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 1

2013 End of Year Summary

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

 2

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

 3

Agenda

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

 4

Antenna Fundamentals End of Year Summary

Santa Clara County ARES®/RACES
Last Updated 12-02-2013

 5

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

 7

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

 8

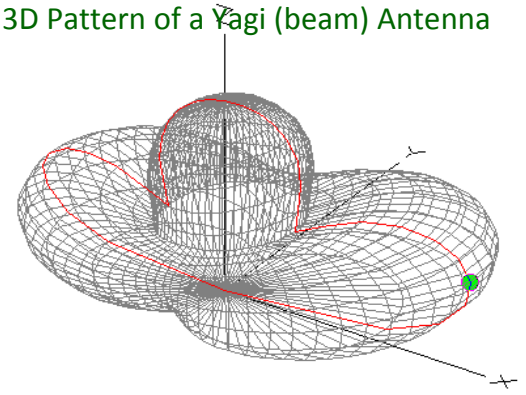
Antenna Pattern

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

May be a table or graphical view

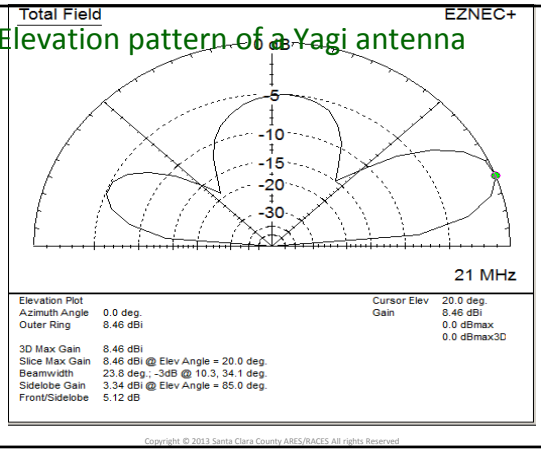
 9

3D Pattern of a Yagi (beam) Antenna



 10

Elevation pattern of a Yagi antenna



Elevation Plot		Cursor Elev	20.0 deg.
Azimuth Angle	0.0 deg.	Gain	8.46 dBi
Outer Ring	8.46 dBi		0.0 dBmax
			0.0 dBmax3D
3D Max Gain	8.46 dBi		
Slice Max Gain	8.46 dBi @ Elev Angle = 20.0 deg.		
Beamwidth	23.8 deg.; -3dB @ 10.3, 34.1 deg.		
Sidelobe Gain	3.34 dBi @ Elev Angle = 85.0 deg.		
Front/Sidelobe	5.12 dB		

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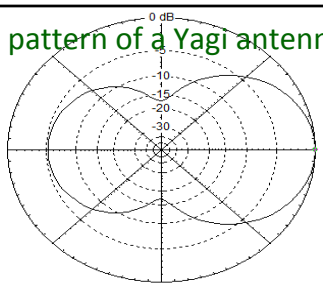
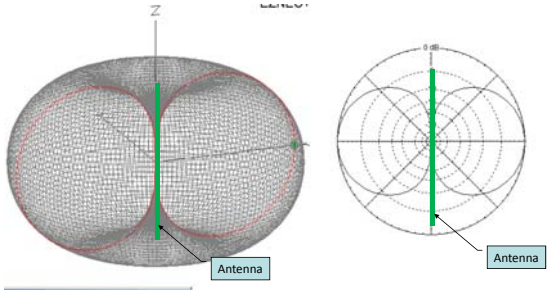
Azimuth pattern of a Yagi antenna



Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	20.0 deg.	Gain	8.46 dBi
Outer Ring	8.46 dBi		0.0 dBmax
			0.0 dBmax3D
3D Max Gain	8.46 dBi		
Slice Max Gain	8.46 dBi @ Az Angle = 0.0 deg.		
Front/Back	5.2 dB		
Beamwidth	75.9 deg.; -3dB @ 322.0, 37.9 deg.		
Sidelobe Gain	3.26 dBi @ Az Angle = 180.0 deg.		
Front/Sidelobe	5.2 dB		

 12

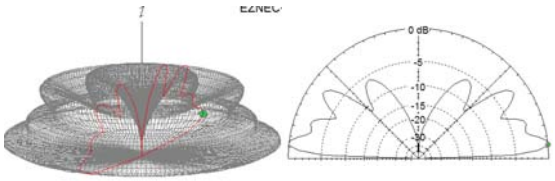
½ Wave Vertical Dipole in Free Space



3 D view Elevation Pattern

 13

½ Wave Vertical Dipole 10 ft high



3D View Elevation Pattern

- Note the null directly above the antenna

 14

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.

 15

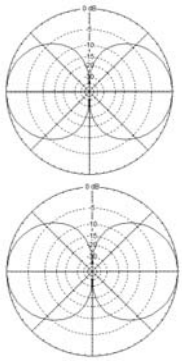
Antenna Placement

- 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.

 16

Antenna Placement

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



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Coax Cable

Connecting the radio to the antenna

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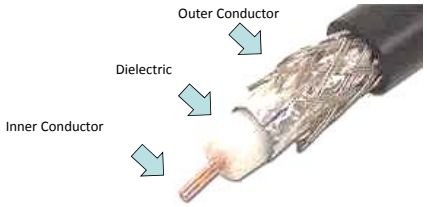
Anatomy of Coax Cable



- 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

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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

 20

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

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"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)
XMT Power (watts)
XMT Ant Gain (factor)
RCV Ant Gain (factor)
Wavelength (meters)
Range (meters)

 22

In Decibel form…

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

Path loss α = 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

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

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

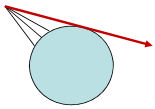
$$158.2 = 20 \log (R * 146) + 37.8$$

$$R = 7{,}172 \text{ NM}$$

 23

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

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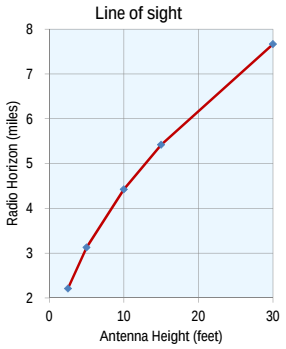
Radio Horizon at 146 MHz

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



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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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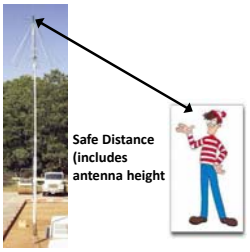
From OET Bulletin 65 Appendix B…

- 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)



	(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

 29

Outpost Packet Message Manager
Packet Radio for Emergency Communications

Outpost Enhancements

 30

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

 32

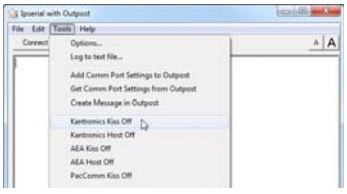
PC Time Check

- 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

 33

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!



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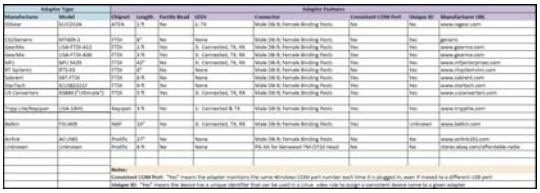
New Serial Comm Library

- 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.*

 35

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



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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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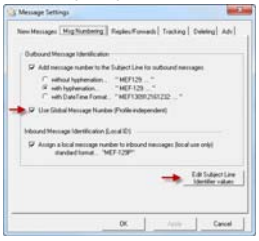
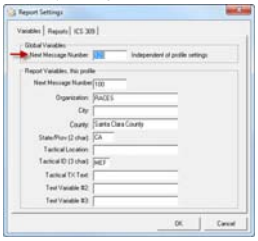
Global Message Numbering

- How to Use It
- Global message numbering is now the default
- To update old profiles …

Tools > Message Settings



Tools > Report Settings



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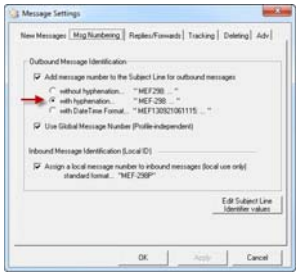
New Default Message Number Format

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



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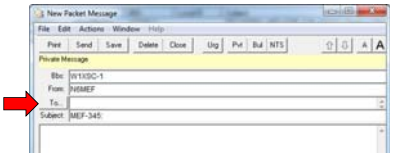
Improved Address Handling

- 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



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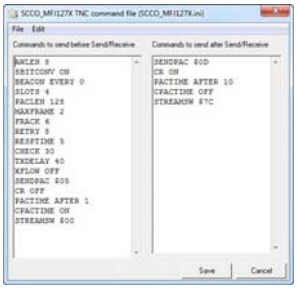
New TNC Command Files

- Optimizes channel utilization for two additional TNCs:
  - MFJ 127X
  - TAPR TNC2



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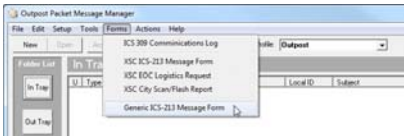
Return of Generic ICS-213 Form

- 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



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PacFORMS Enhancements

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New Logistics Form

- Matches updated form in county EOC

 44

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

 45

Network Enhancements

 46

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

 48

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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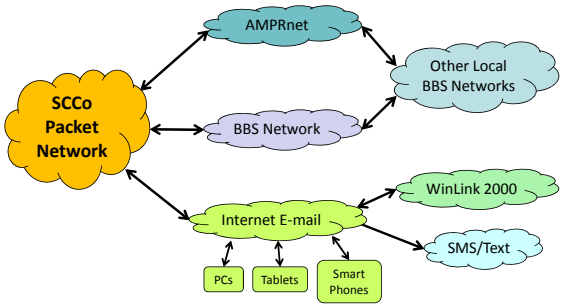
We Are Well Connected!



 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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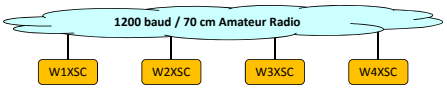
Section-wide BBS Forwarding via RF

- 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

 54

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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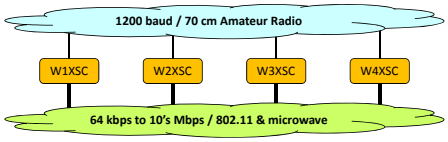
Enhanced Backbone Connectivity

- 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	FROM Msg #	TO Call Sign/ID	TO 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	FROM Msg #	TO Call Sign/ID	TO 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	FROM Msg #	TO Call Sign/ID	TO 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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