

**HIGH-LEVEL STUDY OF DEL NORTE
PUBLIC SAFETY COMMUNICATIONS AND OPPORTUNITIES FOR SHARED
TELECOMMUNICATIONS PLANNING**



Prepared and funded under the auspices of:
Del Norte Local Transportation Commission

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Submitted:
May 7, 2008

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Executive Summary

It only takes a moment to reflect on how teletransportation / telecommunication technologies impact public safety (i.e., radios, wire line telephony, cellular phones). These Public Safety Communications (PSC) capabilities are important for protection of lives. Economic well-being depends on the public safety support net provided to a community. PSC needs to be included in the definition of and planning for teletransportation.

Growing information needs of first responders and other public safety workers for day-to-day operations as well as for management of resources on the occasion of a major event means evaluation and adoption of new and expanded approaches and increased reliance on a robust teletransportation /telecommunications infrastructure.

New technologies are providing new options and creating growing demands for bandwidth. Most older public safety communication networks were designed to provide voice communication on radio networks. As we rebuild and replace older radio systems it will be useful to rethink the assumptions and applications of public safety communication in the light of new technical opportunities, especially the use of IP-based broadband. The opportunities in the new broadband digital age are much different than they were in the age of narrowband analog voice communications.

In this high-level study we take a first and high-level look at whether or not opportunities for sharing network investment might even exist. It provided the following insight:

- A definite interest in exploring joint teletransportation /telecommunications planning
- Public safety communications status and planning as viewed by members of the public safety community.
- Locations that may be suitable for location of broadband wireless radios and identification of licensed spectrum in use for PSC

This study provided a valuable first step toward understanding that there is a potential and willingness to explore integrating PSC planning with the myriad other components of teletransportation / telecommunications planning. In an era of tight funding we have an opportunity to conjoin efforts to leverage funds while at the same time continuing the expansion of county-wide teletransportation / telecommunications capabilities and capacities.

To gain a more in-depth background on this topic the reader is encouraged to follow the links to documents referenced in the footnotes. Additional detailed background information is available on request.

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Introduction and Rationale for the Study

It only takes a moment to reflect on how teletransportation / telecommunication technologies impact public safety (i.e., radios, wire line telephony, cellular phones). These Public Safety Communications (PSC) capabilities are important for protection of lives. Economic well-being depends on the public safety support net provided to a community. PSC needs to be included in the definition of and planning for teletransportation.

Growing information needs of first responders and other public safety workers for day-to-day operations as well as for management of resources on the occasion of a major event means evaluation and adoption of new and expanded approaches and increased reliance on a robust teletransportation /telecommunications infrastructure.¹ Typically these needs can be characterized as data and/or media intense, exceeding the capabilities of voice-only networks.

Rapidly growing demand exists for mobile broadband services (data) within public health, fire fighting, law enforcement and other related functions. One example is the ability to deliver maps and on scene video in real time to fire fighters, law enforcement or emergency medical technicians (for example, areas impacted by a pandemic). PSC demand for more and more broadband capacity is now added to other surging demand for broadband capacity.

The role of PSC is expanding as new technology makes it possible to include many whose role in preventing or responding to disaster lies outside the conventional definition of first responder. Traditionally, public safety agencies included the nation's first responders (such as firefighters, police officers, and ambulance services), a number of local, state, federal, and sometimes regional authorities.

Today ensuring public safety is not just a law enforcement, fire response or emergency medical technician (EMT) activity, but also includes utilities, healthcare, schools and other government agencies. Even the role of private citizens has become more important than ever. An updated and more inclusive description of public safety responders might include utility workers (often among the first on the scene to shut down power sources), healthcare workers other than those in emergency medical services, operators in 911 call centers, school personnel, and bystanders (citizen first responders) at the scene of an accident or disaster.

With the advent of Internet Protocol (IP) based technologies emerging in use in public safety and the looming Federal Communications Commission (FCC) requirement² to narrow band³ radios

¹ "Public Safety Communications: Policy, Proposals, Legislation and Progress," Linda K. Moore, Analyst in Telecommunications Policy, Resources, Science, and Industry Division, Congressional Research Service, The Library of Congress, <http://www.fas.org/sgp/crs/homesec/RL32594.pdf>, updated June 8, 2005

² THIRD MEMORANDUM OPINION AND ORDER, THIRD FURTHER NOTICE OF PROPOSED RULE MAKING AND ORDER, http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-292A1.pdf, Adopted: December 20, 2004

³ For radios narrow banding should not be confused with broadband. For radios this means sending a signal with a significantly reduced wave height and results in squeezing more signal into the same frequency space.

by January 1, 2013 opportunities may exist in the county for some level of teletransportation / telecommunication infrastructure shared development. IP-based radios and other emerging devices create a whole new era of opportunities for increasing public safety effectiveness.

Meeting the region's growing bandwidth intense PSC needs is critical to the future of Del Norte residents no matter where they live in the region, rural or urban. This will require substantial teletransportation / telecommunications infrastructure improvements to meet growing needs.

As such it is worth understanding the opportunities for integrating PSC factors into the overall general purpose teletransportation / telecommunication planning efforts. Planning for appropriate and thoughtful sharing of network infrastructure starts with a high-level inventory of a few baseline factors. Then we can look to if and how we might jointly leverage funds for infrastructure investment.

In this high-level study we take a first look at whether or not such opportunities for sharing network investment might even exist. A by-product is some high-level insight into PSC in Del Norte County, including the topic of inter-operability.

While this study admittedly barely touches the many complexities of PSC, it does provide a valuable first step toward understanding potential for integrating PSC planning with the myriad other components of teletransportation / telecommunications planning.

Statewide Integrated Public Safety Communications Strategic Planning

Statewide PSC strategic planning⁴ is underway.

“California has developed and maintained an integrated multi-discipline, multi-agency emergency management system. The state's public safety responders -- local, state, tribal, and federal -- must be able to communicate with each other using an interoperable communications system. The system components are more than pieces of equipment. To be successful, the system must be supported by an organizational structure, standard operating procedures, and training and exercises. And, as with any successful business venture, the system must have reliable funding to remain viable.”⁵

⁴ Today communications interoperability is defined in the context of radio communications as the ability of public safety agencies to talk across disciplines and jurisdictions via radio communications systems, exchanging voice and/or data with one another on demand, in real time, when needed and as authorized. “Methodology for Statewide Communications Interoperability Planning,” SAFECOM, Department of Homeland Security, October, 2004, <http://www.safecomprogram.gov/NR/rdonlyres/C0327AC2-84ED-4E38-B9BE-04DDB09B45F9/0/VAExeSumFinal2.pdf>

⁵ “A plan for California State public safety communications system integration, modernization, and interoperability”, Report to the California State Legislature as required by Government Code § 8592.6, Henry R. Renteria, Director, Governor's Office of Emergency Services, [http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/PSRSPC-2007%20Strategic%20Plan/\\$file/PSRSPC-all.pdf](http://www.oes.ca.gov/Operational/OESHome.nsf/PDF/PSRSPC-2007%20Strategic%20Plan/$file/PSRSPC-all.pdf), January 2007

Emergency Management Coordination, 911, and Public Safety Answering Point (PSAP)

The Emergency Management Division⁶ of the Department of Emergency Services is responsible for the planning, coordination of response, recovery, and mitigation activities related to county-wide emergencies and disasters; serving as the primary coordination point for emergency management's communication flow between the Federal, State, and local levels; developing emergency operation plans for the county, cities, and districts; conducting training and educational outreach programs related to emergency preparedness; and sponsoring emergency management training.

The Division of Emergency Management in the Department of Emergency Services is the lead agency for the Del Norte Operational Area. Under the State of California's Standardized Emergency Management System (SEMS), the Operational Area is the primary level of coordination for response and recovery activities following an emergency or disaster. SEMS is a management system that provides an organizational framework and guidance for operations at each level of the state's emergency management system. It provides the umbrella under which all response agencies may function in an integrated fashion.

A primary public safety answering point (PSAP) is defined as a PSAP to which 911 calls are routed directly from the 911 Control Office, such as, a selective router or 911 tandem. A secondary PSAP is defined as a PSAP to which 911 calls are transferred from a primary PSAP.

The FCC PSAP Registry⁷ lists the following information for Del Norte County:

675	Crescent City Fire Department	CA	Del Norte	Crescent City	Orphaned PSAP no longer considered a primary call taking answering point. Refrain from using these in future filings.
692	Del Norte County Sheriff's Department	CA	Del Norte	Crescent City	

Public Safety Communications Infrastructure

Blue Dots placed in Figure 1 (next page) show the location of fixed base radios classified by the FCC as belonging to the Public Safety pool.⁸ The microwave path between state of California microwave backhaul locations is shown as a green dotted line. In this view some locations just outside of Del Norte are included, especially those associated with Yurok Public Safety.

⁶ Handling Emergencies, County of Del Norte,

<http://www.dnco.org/cf/topic/topic4.cfm?Topic=Handling%20Emergencies&SiteLink=200029.html>

⁷ Public Safety and Homeland Security Bureaus, Federal Communications Commission, April 01, 2008. The PSAP database serves as a tool to aid the Commission in evaluating the state of PSAP readiness and E911 deployment.

⁸ FCC Universal License System, License Search, Advanced License Search,

http://wireless2.fcc.gov/UlsApp/UlsSearch/searchAdvanced.jsp;JSESSIONID_ULSSEARCH=wk3GLR5Gp58jLQzJJpBwD4z6hT2YwhZQOPL5pw2WGk2hj9gbkc5r!1373044486!-435144080, Search criteria = PW – Public Safety Pool, Conventional



Figure 1 -- Public Safety Communications Map -- Conventional and Microwave

Additional detailed topological maps are available. These show the exact GPS locates of the radio and show how they fit into the terrain (mountain tops, etc. – see Appendix 4 for an example). These maps can be provided as JPG or bitmap files in high resolution for printing as poster-sized maps. Contact the consultant if interested. They were not included in this document to conserve paper and space.

Appendix 1 shows the various categories of radio technologies and spectrum used in PSC. Appendix 2 and 3 contain details for Del Norte public safety fixed base radio locations and spectrum information. This information can be used later when looking for placement of wireless broadband radio technologies (e.g., WiFi, WiMax, etc.).

Public Safety Communications Survey

Overview of the Survey Process and Tabulation

The primary purpose of the survey was to identify opportunities for joint telecommunication related projects. A secondary benefit was to gain understanding of some of the underlying factors planning specific to PSC that might drive additional broadband capacity needs. The survey questions are a subset of the National Interoperability Baseline Survey.⁹

⁹ National Interoperability Baseline Survey, Safecom, December 2006, <http://tinyurl.com/yf58de>

The survey results are interesting and informative. However, it is appropriate here to advise that this was not a random survey and as such the results are not necessarily extensible across all of the public safety entities serving Del Norte County. Responses may even differ within an agency or department based on who responded to the survey. Never the less, the results are quite useful for our purpose.

The surveyed group received a commitment that their responses would be aggregated and reported as a group. Comments, however, could not be averaged and are stated as provided without revealing the source.

Responding Organizations

A total of 17 public safety entities serving Del Norte County were surveyed (e.g., fire, law enforcement, prison, ambulance). Responses totaled 11 (65%).

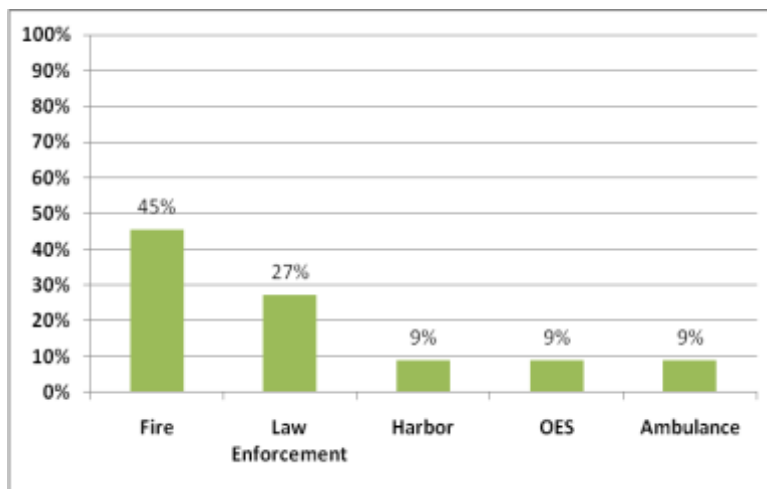


Figure 2 -- Entities Responding to the Survey

Entities not responding included: California Highway Patrol, Redwood National and State Parks, and Six Rivers National Forest

Numerical results on the following pages are shown as percentages of total responses. For a number of the questions responses may not total to 100% due to rounding. For some of the questions, national survey data was not available, although the question was asked.

In many instances the Del Norte responses were roughly on par with responses from the national survey.

Survey Responses

Primary wireless communications system

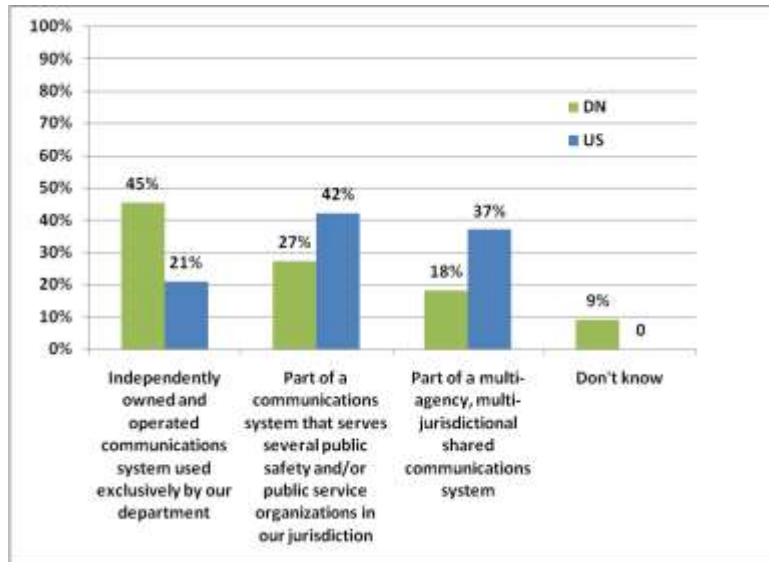


Figure 3 -- Primary Wireless Communication Systems

This likely reflects a county where PSC networks are in transition from siloed networks to more highly inter-operable networks.

Communication equipment used in Daily Operations

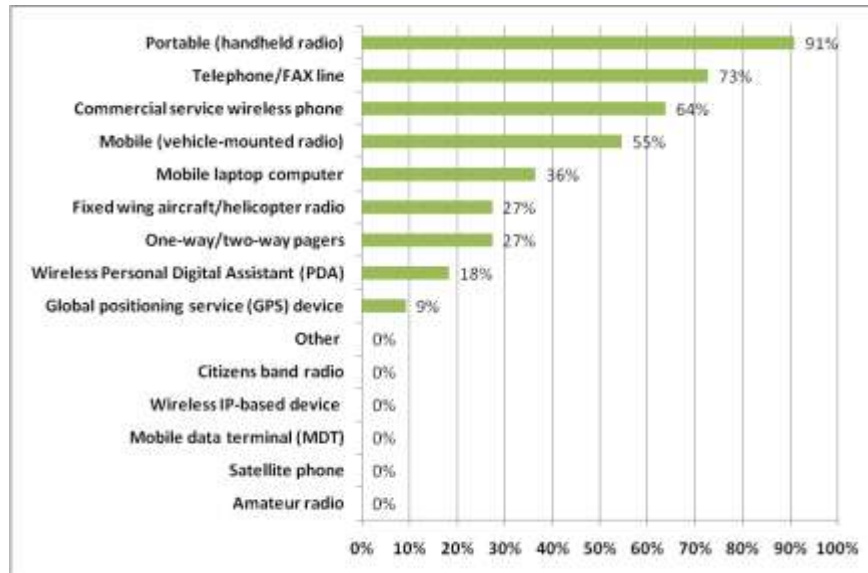


Figure 4 -- Communication Equipment Used in Daily Operations

Note: National data not available

Use of handheld radios, telephone, cellular phones and MDTs are not surprising. The growing use of PDAs is reflected here.

Communication equipment used for Interoperability

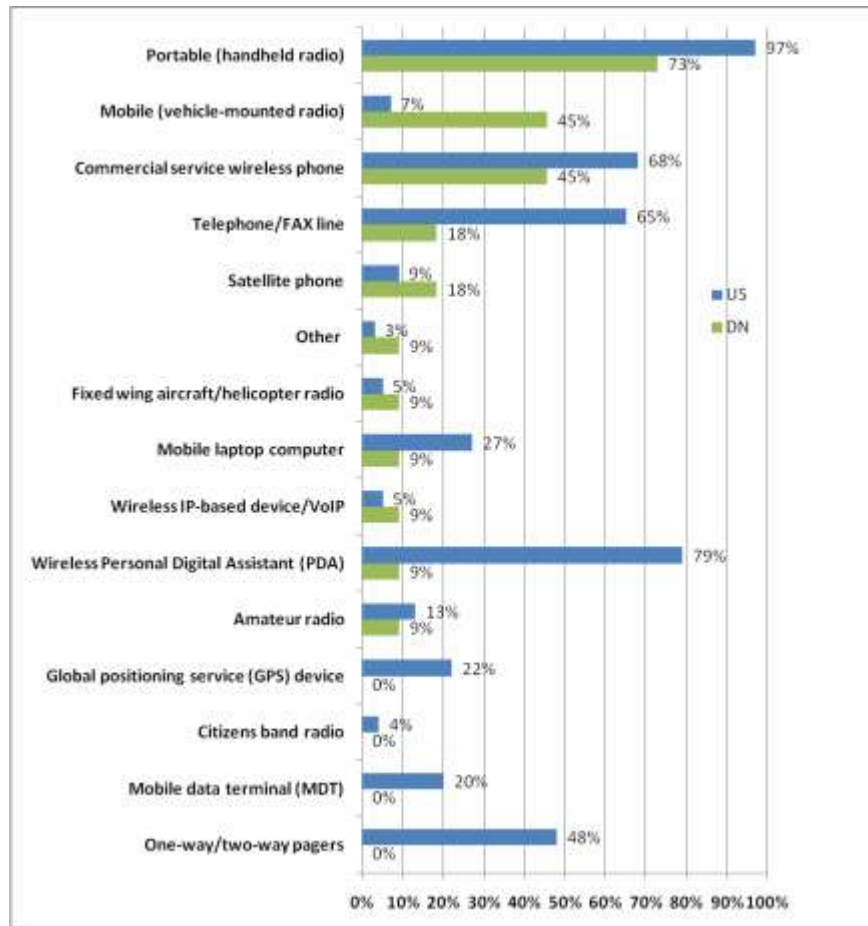


Figure 5 -- Communication Equipment Used for Interoperability

The interoperability communications picture is quite different from the daily operations picture. This points to opportunities for improvements.

Wireless solutions in current use to support Interoperability

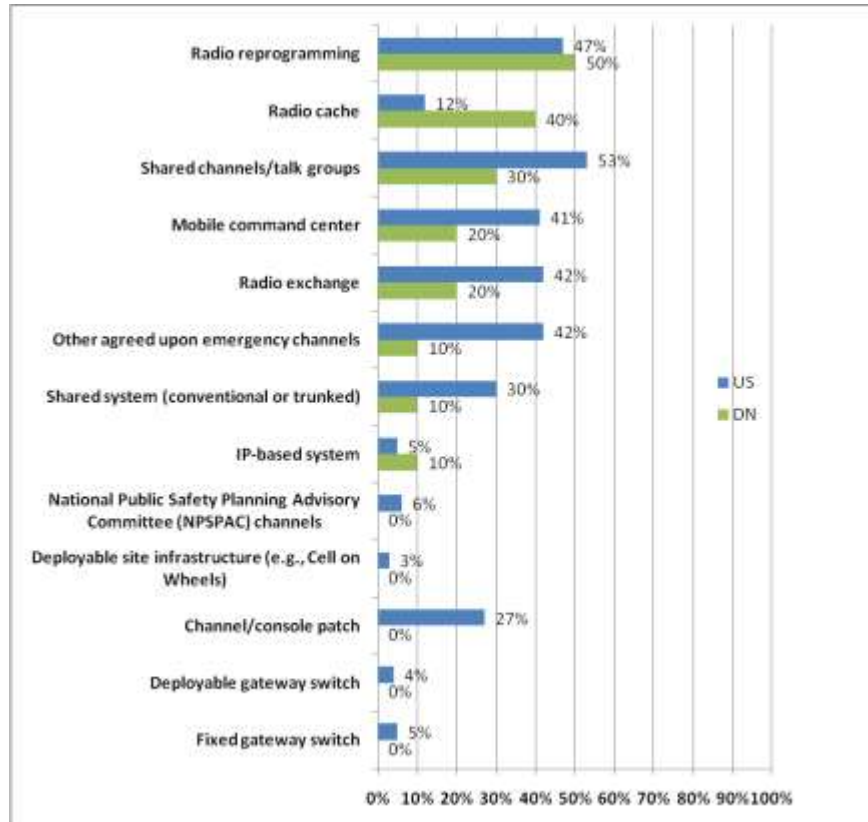


Figure 6 -- Wireless Solutions in Current Use to Support Interoperability

Opportunities exist to explore expanded use of other technologies in the county interoperability PSC mix.

Spectrum sufficiency for Daily Operational needs today

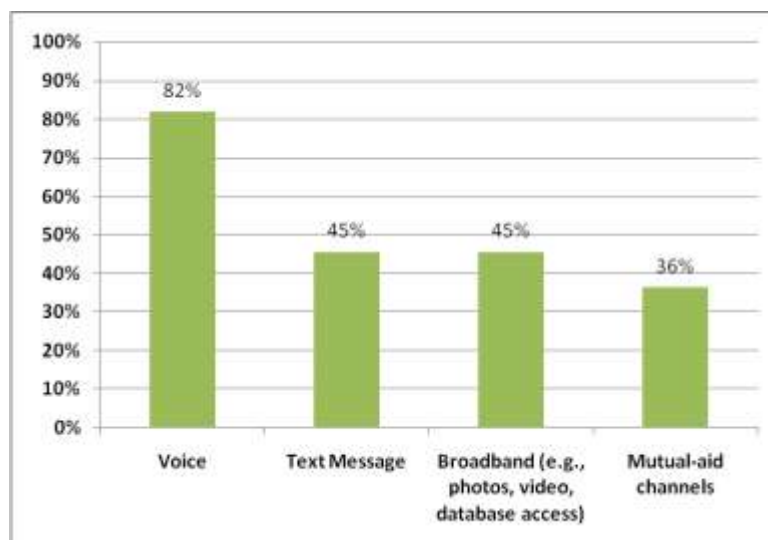


Figure 7 -- Sufficient Spectrum for the Daily Operations Needs?

Note: National data not available

Spectrum for daily needs falls short. The demand for additional capacity will only grow.

Spectrum sufficiency for Interoperability needs

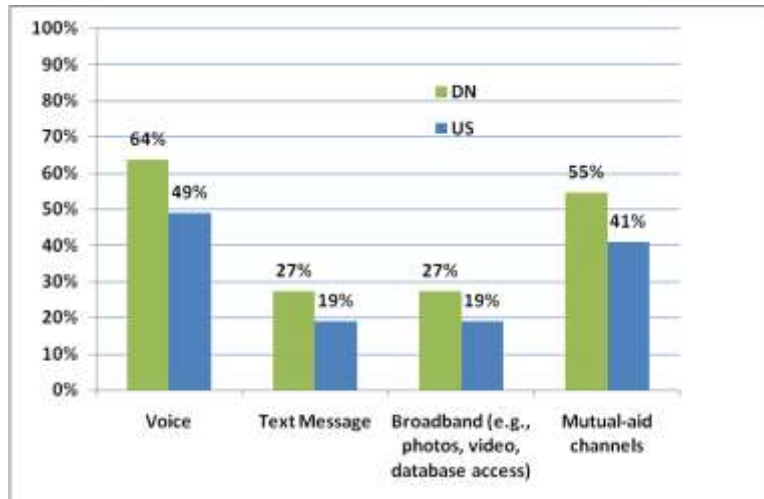


Figure 8 -- Sufficient Spectrum for Interoperability needs?

Spectrum for interoperability purposes falls short of needs. The demand for additional capacity will only grow.

Spectrum sufficiency for foreseeable Daily Operations over next five years

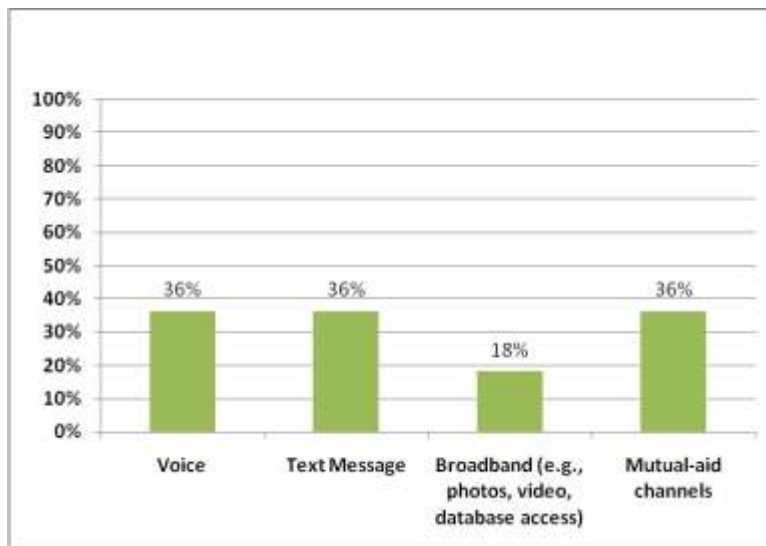


Figure 9 -- Sufficient Spectrum for Daily Operations Over Next Five Years?

Note: National data not available

The long term picture for spectrum for daily needs falls short.

Spectrum sufficiency for foreseeable Interoperability needs (i.e., next five years)

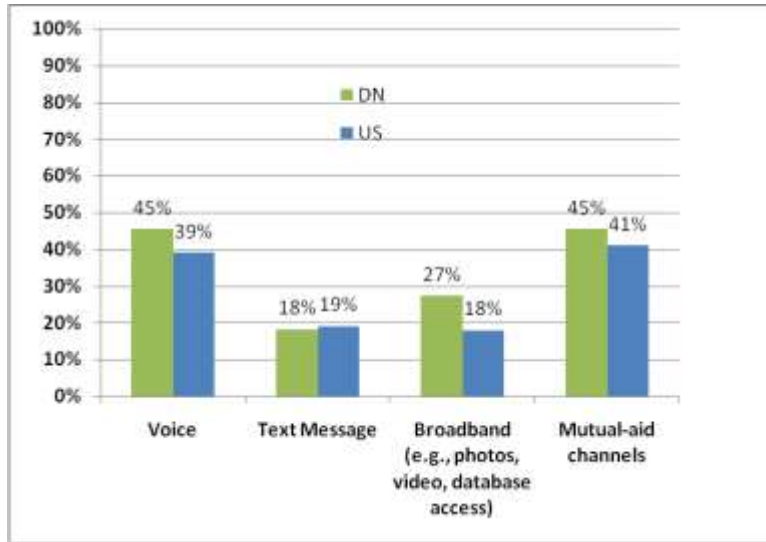


Figure 10 -- Sufficient Spectrum for Interoperability Over Next Five Years?

The long term picture for spectrum for interoperability needs falls short.

Use or plan to use spectrum between 764 MHz and 776 MHz cleared for public safety use

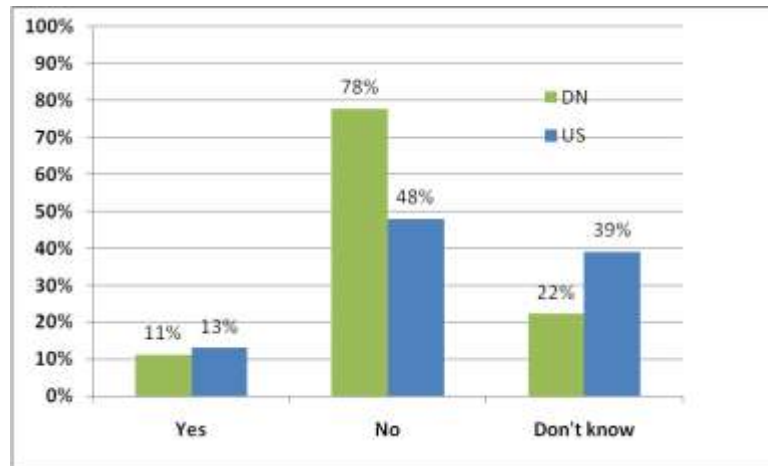


Figure 11 -- Use or Plan to Use Spectrum between 764 MHz and 776 MHz

This is an emerging discussion on the national landscape. Del Norte is roughly on par with the national survey results. Significant discussion and planning is ahead.

Organization's use of spectrum between 764 - 776 MHz

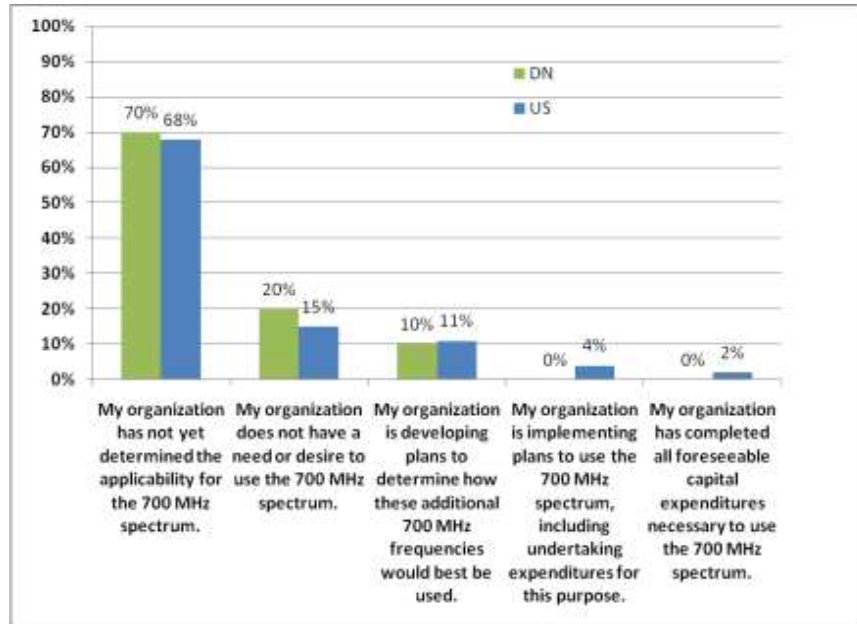


Figure 12 -- Organization's Use of Spectrum between 764 - 776 MHz

Radio frequencies your Primary system or network use

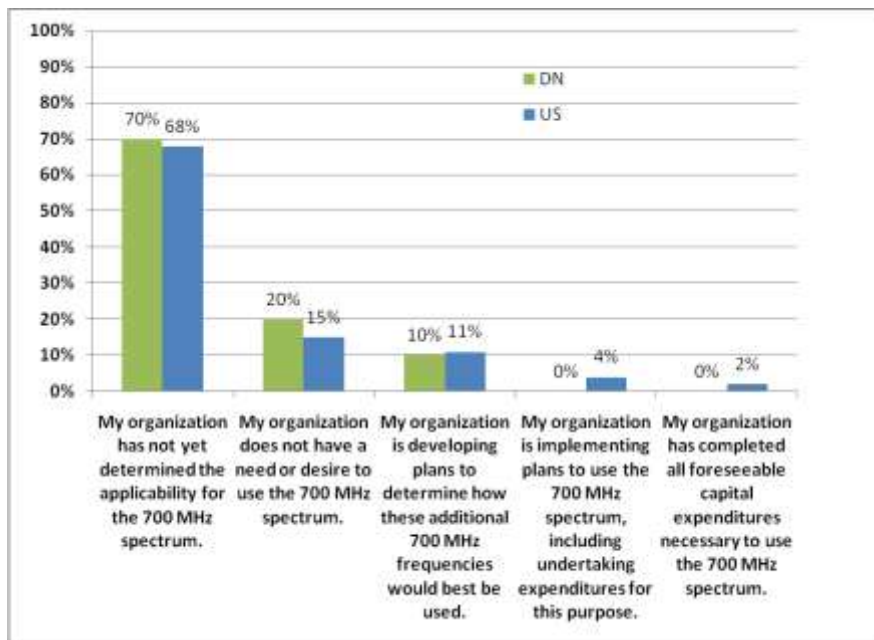


Figure 13 -- Radio Frequencies Your Primary System or Network Use

Network architecture of your Primary wireless communication system

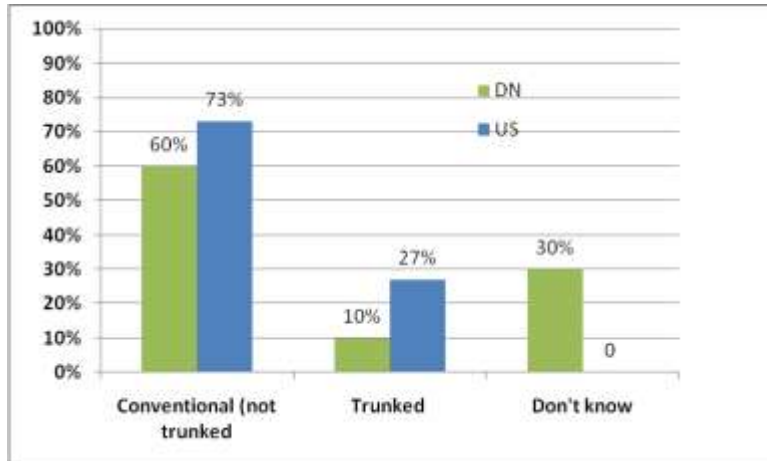


Figure 14 -- Network Architecture of Your Primary Wireless Communication System

Frequency modulation of your Primary wireless communication system

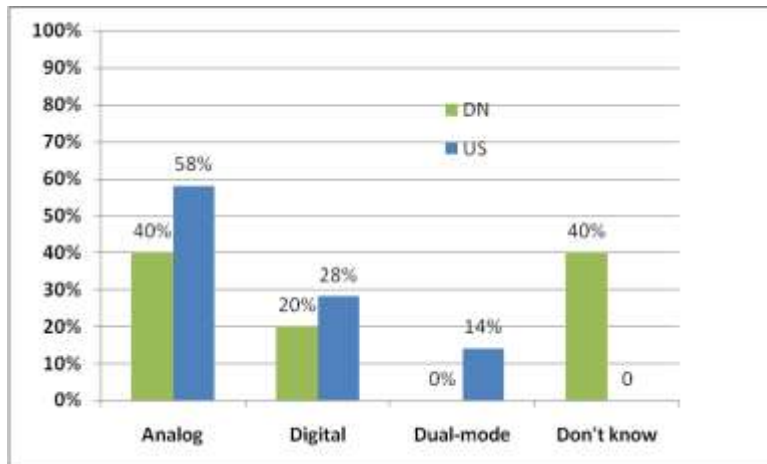


Figure 15 -- Frequency Modulation of Your Primary Wireless Communication System

The “Don’t Know” response is a bit disconcerting. The migration to digital radios is underway.

Age of Primary wireless communication system

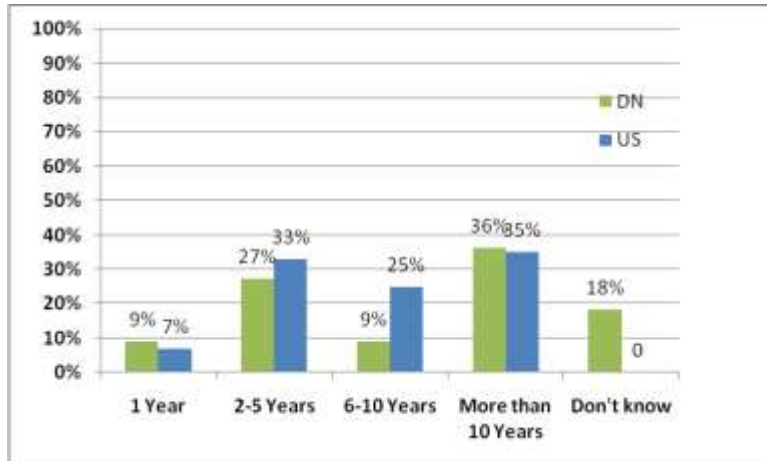


Figure 16 -- Age of Primary Wireless Communication System

44% of Del Norte's systems appear to be 6 or more years old.

Plans to replace or substantially upgrade PRIMARY wireless communication system

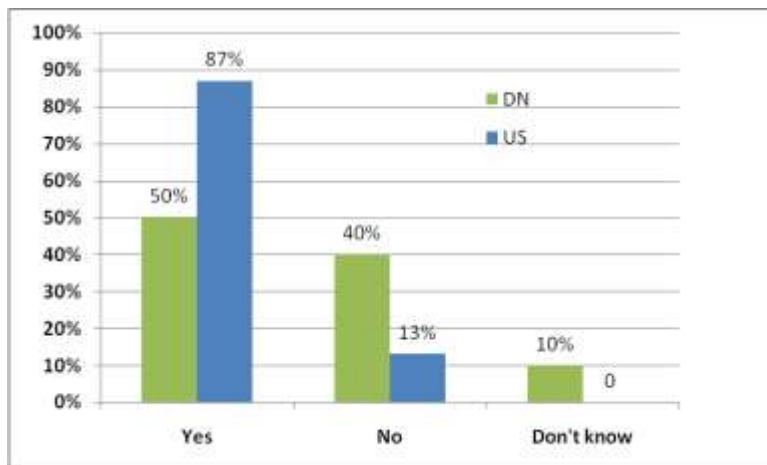


Figure 17 -- Plans to Replace or Substantially Upgrade

50% of the entities that responded to the survey plan to replace or substantially upgrade.

Plans to replace or substantially upgrade your Primary wireless communication system

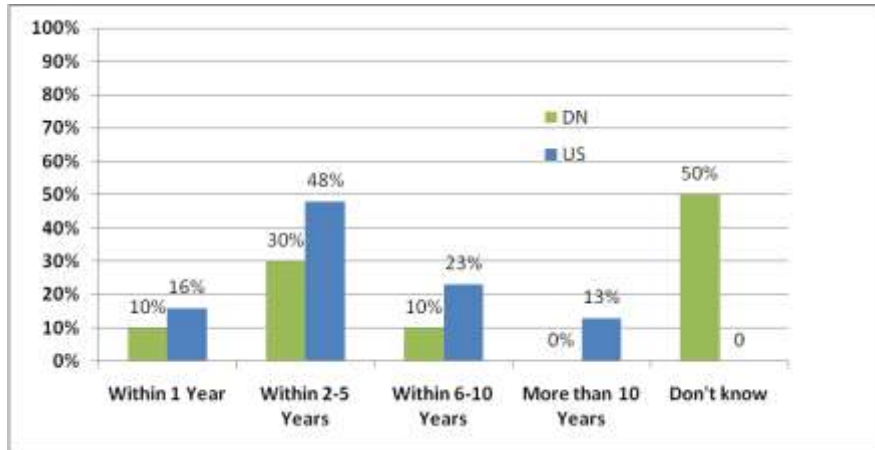


Figure 18 -- When will your organization replace or substantially upgrade?

40% indicate replacement plans within 5 years.

Timeframe for meeting the FCC narrowbanding deadline

For Public Safety Radio Pool licensees operating Private Land Mobile Radio (PLMR) services in the same bands, the FCC established a January 1, 2013 deadline for migration to 12.5 kHz technology, or a technology that achieves the narrowband equivalent of one channel per 12.5 kHz of channel bandwidth (voice) or 4800 bits per second per 6.25 kHz (data) if the bandwidth for transmissions specified in the modification application is greater than 12.5 kHz. What best describes your timeframe for meeting this deadline?

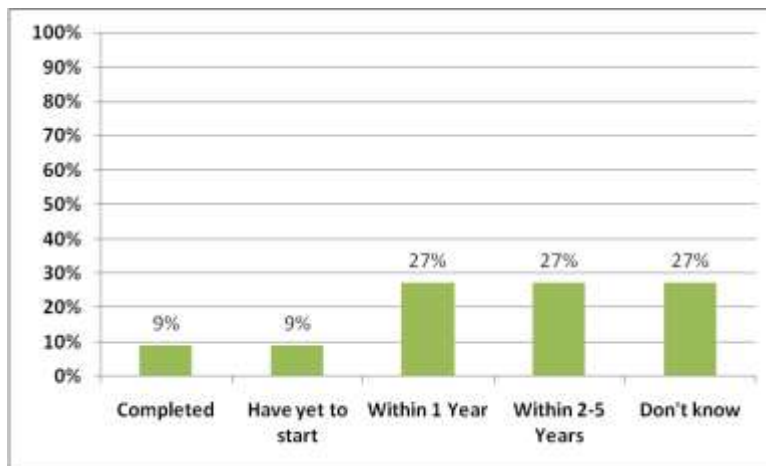


Figure 19 -- Timeframe for Meeting FCC Narrowbanding Deadline

Note: National data not available

This needs to be completed by January 1, 2013 to avoid fines. That is less than 5 years away. Some waivers may be available.

Interest in exploring shared infrastructure options
(e.g., towers, fiber or other connectivity modalities, etc.)?

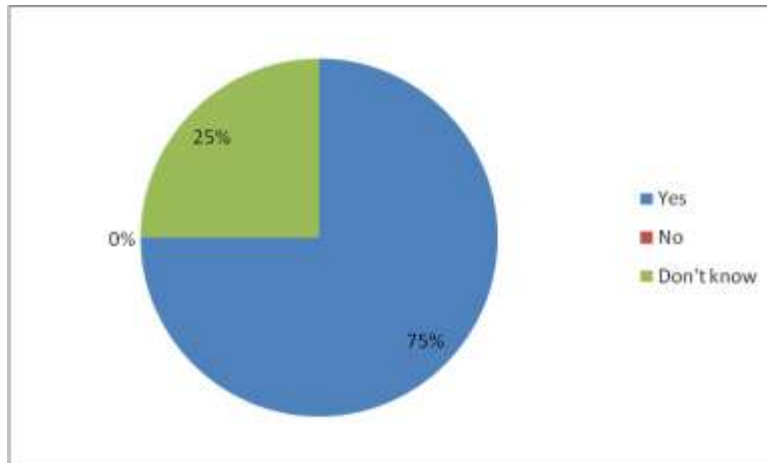


Figure 20 -- Interest in Exploring Shared Infrastructure Options
Note: National data not available

Good news!! Herein resides an opportunity to work together across disciplines to maximize return on investment and to create continuing improvement in the region's teletransportation / telecommunications infrastructure.

Interoperability - Planning

The following set of responses indicates opportunities for continuing progress toward ubiquitous interoperability across the region.

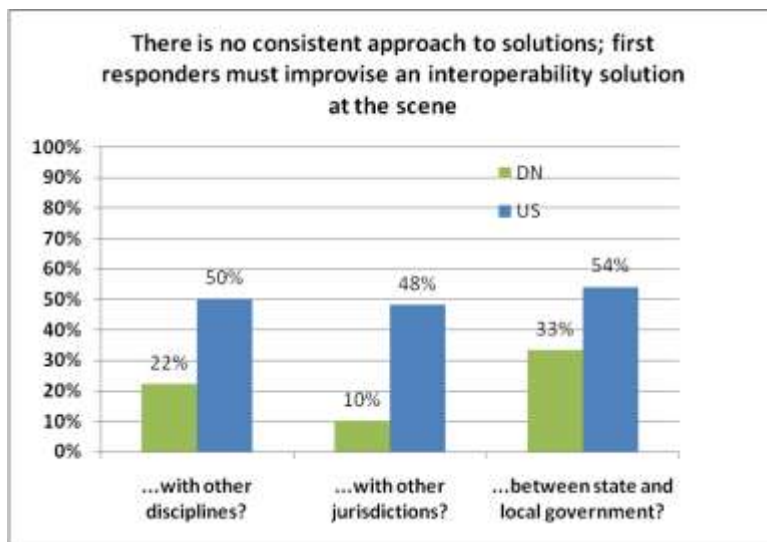


Figure 21 -- Inter-op Today: No Consistent Approach

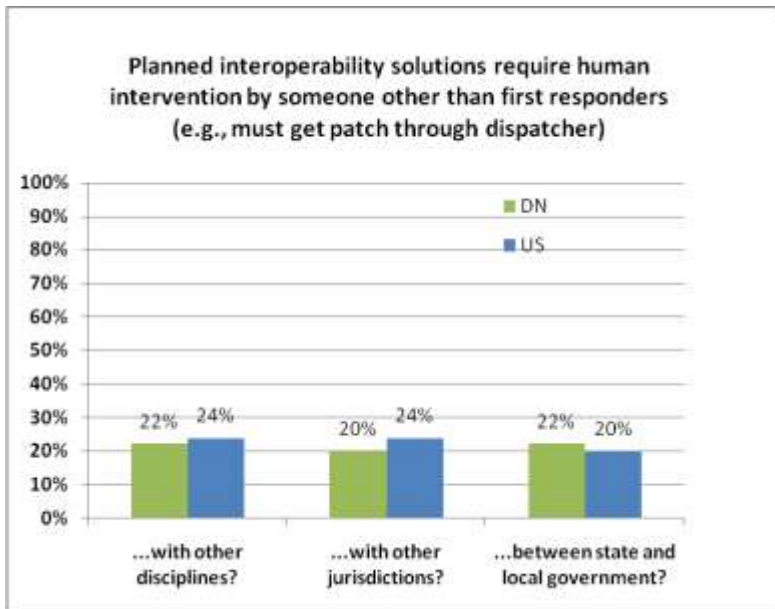


Figure 22 -- Inter-op Today: Solutions Require Human Intervention

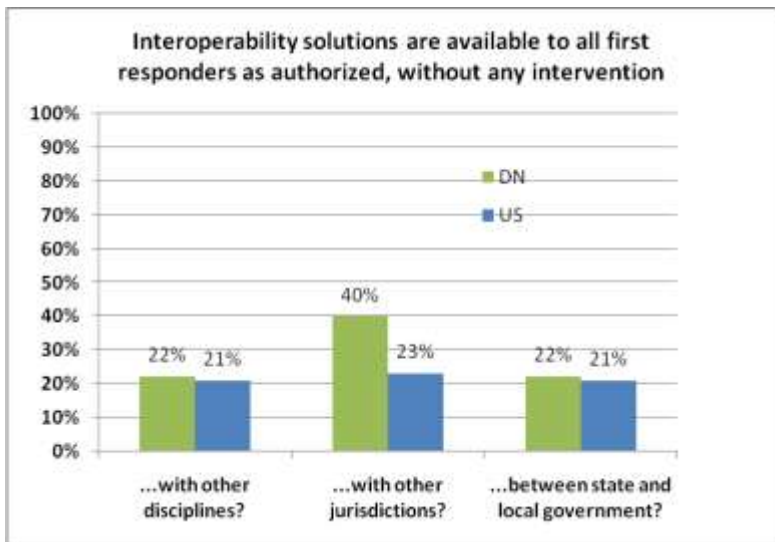


Figure 23 -- Inter-op Today: Available Without Intervention

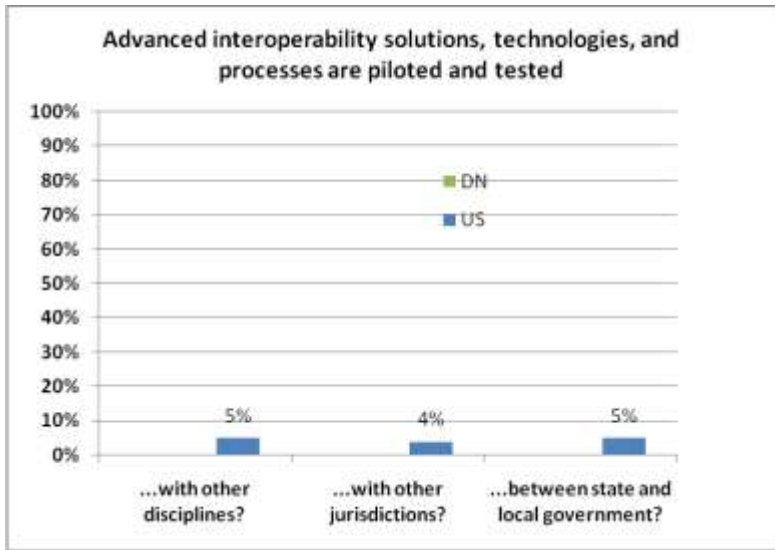


Figure 24 -- Inter-op Today: Piloted and Tested

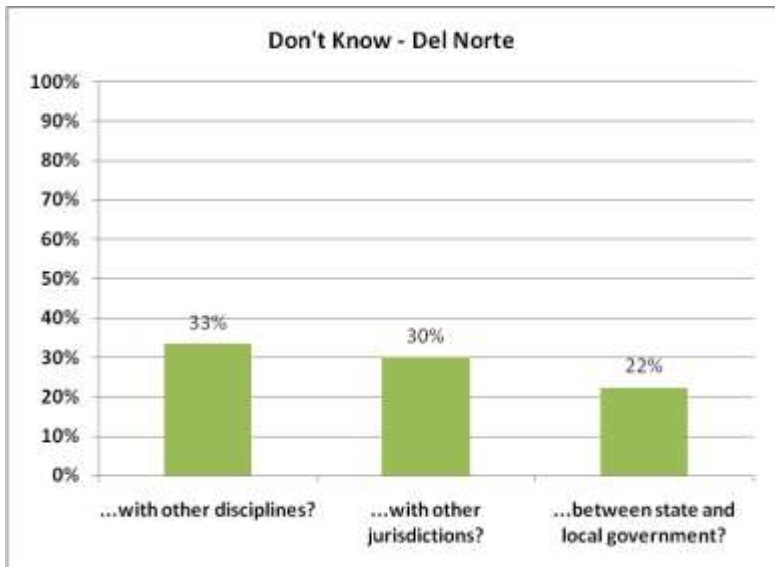


Figure 25 -- Inter-op Today: Don't Know

	There is no consistent approach to solutions; first responders must improvise an interoperability solution at the scene		Planned interoperability solutions require human intervention by someone other than first responders (e.g., must get patch through dispatcher)		Interoperability solutions are available to all first responders as authorized, without any intervention		Advanced interoperability solutions, technologies, and processes are piloted and tested		Don't Know
	DN	US	DN	US	DN	US	DN	US	DN
...with other disciplines?	22	50	22	24	22	21	0	5	33
...with other jurisdictions?	10	48	20	24	40	23	0	4	30
...between state and local government?	33	54	22	20	22	21	0	5	22

Figure 26 -- Inter-op Planning Status Survey Results Chart

Note: these three categories add to 100 from left to right.

- **With Other Disciplines:** Membership with another first responder organization of a different discipline within the same jurisdiction
- **With Other Jurisdictions:** Membership with other organizations of the same discipline outside the jurisdiction, but at the same level of government
- **Between State and Local Government:** Membership with other organizations of the same discipline at a different level of government

Communication with Federal Agencies

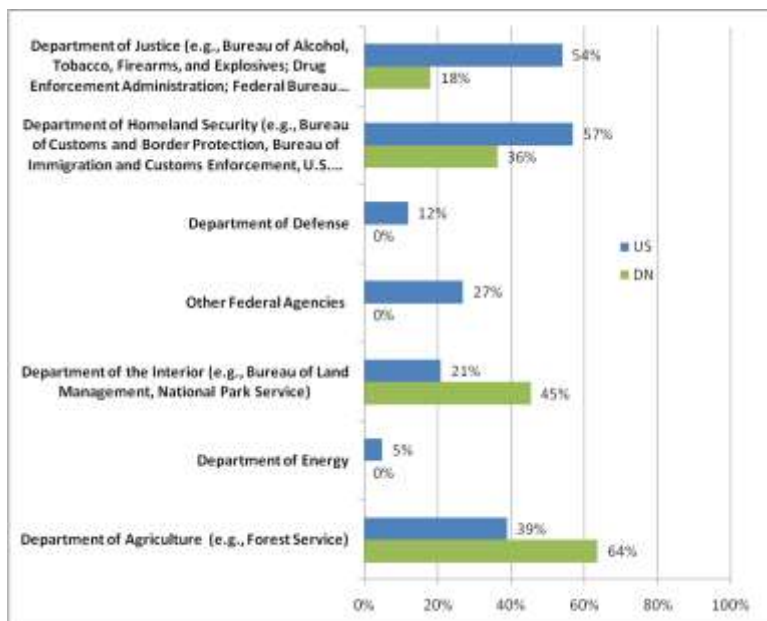


Figure 27 -- Communication with Federal Agencies

Additional Comments by Survey Respondents

...on the use of telecommunications in your organization or in relationships with other organizations (i.e., technologies, agreements and governance, etc.)

Comment 1:

“Our local government has limited understanding of radio & overall communications and the need for backup systems and full interoperability on major events. Over the last 5 years they have used fed funding to buy new radio communications. In a major health event communication will be nil from any outside area that comes to our area.”

Comment 2:

“CDRC has 27 trunked/convention systems at 33 adult prisons, and 5 convention systems at 5 youth facilities. We have 58 county and 640 local agency MOU’s & FUA for mutual aid/dispatch/L.E. support/paroles. Also, have MOU & FUA with counties & cities in southern Oregon for police support.”

Comment 3:

“We have an ACU 1000.¹⁰”

Summary of Findings from Maps, Spectrum Analysis and Survey Results

The high-level study of Del Norte’s PSC capabilities and status provided the following information:

1. Broad overview of statewide efforts and county-wide Emergency Management coordination
2. Locations that may be suitable for location of broadband wireless radios
3. Identification of licensed spectrum in use for PSC to avoid frequency overlaps.
4. Survey results -- PSC entities willingness to explore infrastructure sharing opportunities, status of current and foreseen capabilities, and approaches to PSC operations.

Del Norte teletransportation / telecommunications planners need to ensure ongoing inclusion in these planning efforts to ensure the needs of the rural county are kept in the view of the state. These statewide efforts may afford additional opportunities to meet local needs by integrating with county-level planning efforts.

This information will be integrated into other teletransportation / telecommunications planning as we move into the future. As previously stated the PSC topic is very complex. In an era of tight funding we have an opportunity to conjoin efforts to leverage funds

¹⁰ ACU Interoperability, <http://www.jps.com/page/view/88> , Specification/Data sheet, http://www.jps.com/downloads/pdfs/ACU_data.pdf , The Raytheon ACU 1000 can interconnect up to 24 devices. The ACU-1000 can simultaneously cross-connect different radio networks, connect radio networks to telephone systems (or SATCOM systems) or network RoIP/VoIP talkpaths. It is completely scalable and field configurable to meet the customer and application's needs. It provides three different methods of operation for system redundancy and is neither computer nor network dependant for its operation.

while at the same time continuing the expansion of infrastructure and services capabilities and capacities. Too often we do not consider the potential for integrating planning efforts. As a result opportunities for maximizing investments are missed.

New technologies are providing new options and creating growing demands for bandwidth. Most older public safety communication networks were designed to provide voice communication on radio networks. As we rebuild and replace older radio systems it will be useful to rethink the assumptions and applications of public safety communication in the light of new technical opportunities, especially the use of IP-based broadband. The opportunities in the new broadband digital age are much different than they were in the age of narrowband analog voice communications.

Policymakers are urged to consider and to embrace the virtues of a new model. In short, this model would rest on the following four basic principles:¹¹

- Migration away from a single-purpose network composed purely of specialized equipment and toward a *multi-purpose, flexible network of networks* concept.
- An end to the culture of information silos and embrace of an ecosystem of shared access to a *network based on Internet Protocol* technology. By embracing such a unitary network for scores of different agencies, state governments can facilitate huge efficiency gains and provide more effective service to the public.
- *Use of a rights management system* that provides access to a variety of core services and valuable applications through a network of networks. This system can protect the integrity and security of sensitive government information and databases while enabling access—as needed and appropriate—across an array of agencies that will provide emergency services.
- *An integrated system of leadership and governance* to oversee the transition from the balkanized system that limits the effectiveness of public safety communications to one based on a network of networks architecture.”

By working together across the sectors and disciplines we can achieve even more robust network capabilities and capacities. A first step is to begin the process of joint planning between general purpose and public safety teletransportation / telecommunications efforts.

¹¹ "Clearing the Air: Convergence and the Safety Enterprise," The Aspen Institute Communications and Society Program, Aspen Institute Roundtable on Spectrum Policy (AIRS), spring 2006, Philip J. Weiser, *Rapporteur*, <http://www.aspeninstitute.org/atf/cf/{DEB6F227-659B-4EC8-8F84-8DF23CA704F5}/C&S%20FINALAIRSREP06.PDF>

Appendix 1 – Public Safety Radio Communications Bands¹²

Reference Name	Frequency Band	Characteristics, State Users, Notes
High Frequency	2 – 25 MHz	“Long haul” disaster communications. Used by CDF, CalTrans, and OES for intra-state and inter-state coordination. <i>Not subject to FCC’s “Refarming” initiatives or digital radio standards.</i>
VHF – Lo Band	30 – 50 MHz	Good for penetration in hilly or open areas, but not into buildings or for hand-held radios. Local activities are frequently interfered with by out-of-area operations (“skip”). Used by CDCR, CDF, CHP, CalTrans, and OES. <i>Not subject to FCC’s “Refarming” initiatives or digital radio standards.</i>
VHF – Mid Band	72 – 76 MHz	Fixed (point – to – point) links. Used by CHP <i>Not subject to FCC’s “Refarming” initiatives or digital radio standards.</i>
VHF – Hi Band	136 – 174 MHz	Mixed Federal / non-Federal spectrum 136 – 150 MHz Military [NTIA-controlled] 150 – 162 MHz non-Federal [FCC-controlled] 162 – 174 MHz Federal [NTIA-controlled] Widely used band in state and Federal systems. Offers good coverage in hilly terrain and in urban areas. Signals are generally not affected by dense foliage, but poor penetration into steel and masonry buildings. Used by CDCR, CDF, CHP, DFG, DGS, DOJ, DPR, DWR, and OES. <i>Subject to FCC’s “Refarming” initiatives</i>
220 MHz Band	220 – 222 MHz	Predominately for industrial users, but some public safety allocations. Lightly used in California, mostly by local agencies for non life-safety applications (e.g. public works). <i>Not subject to FCC’s “refarming” initiatives or digital radio standards.</i>
406 MHz Band	406 – 420 MHz	Federal spectrum, NTIA-controlled; used by state departments (CDF, OES, EMSA) who are cooperators with Federal users (USFS, DHS, HHS). NTIA has mandated narrow bandwidths starting 01/01/2005
UHF Band	450 – 470 MHz	Non-Federal spectrum. Shares many of the aspects of VHF-High band; better building penetration, in exchange for less range on signals. Used by CDCR, CHP, numerous small departments, OES <i>Subject to FCC’s “Refarming” initiatives</i>
UHF – TV Band	470 – 512 MHz	Television Broadcast spectrum (Channels 14 – 20) reallocated to Public Safety and industrial services in 13 largest metropolitan areas of U.S. Characteristics same as UHF band. Channels 14, 16, and 20 in Los Angeles area Used by Los Angeles County and majority of cities for Law Enforcement operations Channels 16 and 17 in San Francisco Bay area. Used by local systems in Marin, San Mateo, and Santa Clara counties <i>Subject to FCC’s “Refarming” initiatives</i>

¹² Ibid, “A plan for California State public safety communications system integration, modernization, and interoperability”, page 51 - 53

Reference Name	Frequency Band	Characteristics, State Users, Notes
700 MHz Band	764 – 776 MHz 794 – 806 MHz	New band (established 1998) for Public Safety, reallocated from Television Broadcast. Provides shorter range than UHF bands, excellent penetration into some building materials, very poor penetration into other building materials. Requires more infrastructure (fixed sites) to provide coverage over a given area compared to VHF-High or UHF bands. Does not cover well in dense foliage. Voice and data allocations Portion allocated exclusively to States Portion allocated exclusively to Interoperability Not available in most areas of California until incumbent TV stations relocate (This date is uncertain. Current legislation in Congress proposes April 7, 2009) <i>All operations must use new digital technologies.</i>
800 MHz Band	806 – 821 MHz 851 – 866 MHz	Mixed Industrial, Cellular-like (Nextel), and Public Safety systems. Provides shorter range than UHF bands, excellent penetration into some building materials, very poor penetration into other building materials. Requires additional infrastructure (fixed sites) to provide coverage over a given area compared to VHF-High or UHF bands. Does not cover well in dense foliage. Used by CalTrans, CDCR, DGS, DPR, Legislature, and OES <i>While not subject to the “Refarming” initiatives or the digital radio standards, the “800” and “NPSPAC” bands are under an FCC-mandated realignment plan to correct interference issues. This is being handled in four ‘waves’ nationally; the 48 northern-most counties in California are in Wave 1, and the 10 southern-most counties in California are in Wave 4. This transition will take place in the 2006-2008 timeframe.</i>
NPSPAC Band	821 – 824 MHz 866 – 869 MHz	Public Safety exclusive band, same coverage as 700 MHz and 800 MHz. Used by CalTrans, CDCR, DGS, DPR, and OES <i>While not subject to the “Refarming” initiatives or the digital radio standards, the “800” and “NPSPAC” bands are under an FCC-mandated realignment plan to correct interference issues. This is being handled in four ‘waves’ nationally; the 48 northern-most counties in California are in Wave 1, and the 10 southern-most counties in California are in Wave 4. This transition will take place in the 2006-2008 time frame.</i>
4.9 GHz Band	4940 – 4990 MHz	New band (established in 2003) for Public Safety wireless data (“Wi-Fi”) applications. Low power, small coverage areas (< 3/4 mile), share data among PCs PDA,s etc..

Not included in this table are the Aviation frequencies (108-136 MHz) and the Marine Radio Frequencies (156 – 162 MHz) used by some public safety agencies to communicate with non-public safety entities.

Appendix 2 – FCC Listed Del Norte Public Safety Communication - Conventional

Note: Table sorted by Name

Call Sign/Lease ID	Name	Expiration Date	Transmitter Address /Area of Operation	Latitude, Longitude	Frequency
WPMS574	AMERICAN NATIONAL RED CROSS	12/1/2013	1672 NORTHCREST DRIVE CRESCENT CITY, CA DEL NORTE County	41-46-31.7 N 124-11-59.9 W	000047.42000000 ¹³
KAN791	CALIFORNIA, STATE OF	11/14/2011	HWY 101 & NORTH CREST DRIVE CRESCENT CITY, CA DEL NORTE County	41-45-48.4 N 124-11-49.3 W	000044.64000000 000044.80000000 000044.88000000 000044.96000000
KBM647	CALIFORNIA, STATE OF	2/28/2014	RED MOUNTAIN 7 MI E KLAMATH, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W	000151.25000000 000151.26500000 000151.35500000
KFW22	CALIFORNIA, STATE OF	9/26/2015	KLAMATH RIVER GAGE STA N RIVER RD KLAMATH, CA DEL NORTE County	41-30-55.4 N 123-59-59.3 W	000169.50000000
KHQ90	CALIFORNIA, STATE OF	5/6/2012	GAGE STATION SMITH RIVER 11 KM NE CRESCENT CITY, CA DEL NORTE County	41-47-29.4 N 124-04-35.3 W	000171.92500000
KHQ91	CALIFORNIA, STATE OF	8/28/2013	ELK VALLEY TELEMETRY STA 26 KM NE GASQUET, CA DEL NORTE County	41-59-07.4 N 123-43-08.3 W	000171.92500000
KHS92	CALIFORNIA, STATE OF	8/28/2013	CAMP SIX RADIO SITE 6 KM SE GASQUET, CA DEL NORTE County	41-49-41.4 N 123-52-38.3 W	000169.50000000
KHS93	CALIFORNIA, STATE OF	8/28/2013	RED MOUNTAIN 10 KM E KLAMATH, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W	000171.92500000
KJS712	CALIFORNIA, STATE OF	12/16/2011	RED MTN 7 MI E KLAMATH, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W	000153.75500000
KLX851	CALIFORNIA, STATE OF	11/25/2013	DEL NORTE STATE PARK 8 MI SE CRESCENT CITY, CA DEL NORTE County	41-41-18.4 N 124-06-01.3 W	000044.64000000 000044.88000000 000044.96000000
KMA427	CALIFORNIA, STATE OF	12/17/2011	RED MOUNTAIN 7 MI E KLAMATH, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W	000047.20000000

¹³ Statewide, mobile

Call Sign/Lease ID	Name	Expiration Date	Transmitter Address /Area of Operation	Latitude, Longitude	Frequency
KME385	CALIFORNIA, STATE OF	3/16/2013	1444 PARKWAY DR CRESCENT CITY, CA DEL NORTE County	41-45-40.4 N 124-11-50.3 W	000042.34000000 000042.54000000 000075.76000000
KME386	CALIFORNIA, STATE OF	10/19/2014	RED MOUNTAIN 7 MI E KLAMATH, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W	000042.34000000 000042.54000000
KOO93	CALIFORNIA, STATE OF	8/28/2013	GASQUET RANGER STA GASQUET, CA DEL NORTE County	41-50-43.4 N 123-57-56.3 W	000171.92500000
KQR617	CALIFORNIA, STATE OF	12/15/2011	RED MOUNTAIN 7 MI E KLAMATH, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W	000154.16000000
KSQ945	CALIFORNIA, STATE OF	12/15/2011	COUNTY AGRICULTURE DEPT WASHINGTON BLVD CRESCENT CITY, CA DEL NORTE County	41-46-20.4 N 124-14-02.3 W	000154.92000000
KTN274	CALIFORNIA, STATE OF	11/14/2011	DOT MAINTENANCE STATION IDLEWILD, CA DEL NORTE County	41-54-03.4 N 123-46-12.3 W	000047.08000000 000047.20000000
KVM26	CALIFORNIA, STATE OF	8/14/2011	1400 ALDER CAMP RD KLAMATH, CA DEL NORTE County	41-30-02.4 N 124-03-37.3 W	000151.25000000 000151.26500000 000151.35500000 000159.27000000 000159.30000000 000159.33000000 000159.40500000
KVX90	CALIFORNIA, STATE OF	10/22/2011	1025 HWY 101 N CRESCENT CITY, CA DEL NORTE County	41-45-54.4 N 124-11-41.3 W	000159.27000000 000159.33000000 000159.40500000
KVY51	CALIFORNIA, STATE OF	12/17/2011	CDF FIRE STA 4 MI N KLAMATH, CA DEL NORTE County	41-34-34.4 N 124-04-24.3 W	000159.27000000 000159.30000000 000159.40500000
KXQ825	CALIFORNIA, STATE OF	7/20/2015	DOT MTCE STA HWY 101 & NORTH CREST DR CRESCENT CITY, CA DEL NORTE County	41-45-48.4 N 124-11-49.3 W	000047.20000000 000457.97500000

Call Sign/Lease ID	Name	Expiration Date	Transmitter Address /Area of Operation	Latitude, Longitude	Frequency
WGC761	CALIFORNIA, STATE OF	8/6/2014	FINE BRIDGE TELEMTRY STA 2 KM N FORT DICK, CA HUMBOLDT County	41-52-49.4 N 124-08-11.3 W	000169.5000000
WGU627	CALIFORNIA, STATE OF	10/3/2015	CAMP SIX RADIO SITE 6 KM SE GASQUET, CA DEL NORTE County	41-49-41.4 N 123-52-38.3 W	000047.2000000 000452.9750000
WNBV336	CALIFORNIA, STATE OF	2/5/2015	650 5TH ST CRESCENT CITY, CA DEL NORTE County	41-45-16.4 N 124-11-58.3 W	000155.4750000
WNJZ478	CALIFORNIA, STATE OF	9/28/2012	RED MOUNTAIN 10 KM E KLAMATH, CA DEL NORTE County TRACY RADIO SITE 9 KM SW GASQUET, CA DEL NORTE County POINT SAINT GEORGE SITE 5 KM SW CRESCENT CITY, CA DEL NORTE County REQUA KLAMATH AF STATION 6 KM NW KLAMATH, CA DEL NORTE County VAULT WASHINGTON BLVD & COAST DR CRESCENT CITY, CA DEL NORTE County	41-31-27.4 123-54-29.3 W 41-47-05.4 N 124-03-23.3 W 41-46-57.4 N 124-15-10.3 W 41-33-33.3 N 124-02-08.3 W 41-46-19.4 N 124-14-16.3 W	000151.0100000 000158.9700000
WNJZ479	CALIFORNIA, STATE OF	12/9/2012	RED MOUNTAIN 7 MI E KLAMATH, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W	000151.4150000
WPBN772	CALIFORNIA, STATE OF	1/28/2013	RED MOUNTAIN 7 MI E KLAMATH, CA DEL NORTE County BOYES CREEK TELEMTRY STA 7 MI NE ORICK, CA HUMBOLDT County	41-31-27.4 N 123-54-29.3 W 41-22-07.4 N 123-59-27.3 W	000453.8500000
WPET542	CALIFORNIA, STATE OF	12/5/2014	5905 LAKE EARL DR CRESCENT CITY, CA DEL NORTE County	41-51-27.4 N 124-08-59.3 W	000154.8150000
WPLX456	CALIFORNIA, STATE OF	4/1/2013	18071 HWY 199 GASQUET, CA DEL NORTE County	41-59-16.4 N 123-43-05.3 W	000042.3400000 000042.5400000

Call Sign/Lease ID	Name	Expiration Date	Transmitter Address /Area of Operation	Latitude, Longitude	Frequency
WPQE673	CALIFORNIA, STATE OF	6/16/2015	ROADSIDE SITE US199 MILEPOST DN23 GASQUET, CA DEL NORTE County	41-52-03.4 N 123-50-12.3 W	000458.88750000 000458.91250000 000458.93750000
			ROADSIDE SITE US199 MILEPOST DN11 GASQUET, CA DEL NORTE County	41-50-21.4 N 124-01-36.3 W	
			TRACY RADIO SITE 9 KM SW GASQUET, CA DEL NORTE County	41-47-05.4 N 124-03-23.3 W	
WPTV358	California, State of	12/20/2011	JED SMITH REDWOODS PARK 11 KM NE CRESCENT CITY, CA DEL NORTE County	41-47-16.0 N 124-05-04.3 W	000044.64000000 000044.80000000 000044.96000000
			1375 ELK VALLEY RD CRESCENT CITY, CA DEL NORTE County	41-45-59.4 N 124-08-45.3 W	000151.01000000 000158.97000000
			LAKE EARL PARK OLD MILL RD 3 KM N CRESCENT CITY, CA DEL NORTE County	41-47-52.4 N 124-12-57.3 W	
			DEL NORTE REDWOODS PARK 5 KM S CRESCENT CITY, CA DEL NORTE County	41-41-56.4 N 124-06-20.3 W	
WPVP711	CALIFORNIA, STATE OF	7/26/2012	COLLIER TUNNEL REST STOP US199 GASQUET, CA DEL NORTE County	41-58-07.4 N 123-44-54.3 W	000001.61000000
WPXH325	CALIFORNIA, STATE OF	4/3/2013	RED MOUNTAIN 10 KM E KLAMATH, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W	000453.18750000 000453.78750000 000458.18750000
			19 KM NW HOPPA, CA HUMBOLDT County	41-12-01.5 N 123-47-02.2 W	000458.78750000
			18 KM W ORLEANS, CA HUMBOLDT County	41-16-00.4 N 123-45-12.2 W	

Call Sign/Lease ID	Name	Expiration Date	Transmitter Address /Area of Operation	Latitude, Longitude	Frequency
WQGS718	CALIFORNIA, STATE OF	4/6/2017	RED MOUNTAIN 10 KM E KLAMATH, CA DEL NORTE County US101 MILE POST 30 HUM 18.5 KM N ORICK, CA HUMBOLDT County DOT MTCE STA HWY 101 & N CREST DR CRESCENT CITY, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W 41-23-00.4 N 123-59-40.3 W 41-45-48.4 N 124-11-49.3 W	000453.23750000 000453.70000000 000458.23750000 000458.70000000
WZR248	CALIFORNIA, STATE OF	10/3/2015	CAMP SIX LOOKOUT 3.5 MI SE GASQUET, CA DEL NORTE County		000042.34000000 000042.54000000 000072.22000000
KDV790	CRESCENT CITY, CITY OF	10/5/2012	900 10TH ST CRESCENT CITY, CA DEL NORTE County	41-45-20.4 N 124-00-04.3 W	000156.00000000
WNKJ623	CRESCENT FIRE PROTECTION DISTRICT	7/17/2013	255 W. Washington Blvd. CRESCENT CITY, CA DEL NORTE County 2.25 km W of US Hwy 101; 1.9 km NW of Requa, CA Crescent City, CA DEL NORTE County 5 Miles SE of Gasquet Gasquet, CA DEL NORTE County	41-46-19.4 N 124-12-20.2 W 41-33-31.8 N 124-05-11.1 W 41-49-49.4 N 123-52-36.3 W	000151.10000000 000154.25000000 000154.34000000 000154.44500000 000158.86500000 000159.06000000
WQAZ974	DEL NORTE COUNTY SCHOOL DISTRICT	9/3/2014	RED MOUNTAIN 10KM E KLAMATH, CA DEL NORTE County CAMP SIX LOOKOUT 6 KM SE GASQUET, CA DEL NORTE County	41-31-27.4 N 123-54-29.3 W 41-49-41.4 N 123-52-38.3 W	000155.71500000 000158.74500000
KSS223	DEL NORTE, COUNTY OF	12/5/2015	ON TOP OF RED MTN KLAMATH, CA DEL NORTE County	41-30-29.4 N 123-54-34.3 W	000153.98000000

Call Sign/Lease ID	Name	Expiration Date	Transmitter Address /Area of Operation	Latitude, Longitude	Frequency
KSS224	DEL NORTE, COUNTY OF	12/5/2015	ON MTN TOP CAMP 6 LOOKOUT GASQUET, CA DEL NORTE County	41-40-59.4 N ¹⁴ 123-53-04.3 W	000153.98000000 000155.08500000
			TOWN OF CRESENT CITY CRESENT CITY, CA DEL NORTE County	41-46-19.9 N 124-12-18.3 W	
WGP60	DEL NORTE, COUNTY OF	12/5/2015	650 5TH ST CRESCENT CITY, CA DEL NORTE County	41-45-16.4 N 124-11-58.3 W	000155.08500000
WNGN647	DEL NORTE, COUNTY OF	5/8/2011	2650 WASHINGTON BLVD CRESCENT CITY, CA DEL NORTE County	41-46-27.4 N 124-12-36.3 W	000039.82000000
WPHQ837	DEL NORTE, COUNTY OF	6/28/2015	650 5TH ST CRESCENT CITY, CA DEL NORTE County	41-45-11.4 N 124-12-03.3 W	000155.56500000
WXM691	DEL NORTE, COUNTY OF	10/5/2012	981 H STREET CRESCENT CITY, CA DEL NORTE County	41-45-24.9 N 124-12-06.6 W	000154.08500000
WZJ219	DEL NORTE, COUNTY OF	3/1/2014	CAMP SIX SITE SIX RIVERS NATIONAL FOREST CRESCENT CITY, CA DEL NORTE County	41-49-49.4 N 123-52-36.3 W	000156.24000000
WNQD425	SUTTER COAST HOSPITAL	5/14/2012	800 E WASHINGTON ST CRESCENT CITY, CA DEL NORTE County	41-46-23.4 N 124-11-26.3 W	000155.23500000
WPWD436	YUOK DEPARTMENT OF PUBLIC SAFETY	10/22/2012	247 SALMON AVE KLAMATH, CA DEL NORTE County	41-31-56.0 N 124-02-31.0 W	000154.02500000 000154.99500000 000155.86500000
			RED MOUNTAIN KLAMATH, CA DEL NORTE County	41-31-25.0 N 123-54-21.0 W	000158.77500000 000158.83500000 000159.12000000
			SCHOOL HOUSE ORICK, CA HUMBOLDT County	41-09-05.0 N 123-52-58.0 W	000453.15000000 000458.15000000
			MINERS CREEK WEITCHPEC, CA HUMBOLDT County	41-15-59.0 N 123-45-15.0 W	

¹⁴ Possible error in coordinates based on description "ON MTN TOP CAMP 6 LOOKOUT GASQUET, CA DEL NORTE County." s/b 41-49-41.4 N, 123-52-38.3 W not 41-40-59.4 N, 123-53-04.3 W?

Appendix 3 - FCC Listed Del Norte Public Safety Communication - Microwave

Call Sign/Lease ID	Name	FRN	Radio Service	Status	Expiration Date
KCU92	CALIFORNIA, STATE OF	0001724541	MW	Active	06/27/2010
KSZ42	CALIFORNIA, STATE OF	0001724541	MW	Active	06/20/2010
KTU75	CALIFORNIA, STATE OF	0001724541	MW	Active	06/20/2010

Appendix 4 – Maps

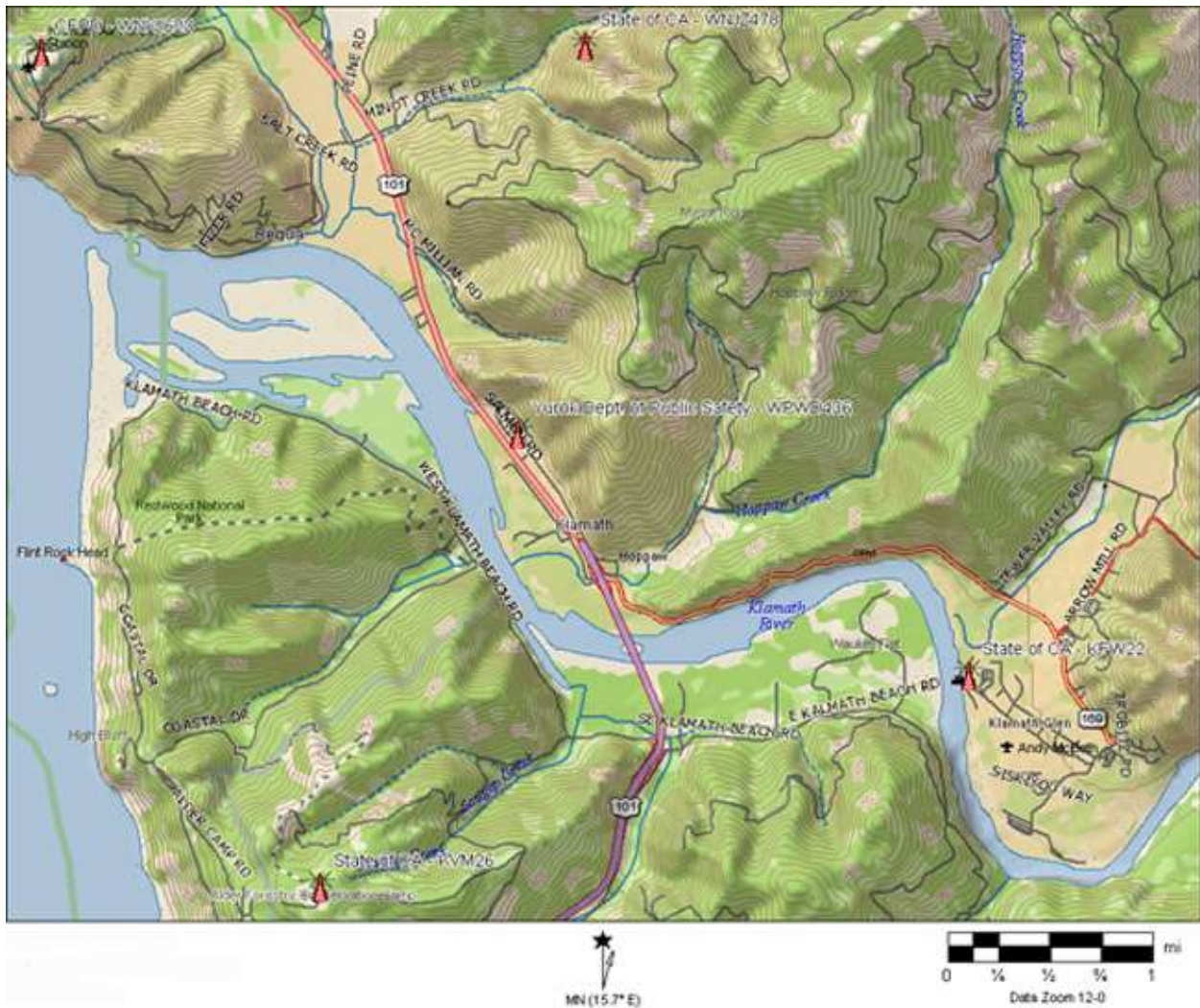


Figure 28 -- Example of PSC Detail Map

The original of this map is 13.5” by 11.3” Radio locations are shown by the antenna icons. Additional detailed maps can be made available in digital formats at no charge. Contact the consultant at jrwin@mind.net or 541.664.2456.