com/group/scc-packet

Global Message Numbering

- What Is It?
  - Outpost automatically generates the next message number when you send a new message
  - Profiles were added in the last version, but message numbering was on a per-profile basis
  - If you don't pay attention to how you set up the profiles, you could cause duplicate message numbers
  - Example:
    - Create Profile 1, next message number = 100
    - Create Profile 2, next message number = 100
    - Send a message using Profile 1; assigned msg # is 100
    - Switch to Profile 2
    - Send a message using Profile 2: assigned msg # is 100; **Duplicate!**

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Global Message Numbering

- How to Use It
- Global message numbering is now the default
- To update old profiles …
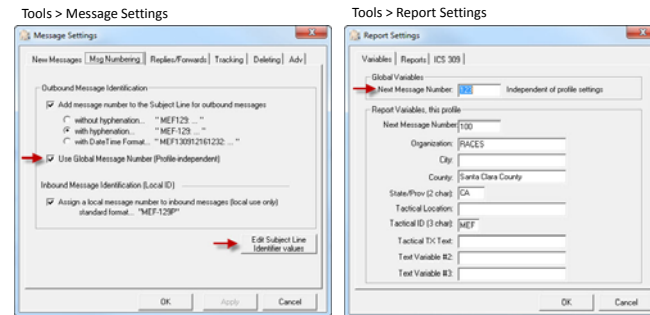
Tools > Message Settings   Tools > Report Settings

38

New Default Message Number Format

- Improves readability
  - FS1234 vs. FS1-234
- Update your old profiles
  - Tools > Message Settings
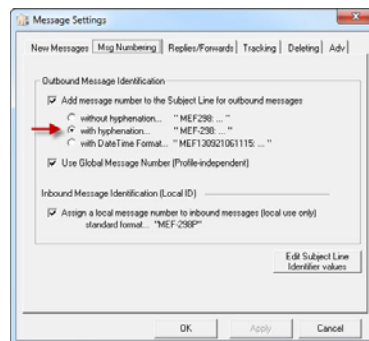
39

Improved Address Handling

- BBS-style
  - Allows use of "#" character (ex: kn6pe@w1xsc.#nca.ca.usa.noam)
- SMTP-style
  - Now supports standard address formats (with/without "< >")
  - Allows use of 2-char top-level-domains (ex: user@host.domain.**eu**)
  - No longer sends delivery receipts to "mailer-daemon"
    - Considered bad practice to respond to mailer system messages
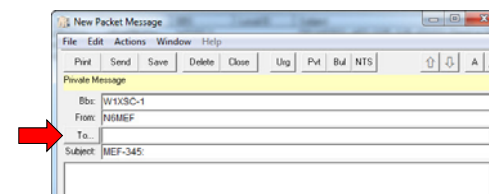
40

New TNC Command Files

- Optimizes channel utilization for two additional TNCs:

  – MFJ 127X
  – TAPR TNC2
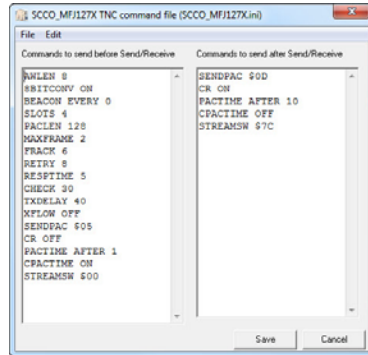
Return of Generic ICS-213 Form

- Use XSC ICS-213 Message Form in Santa Clara County
- Use Generic ICS-213 Message Form elsewhere
  – Communications to/from Regional EOC
  – Communications to/from other counties
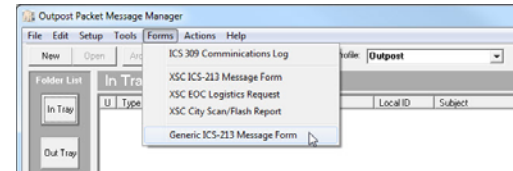
PacFORMS Enhancements

New Logistics Form

- Matches updated form in county EOC

7-bit Compatibility

- Previously, PacFORMS used some 8-bit ASCII characters (¿¥€) for internal formatting purposes
- These were normally stripped out when the PacFORM was received and displayed in the browser
- But if a 7-bit system was in the transmission path, these characters would be corrupted, resulting in lost formatting and extra "?" symbols in messages
  - Examples: e-mail systems; some really old TNCs
- PacFORMS now uses only 7-bit ASCII characters

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Network Enhancements

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Bulletin Area Name Change

Name	Purpose & Usage
xscperm	• Official operating info needed by all network users every day • Examples: tactical call list, primary and alternate BBS assignments, frequency list • Replaced previous "perm" area • Does not expire; requires sysop to remove bulletins
xscevent	• Official operating info related to emergency incidents, public service events, drills or other types of activations • Information changes over time • Examples: official instructions, plans or informational updates specific to the current activation, current operational period • Expires after one day
xsctest	• Unofficial. For testing purposes only. • Users can send test bulletins here to avoid using official bulletin areas • Expires after one day
allxsc	• Multi-purpose bulletin area for future use

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W1XSC Frequency Change

- 2m access frequency on W1XSC changed
  - Previous: 144.990 MHz
  - **Current: 145.750 MHz**
- New frequency is in repeater-prohibited portion of the band

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Two-way E-mail Gateways

- Outbound:
  - Address just like any e-mail application:
    - Example: fat.joey@donutsaremylife.com
- Inbound:
  - <callsign>@<bbscall>.ampr.org
  - FCC Call signs: w6xrl4@w2xsc.ampr.org
  - Tactical Call Signs: xndeoc@w4xsc.ampr.org
- Be sure to set e-mail client to plain text mode
  - Otherwise message may be 10x (or more) larger!
- Redundancy
  - Currently using 3 different ISPs in three different parts of the county

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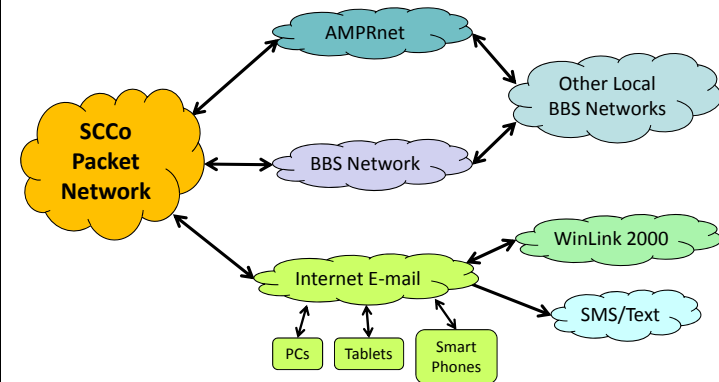
We Are Well Connected!

50

Packet Network Addressing Web Page

- Our network connects to several other networks, each with different address formats

- New web page provides a "cheat sheet" for how to address message to or from any other network type

- Useful in your packet go kit

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Other Documentation Updates

- PDFs (http://www.scc-ares-races.org/packet.html)
  - Standard Outpost Configuration Instructions
  - Standard TNC Parameter Settings
  - Standard Format for Packet Message Subject Line
  - How to Send a Message with Outpost
- Web page updates:
  - http://www.scc-ares-races.org/freqs/packet-freqs.html
  - http://www.scc-ares-races.org/packet.html
  - http://www.scc-ares-races.org/packet/packet-addressing.html

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Preview of Upcoming Data Networking Enhancements

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Section-wide BBS Forwarding via RF

- All surrounding counties can reach at least one of our BBSs by radio from their EOC
  - Monterey, San Benito, San Mateo, Santa Cruz
- But some use non-SCCo BBSs for their primary BBS
  - Santa Cruz uses N0ARY on Mt. Umunhum
  - San Mateo uses N6ZX on Skyline Drive above Woodside
- Forwarding to these other BBSs is currently done via Internet
- Working on forwarding via 1.25m band
- Will require swapping 220 frequencies between W2XSC (Crystal Peak) and W4XSC (Frazier Peak)
- Anticipate completion by January

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Enhanced Backbone Connectivity

- XSC BBSs currently connected via 1200 baud RF on 70 cm band
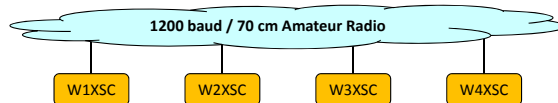
- Advantages
  - Reliable (1200 baud is VERY forgiving)
  - Easy to maintain (deviation can be set by ear, if necessary)
  - Has handled even the heaviest drill traffic without any problem
- Disadvantage
  - 440 radio/TNC failure can isolate an individual BBS
  - It does limit us if we want to move toward higher bandwidth services in the future, including large/binary attachments

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Enhanced Backbone Connectivity

- In 1Q2014, all sites will have higher speed, alternate connectivity of at least 64 kbps; 440 RF as backup
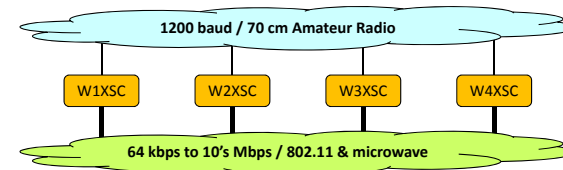
- Equipment in currently on order and will take some time to install (especially given winter weather)

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Mesh Networking

- Currently, user access speed is limited to 1200 baud on 2m or 1.25m bands
  - Advantages:
    - Deployable: *FROM ANYWHERE* in the county, *TO ANYWHERE* in the county, without the Internet or *ANY* additional infrastructure
    - Survivable: Access 2+ backbone sites from anywhere, no Internet required
    - Fast/Functional: Send small text messages about as fast as with Internet e-mail (< 30 sec to send a form or text message)
  - Disadvantages:
    - Limits *reasonable* message size to approx. 10k bytes (+/-)
    - Limits traffic to text messages (no audio, video, or large binary file attachments)

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Mesh Networking

- Mesh networking may be a good option
  - Automatic configuration, operation
    - User doesn't need to know routing protocols
    - Cover as much or as little as local hams desire
  - Operates at multiple Mbps
    - Multiple traffic types: voice, video, large binary files
  - Low cost hardware is available on eBay; easy to update
  - Uses ham portions of 802.11 bands
    - We can use much better antennas, higher power (with no encryption)
- But … very, *VERY* line-of-site limited
  - Even trees are a problem at 2.4 GHz
  - It takes many, many nodes to reach the same distance as existing methods
- Still … we're going to give it a try …

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Mesh Networking

- Some initial "tinkering" underway; more in 2014
- For more information
  - http://www.broadband-hamnet.org/
    - Custom software and instructions
    - Read thoroughly before you buy anything!
- Come join the fun
  - http://groups.yahoo.com/group/scc-mesh
    - New Yahoo group set up to discuss mesh networking in Santa Clara County
  - SVECS Breakfast, January 25, 2014
    - http://www.svecs.net
    - Program: "Toward an Integrated Electronic Messaging System"
    - Covers enhancements to our data networking capabilities made over the last three years, plus a preview of what's coming next

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Training Program Changes

Santa Clara County ARES®/RACES

Last Updated 10-Dec-2013

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New Event Planning Class (Part 1 of 2)

- Intended audience
  - ECs and AECs
  - MAC Type 1 candidates
  - Any others who will be planning events
- Prerequisite
  - Any type 2 class (Field Ops, Net Control, Packet)
- Agenda
  - Type of planning situations
  - The planning process
  - Planning an event
  - Problems and pitfalls

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Night Classes

- Saturday morning classes not possible for some
  - Work or family obligations
- We will experiment with night classes in 2014
- Field Operations classes will be the first such trial
- Attendance and feedback will determine what happens after that
- Check the event schedule for details

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Messaging Passing and Logging

Santa Clara County ARES®/RACES

Last Updated 10-Dec-2013

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A few reminders …

… based on experience from recent events

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Prowords

- Introductory Words for Groups
  - Said BEFORE the object to which they refer
  - Examples: "figures", "telephone figures", "initial", "initials", "mixed group", "mixed group figures", "amateur call", "email address", "packet address", "internet address", …

- Prowords, operational words
  - Said AFTER the object to which they refer
  - Examples: "I spell", "I say again", …

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Exercise: Prowords and Introductory Words

Use the proper prowords and introductory words to make sure the following information is properly conveyed:

- 123
- A123
- 123B
- 123 Apartment B
- 123 Apt B
- K Street
- Kay Street
- 1st Street
- 123 Apt B, K Street
- 456 Apt 4B, Kay Street
- 789 Ste B1, 1st Street

- N6MEF
- N6MEF/P
- (214) 867-5309
- w6xrl4@w2xsc.ampr.org
- w6xrl4@w2xsc.#nca.ca.usa.noam
- http://www.scc-ares-races.org
- Supercalifragilisticexpialidocious
- Sesquipedalianism
- Get me a jelly donut!

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Say Again …

- … word after _____
- … word before _____
- … all after _____
- … all before _____
- … between _____ and _____

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Exercise: Say Again

Use the proper "say again …" phrase to request the missing information

- Michael is a _____ instructor.
- _____ _____ is a better instructor.
- This class is _____ _____.
- On Saturday mornings, I prefer to be _____.

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ICS-213 Transmission Process

- Sender (wait for ACK after each step)
  - Message #, Date, Time
  - Severity, Handling, Requests
  - To, From
  - Subject
  - Reference (if any)
  - Message - 5 words at a time
  - "End of message"
- Receiver
  - ACK each section or request fill
  - ACK end of message followed by …
  - "My message number is <#>. This is <call sign>."
  - Fill in Operator Info
- Sender
  - ACK Msg # / Fill in receiver's message #
  - "This is <call sign>"
  - Fill in Operator Info

http://www.scc-ares-races.org/operations.html

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Say Again … for Multi-Station Message

- If you are the pacing station, you can use "say again …" each time the sender pauses during transmission
- Otherwise, you have to wait until after the entire message is transmitted
- Use field name to quickly isolate the desired word(s):
- Say again <field name> …
  - Say again message number
  - Say again situation severity
  - Say again to location
  - Say again subject
  - Say again message (ouch!)
  - Say again message, word after …
  - Say again message, between … and …
- Use more than one word to describe location, if needed
  - Say again message, word after "Pinky and the"

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ICS 309 – Communications Log

- Our version: ICS 309-SCCo
- Net Control Operators and stations with high message traffic
- Columns help organize key message tracking info
- Does not replace 214
  - EVERYONE fills out a 214
- Turn in to supervisor at end of shift
- Instructions on back

http://www.scc-ares-races.org/operations.html

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ICS 309: Header and Footer

- When you start a new page, fill in the header

COMM Log ICS 309-SCCo ARES/RACES	1. Incident Name and Activation Number Transylvania Mummy Race TSV-13-13	2. Operational Period (Date/Time) Oct 31, 2013 Oct 31, 2013 From: 2000 To: 2359
	3. Radio Net Name (for NCOs) or Position/Tactical Call Resource Net	4. Radio Operator (Name, Call Sign) Herman Munster, W6XRL4

5.		COMMUNICATIONS LOG		
Time (24:00)	FROM		TO	Message
	Call Sign/ID	Msg #	Call Sign/ID	Msg #

- When you complete a page (or the net) fill in footer

6. Prepared By (Name, Call Sign) Wolf Man, K6WOOF	7. Date & Time Prepared Oct 31, 2013, 2359	Page 1 of 1

ICS 309-SCCo ARES/RACES (rev. 2009-Sep-03)

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ICS 309: Shift Change

- Record outgoing and incoming Net Control/Scribe
- Make it clear, obvious what happened

5.	COMMUNICATIONS LOG			
Time (24:00)	FROM Call Sign/ID	Msg #	TO Call Sign/ID	Msg #	Message

Time (24:00)	Call Sign/ID	Msg #	Call Sign/ID	Msg #	Message
					[End of shift H&W Check entries]
1300	-------------------		-------------------		---- SHIFT CHANGE ----
------	-------------------		------------------		Outgoing NCO=<call sign>; Scribe=<call sign>
------	-------------------		------------------		Incoming NCO=<call sign>; Scribe=<call sign>
					[Log continues]

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ICS 309: Activity on Another Form

Be sure to record all activity, even if using another form

- ICS 213 Message Form

5.	COMMUNICATIONS LOG				
Time (24:00)	FROM Call Sign/ID	Msg #	TO Call Sign/ID	Msg #	Message
1327	XNDEOC	XND-107			Inventory Status

- Crowd Count (Los Altos Festival of Lights)

5.	COMMUNICATIONS LOG				
Time (24:00)	FROM Call Sign/ID	Msg #	TO Call Sign/ID	Msg #	Message
1745	-------------------		----------------		Conducted 1st crowd count; see crowd count form

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And Finally: Staying Current

- Today's purpose was …
  - To review *changes* to training and operational procedures that occurred over the past year (and a few that are coming soon)
- Obviously …
  - This is only effective for those who are already familiar with the training and operations procedures in place the year before
- So …
  - If you haven't taken the base classes in the last two years and/or you haven't practiced at least a few times by attending a few drills/events per year, you won't have the whole story
- Therefore …
  - To keep current and maintain top skill levels, you need to attend full training classes at least every two years and attend a few drills/events each year.

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The End … For Now

Thanks

See you next year!

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